ELA
Grade 8
Covers week of May 4th –
week of June 16th
ELA
Grade 8

Pencil-Paper Packet
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Before Reading

The Diary of Anne Frank

Drama by Frances Goodrich and Albert Hackett

What IMPACT will you have on the world?

Everyone makes an impact on the world in some way. National leaders or sports heroes may inspire millions, while the rest of us can influence a smaller circle of friends and family through our actions, our beliefs, or our commitments. Whether you make your mark quietly or boldly, a life well lived can be a guide to others. In the play you're about to read, a young girl doesn't realize that the thoughts she expresses in her diary will later influence readers all over the world.

QUICKWRITE People of all ages make important contributions to the world. What impact do you now have on others? What impact do you hope to have later in your life? Write your ideas in a brief journal entry. Think about how education and life experience might affect your goals for the future.
CHARACTERS

SECRET ANNEX RESIDENTS

Anne Frank
Margot Frank
Mr. Frank

Mrs. Frank
Peter Van Daan
Mr. Van Daan

Mrs. Van Daan
Mr. Dussel

WORKERS IN MR. FRANK'S BUSINESS

Miep Gies (mēp ĝēs)
Mr. Kraler (krā'lar)

The Time. July 1942—August 1944, November 1945
The Place. Amsterdam, the Netherlands

The scene remains the same throughout the play. It is the top floor of a warehouse and office building in Amsterdam, Holland. The sharply peaked roof of the building is outlined against a sea of other rooftops, stretching away into the distance. Nearby is the belfry of a church tower, the Westertoren, whose carillon rings out the hours. Occasionally faint sounds float up from below: the voices of children playing in the street, the tramp of marching feet, a boat whistle from the canal.

The three rooms of the top floor and a small attic space above are exposed to our view. The largest of the rooms is in the center, with two small rooms, slightly raised, on either side. On the right is a bathroom, out of sight. A narrow steep flight of stairs at the back leads up to the attic. The rooms are sparsely furnished with a few chairs, cots, a table or two. The windows are painted over, or covered with makeshift blackout curtains. In the main room there is a sink, a gas ring for cooking and a wood-burning stove for warmth.

The room on the left is hardly more than a closet. There is a skylight in the sloping ceiling. Directly under this room is a small steep stairwell, with steps leading down to a door. This is the only entrance from the building below. When the door is opened we see that it has been concealed on the outer side by a bookcase attached to it.

The Diary of Anne Frank, starring Natalie Portman as Anne, ran on Broadway at the Music Box Theatre from December 1997 to June 1998.
ACT ONE
Scene 1

The curtain rises on an empty stage. It is late afternoon November, 1945.
The rooms are dusty, the curtains in rags.
Chairs and tables are overturned.
The door at the foot of the small stairwell swings open. Mr. Frank comes up the steps into view. He is a gentle, cultured European in his middle years. There is still a trace of a German accent in his speech.
He stands looking slowly around, making a supreme effort at self-control. He is weak, ill.
His clothes are threadbare.

After a second he drops his rucksack on the couch and moves slowly about. He opens the door to one of the smaller rooms, and then abruptly closes it again, turning away. He goes to the window at the back, looking off at the Westertoren as its carillon strikes the hour of six, then he moves restlessly on.

From the street below we hear the sound of a barrel organ and children's voices at play. There is a many-colored scarf hanging from a nail. Mr. Frank takes it, putting it around his neck. As he starts back for his rucksack, his eye is caught by something lying on the floor. It is a woman's white glove. He holds it in his hand and suddenly all of his self-control is gone. He breaks down, crying.

We hear footsteps on the stairs. Miep Gies comes up, looking for Mr. Frank. Miep is a Dutch girl of about twenty-two. She wears a coat and hat, ready to go home. She is pregnant. Her attitude toward Mr. Frank is protective, compassionate.

Miep. Are you all right, Mr. Frank?
Mr. Frank (quickly controlling himself). Yes, Miep, yes.

Miep. Everyone in the office has gone home . . . It's after six. (then pleading) Don't stay up here, Mr. Frank. What's the use of torturing yourself like this?

Mr. Frank. I've come to say good-bye . . . I'm leaving here, Miep.

Miep. What do you mean? Where are you going? Where?

Mr. Frank. I don't know yet. I haven't decided.

Miep. Mr. Frank, you can't leave here! This is your home! Amsterdam is your home. Your business is here, waiting for you . . . You're needed here . . .

Now that the war is over, there are things that . . .

Mr. Frank. I can't stay in Amsterdam, Miep. It has too many memories for me. Everywhere there's something . . . the house we lived in . . . the school . . . that street organ playing out there . . .

I'm not the person you used to know, Miep.

I'm a bitter old man. (breaking off) Forgive me. I shouldn't speak to you like this . . . after all that you did for us . . . the suffering . . .

Miep. No. No. It wasn't suffering. You can't say we suffered. (As she speaks, she straightens a chair which is overturned.)

Mr. Frank. I know what you went through, you and Mr. Kraler. I'll remember it as long as I live.

(He gives one last look around.) Come, Miep.

(He starts for the steps, then remembers his rucksack, going back to get it.)

Miep (hurrying up to a cupboard). Mr. Frank, did you see? There are some of your papers here. (She brings a bundle of papers to him.) We found them in a heap of rubbish on the floor after . . . after you left.

Mr. Frank. Burn them.

(He opens his rucksack to put the glove in it.)

Miep. But, Mr. Frank, there are letters, notes . . .

Mr. Frank. Burn them. All of them.

Miep. Burn this?

(She hands him a paperbound notebook.)

Mr. Frank (quietly). Anne's diary. (He opens the diary and begins to read.) "Monday, the sixth of July, nineteen forty-two." (to Miep) Nineteen
forty-two. Is it possible, Miep? . . . Only three years ago. (As he continues his reading, he sits down on the couch.) "Dear Diary, since you and I are going to be great friends, I will start by telling you about myself. My name is Anne Frank. I am thirteen years old. I was born in Germany the twelfth of June, nineteen-twenty-nine. As my family is Jewish, we emigrated to Holland when Hitler came to power."

(As Mr. Frank reads on, another voice joins his, as if coming from the air. It is Anne's Voice.)

Mr. Frank and Anne. "My father started a business, importing spice and herbs. Things went well for us until nineteen forty. Then the war came, and the Dutch capitulation, followed by the arrival of the Germans. Then things got very bad for the Jews."

(Mr. Frank's Voice dies out. Anne's Voice continues alone. The lights dim slowly to darkness. The curtain falls on the scene.)

Anne's Voice. You could not do this and you could not do that. They forced Father out of his business. We had to wear yellow stars. I had to turn in my bike. I couldn't go to the movies, or ride in an automobile, or even on a streetcar, and a million other things. But somehow we children still managed to have fun. Yesterday Father told me we were going into hiding. Where, he wouldn't say. At five o'clock this morning Mother woke me and told me to hurry and get dressed. I was to put on as many clothes as I could. It would look too suspicious if we walked along carrying suitcases. It wasn't until we were on our way that I learned where we were going. Our hiding place was to be upstairs in the building where Father used to have his business. Three other people were coming in with us . . . the Van Daans and their son Peter . . . Father knew the Van Daans but we had never met them . . .

(During the last lines the curtain rises on the scene. The lights dim on. Anne's Voice fades out.)

Scene 2

It is early morning. July, 1942. The rooms are bare, as before, but they are now clean and orderly.

Mr. Van Daan, a tall, portly man in his late forties, is in the main room, pacing up and down, nervously smoking a cigarette. His clothes and overcoat are expensive and well cut.

Mrs. Van Daan sits on the couch, clutching her possessions, a hatbox, bags, etc. She is a pretty woman in her early forties. She wears a fur coat over her other clothes.

Peter Van Daan is standing at the window of the room on the right, looking down at the street below. He is a shy, awkward boy of sixteen. He wears a cap, a raincoat, and long Dutch trousers, like "plus fours." At his feet is a black case, a carrier for his cat.

The yellow Star of David is conspicuous on all of their clothes.

Mrs. Van Daan (rising, nervous, excited). Something's happened to them! I know it!

Mr. Van Daan. Now, Kerli!

Mrs. Van Daan. Mr. Frank said they'd be here at seven o'clock. He said . . .

Mr. Van Daan. They have two miles to walk. You can't expect . . .

Mrs. Van Daan. They've been picked up. That's what's happened. They've been taken . . .

(Mr. Van Daan indicates that he hears someone coming.)

Mr. Van Daan. You see?

(Peter takes up his carrier and his schoolbag, etc., and goes into the main room as Mr. Frank comes up the stairwell from below. Mr. Frank looks much younger now. His movements are brisk, his manner confident. He wears an overcoat and carries his hat and a small cardboard box. He crosses to the Van Daans, shaking hands with each of them.)

Mr. Frank. Mrs. Van Daan, Mr. Van Daan, Peter. (then, in explanation of their lateness) There were

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1. yellow stars: the six-pointed Stars of David that the Nazis ordered all Jews to wear for identification.
Mr. Kraler. I never thought I’d live to see the day when a man like Mr. Frank would have to go into hiding. When you think—(He breaks off, going out. Mr. Frank follows him down the steps, bolting the door after him. In the interval before he returns, Peter goes over to Margot, shaking hands with her. As Mr. Frank comes back up the steps, Mrs. Frank questions him anxiously.)

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Mrs. Frank. What did he mean, about the noise?

Mr. Frank. First let us take off some of these clothes. (They all start to take off garment after garment. On each of their coats, sweaters, blouses, suits, dresses, is another yellow Star of David. Mr. and Mrs. Frank are underdressed quite simply. The others wear several things, sweaters, extra dresses, bathrobes, aprons, nightgowns, etc.)

Mr. Van Daan. It’s a wonder we weren’t arrested, walking along the streets... Petronella with a fur coat in July... and that cat of Peter’s crying all the way.

Anne (as she is removing a pair of panties). A cat?

Mrs. Frank (shocked). Anne, please!

Anne. It’s all right. I’ve got on three more. (She pulls off two more. Finally, as they have all removed their surplus clothes, they look to Mr. Frank, waiting for him to speak.)

Mr. Frank. Now. About the noise. While the men are in the building below, we must have complete quiet. Every sound can be heard down there, not only in the workrooms, but in the offices too. The men come at about eight-thirty, and leave at about five-thirty. So, to be perfectly safe, from eight in the morning until six in the evening we must move only when it is necessary, and then in stocking feet. We must not speak above a whisper. We must not run any water. We cannot use the sink, or even, forgive me, the w.c.? The pipes go down through the workrooms. It would be heard. No trash... (Mr. Frank stops abruptly as he hears the sound of marching feet from the street below. Everyone is motionless, paralyzed with fear. Mr. Frank goes quietly into the room on the right to look down out of the window. Anne runs after him, peering out with him. The tramping feet pass without stopping. The tension is relieved. Mr. Frank, followed by Anne, returns to the main room and resumes his instructions to the group)... No trash must ever be thrown out which might reveal that someone is living up here... not even a potato paring. We must burn everything in the stove at night. This is the way we must live until it is over, if we are to survive. (There is silence for a second.)

Mrs. Frank. Until it is over.

Mr. Frank (reassuringly). After six we can move about... we can talk and laugh and have our supper and read and play games... just as we would at home. (He looks at his watch.) And now I think it would be wise if we all went to our rooms, and were settled before eight o’clock. Mrs. Van Daan, you and your husband will be upstairs. I regret that there’s no place up there for Peter. But he will be here, near us. This will be our common room, where we’ll meet to talk and eat and read, like one family.

Mr. Van Daan. And where do you and Mrs. Frank sleep?

Mr. Frank. This room is also our bedroom.

Mrs. Van Daan. That isn’t right. We’ll sleep here and you take the room upstairs.

Mrs. Van Daan. It’s your place.

Mr. Frank. Please. I’ve thought this out for weeks. It’s the best arrangement. The only arrangement.

Mrs. Van Daan (to Mr. Frank). Never, never can we thank you. (then to Mr. Frank) I don’t know what would have happened to us, if it hadn’t been for Mr. Frank.

Mr. Frank. You don’t know how your husband helped me when I came to this country... knowing no one... not able to speak the language. I can never repay him for that. (going to Van Daan) May I help you with your things?

5. w.c.: water closet, toilet.
Mr. Frank. It doesn’t matter. I don’t want you ever to go beyond that door.

Anne (sobered). Never . . .? Not even at nighttime, when everyone is gone? Or on Sundays? Can’t I go down to listen to the radio?

Mr. Frank. Never. I am sorry, Anneke. It isn’t safe. No, you must never go beyond that door.

(For the first time Anne realizes what “going into hiding” means.)

Anne. I see.

Mr. Frank. It’ll be hard, I know. But always remember this, Anneke. There are no walls, there are no bolts, no locks that anyone can put on your mind. Miep will bring us books. We will read history, poetry, mythology. (He gives her the glass of milk.) Here’s your milk. (With his arm about her, they go over to the couch, sitting down side by side.) As a matter of fact, between us, Anne, being here has certain advantages for you. For instance, you remember the battle you had with your mother the other day on the subject of overshoes? You said you’d rather die than wear overshoes. But in the end you had to wear them? Well now, you see, for as long as we are here you will never have to wear overshoes! Isn’t that good? And the coat that you inherited from Margot, you won’t have to wear that any more. And the piano! You won’t have to practice on the piano. I tell you, this is going to be a fine life for you!

(Anne’s panic is gone. Peter appears in the doorway of his room, with a saucer in his hand. He is carrying his cat.)

Peter. I . . . I . . . I thought I’d better get some water for Mouschi before . . .

Mr. Frank. Of course.

(As he starts toward the sink the carillon begins to chime the hour of eight. He tiptoes to the window at the back and looks down at the street below. He turns to Peter, indicating in pantomime that it is too late. Peter starts back for his room. He steps on a creaking board. The three of them are frozen for a minute in fear. As Peter starts away again, Anne tiptoes over to him and pours some of the milk from her glass into the saucer for the cat. Peter squats on the floor, putting the milk before the cat. Mr. Frank gives Anne his fountain pen, and then goes into the room at the right. For a second Anne watches the cat, then she goes over to the center table, and opens her diary.

In the room at the right, Mrs. Frank has sat up quickly at the sound of the carillon. Mr. Frank comes in and sits down beside her on the settee, his arm comfortably around her.

Upstairs, in the attic room, Mr. and Mrs. Van Daan have hung their clothes in the closet and are now seated on the iron bed. Mrs. Van Daan leans back exhausted. Mr. Van Daan fings her with a newspaper.

Anne starts to write in her diary. The lights dim out, the curtain falls.

In the darkness Anne’s Voice comes to us again, faintly at first, and then with growing strength.

Anne’s Voice. I expect I should be describing what it feels like to go into hiding. But I really don’t know yet myself. I only know it’s funny never to be able to go outdoors . . . never to breathe fresh air . . . never to run and shout and jump. It’s the silence in the nights that frightens me most. Every time I hear a creak in the house, or a step on the street outside, I’m sure they’re coming for us. The days aren’t so bad. At least we know that Miep and Mr. Kraler are down there below us in the office. Our protectors, we call them. I asked Father what would happen to them if the Nazis found out they were hiding us. Pim said that they would suffer the same fate that we would . . . Imagine! They know this, and yet when they come up here, they’re always cheerful and gay as if there were nothing in the world to bother them . . . Friday, the twenty-first of August, nineteen forty-two. Today I’m going to tell you our general news. Mother is unbearable. She insists on treating me like a baby, which I loathe. Otherwise things are going better. The weather is . . .

(At Anne’s Voice is fading out, the curtain rises on the scene.)

520  UNIT 4: THEME AND SYMBOL
Mr. Frank. He isn’t used to girls. Give him a little time.

Anne. Time? Isn’t two months time? I could cry.

(catching hold of Margot) Come on, Margot... dance with me. Come on, please.

Margot. I have to help with supper.

Anne. You know we’re going to forget how to dance... When we get out we won’t remember a thing.

(She starts to sing and dance by herself: Mr. Frank takes her in his arms, waltzing with her. Mrs. Van Daan comes in from the bathroom.)

Mrs. Van Daan. Next? (She looks around as she starts putting on her shoes.) Where’s Peter?

Anne (as they are dancing). Where would he be!

Mrs. Van Daan. He hasn’t finished his lessons, has he? His father’ll kill him if he catches him in there with that cat and his work not done.

(Mr. Frank and Anne finish their dance. They bow to each other with extravagant formality.) Anne, get him out of there, will you?

Anne (at Peter’s door). Peter? Peter?

Peter (opening the door a crack). What is it?

Anne. Your mother says to come out.

Peter. I’m giving Mouschi his dinner.

Mrs. Van Daan. You know what your father says. (She sits on the couch, sewing on the lining of her fur coat.)

Peter. For heaven’s sake, I haven’t even looked at him since lunch.

Mrs. Van Daan. I’m just telling you, that’s all.

Anne. I’ll feed him.

Peter. I don’t want you in there.

Mrs. Van Daan. Peter!

Peter (to Anne). Then give him his dinner and come right out, you hear? (He comes back to the table. Anne shuts the door of Peter’s room after her and disappears behind the curtain covering his closet.)

Mrs. Van Daan (to Peter). Now is that any way to talk to your little girl friend?

Peter. Mother... for heaven’s sake... will you please stop saying that?

Mrs. Van Daan. Look at him blush! Look at him!

Peter. Please! I’m not... anyway... let me alone, will you?

Mrs. Van Daan. He acts like it was something to be ashamed of. It’s nothing to be ashamed of, to have a little girl friend.

Peter. You’re crazy. She’s only thirteen.

Mrs. Van Daan. So what? And you’re sixteen. Just perfect. Your father’s ten years older than I am. (to Mr. Frank) I warn you, Mr. Frank, if this war lasts much longer, we’re going to be related and then...

Mr. Frank. Mazeltov! 10

Mrs. Frank (deliberately changing the conversation). I wonder where Miep is. She’s usually so prompt.

(Suddenly everything else is forgotten as they hear the sound of an automobile coming to a screeching stop in the street below. They are tense, motionless in their terror. The car starts away. A wave of relief sweeps over them. They pick up their occupations again. Anne flings open the door of Peter’s room, making a dramatic entrance. She is dressed in Peter’s clothes.

Peter looks at her in fury. The others are amused.)

Anne. Good evening, everyone. Forgive me if I don’t stay. (She jumps up on a chair.) I have a friend waiting for me in there. My friend Tom. Tom Cat. Some people say that we look alike. But Tom has the most beautiful whiskers, and I have only a little fuzz. I am hoping... in time...

Peter. All right, Mrs. Quack Quack!

Anne (outraged—jumping down). Peter!

Peter. I heard about you... How you talked so much in class they called you Mrs. Quack Quack. How Mr. Smitter made you write a composition... "Quack, quack," said Mrs. Quack Quack.”

10. Mazeltov (məˈzəltəv) Hebrew: Congratulations!
Anne. Isn't algebra vile, Pim!

Mr. Frank. Vile!

Margot (to Mr. Frank). How did I do?

Anne (getting up). Excellent, excellent, excellent, excellent!

Mr. Frank (to Margot). You should have used the subjunctive here . . .

Margot. Should I? ... I thought ... look here ... I didn't use it here ... (The two become absorbed in the papers.)

Anne. Mrs. Van Daan, may I try on your coat?

Mrs. Frank. No, Anne.

Mrs. Van Daan (giving it to Anne). It's all right . . . but careful with it. (Anne puts it on and struts with it.) My father gave me that the year before he died. He always bought the best that money could buy.

Anne. Mrs. Van Daan, did you have a lot of boy friends before you were married?

Mrs. Frank. Anne, that's a personal question. It's not courteous to ask personal questions.

Mrs. Van Daan. Oh I don't mind. (to Anne) Our house was always swarming with boys. When I was a girl we had . . .

Mr. Van Daan. Oh, God. Not again!

Mrs. Van Daan (good-humored). Shut up! (Without a pause, to Anne. Mr. Van Daan mimic Mrs. Van Daan, speaking the first few words in unison with her.) One summer we had a big house in Hilversum. The boys came buzzing round like bees around a jam pot. And when I was sixteen! . . . We were wearing our skirts very short those days and I had good-looking legs. (She pulls up her skirt, going to Mr. Frank.) I still have 'em. I may not be as pretty as I used to be, but I still have my legs. How about it, Mr. Frank?

Mr. Van Daan. All right. All right. We see them.

Mrs. Van Daan. I'm not asking you. I'm asking Mr. Frank.

Peter. Mother, for heaven's sake.

Mrs. Van Daan. Oh, I embarrass you, do I? Well, I just hope the girl you marry has as good. (then to Anne) My father used to worry about me, with so many boys hanging round. He told me, if any of them gets fresh, you say to him . . . "Remember, Mr. So-and-So, remember I'm a lady."

Anne. "Remember, Mr. So-and-So, remember I'm a lady." (She gives Mrs. Van Daan her coat.)

Mr. Van Daan. Look at you, talking that way in front of her! Don't you know she puts it all down in that diary?

Mrs. Van Daan. So, if she does? I'm only telling the truth!

(Anne stretches out, putting her ear to the floor, listening to what is going on below. The sound of the bombers fades away.)

Mrs. Frank (setting the table). Would you mind, Peter, if I moved you over to the couch?

Anne (listening). Miep must have the radio on.

(Peter picks up his papers, going over to the couch beside Mrs. Van Daan.)

Mr. Van Daan (accusingly, to Peter). Haven't you finished yet?

Peter. No.

Mr. Van Daan. You ought to be ashamed of yourself.

Peter. All right. All right. I'm a dunce. I'm a hopeless case. Why do I go on?

Mrs. Van Daan. You're not hopeless. Don't talk that way. It's just that you haven't anyone to help you, like the girls have. (to Mr. Frank) Maybe you could help him, Mr. Frank?

Mr. Frank. I'm sure that his father . . . ?

Mr. Van Daan. Not me. I can't do anything with him. He won't listen to me. You go ahead . . . if you want.

Mr. Frank (going to Peter). What about it, Peter? Shall we make our school coeducational?

Mrs. Van Daan (kissing Mr. Frank). You're an angel, Mr. Frank. An angel. I don't know why I didn't meet you before I met that one there.
(She goes over, kneeling on the couch beside Mrs. Van Daan.) Did you know she was engaged? His name is Dirk, and Miep's afraid the Nazis will ship him off to Germany to work in one of their war plants. That's what they're doing with some of the young Dutchmen ... they pick them up off the streets—

Mr. Van Daan (interrupting). Don't you ever get tired of talking? Suppose you try keeping still for five minutes. Just five minutes. (He starts to pace again. Again Anne follows him, mimicking him. Mrs. Frank jumps up and takes her by the arm up to the sink, and gives her a glass of milk.)

Mrs. Frank. Come here, Anne. It's time for your glass of milk.

Mr. Van Daan. Talk, talk, talk. I never heard such a child. Where is my . . . ? Every evening it's the same, talk, talk, talk. (He looks around.) Where is my . . . ?

Mrs. Van Daan. What're you looking for?

Mr. Van Daan. My pipe. Have you seen my pipe?

Mrs. Van Daan. What good's a pipe? You haven't got any tobacco.

Mr. Van Daan. At least I'll have something to hold in my mouth! (opening Margot's bedroom door) Margot, have you seen my pipe?

Margot. It was on the table last night. (Anne puts her glass of milk on the table and picks up his pipe, hiding it behind her back.)

Mr. Van Daan. I know. I know. Anne, did you see my pipe? . . . Anne!

Mrs. Frank. Anne, Mr. Van Daan is speaking to you.

Anne. Am I allowed to talk now?

Mr. Van Daan. You're the most aggravating . . . The trouble with you is, you've been spoiled. What you need is a good old-fashioned spanking.

Anne (mimicking Mrs. Van Daan). "Remember, Mr. So-and-So, remember I'm a lady." (She thrusts the pipe into his mouth, then picks up her glass of milk.)

Mr. Van Daan (restraining himself with difficulty). Why aren't you nice and quiet like your sister Margot? Why do you have to show off all the time? Let me give you a little advice, young lady. Men don't like that kind of thing in a girl. You know that? A man likes a girl who'll listen to him once in a while . . . a domestic girl, who'll keep her house shining for her husband . . . who loves to cook and sew and . . .

Anne. I'd cut my throat first! I'd open my veins! I'm going to be remarkable! I'm going to Paris . . .

Mr. Van Daan (scathingly). Paris!

Anne. . . . to study music and art.

Mr. Van Daan. Yeah! Yeah!

Anne. I'm going to be a famous dancer or singer . . . or something wonderful. (She makes a wide gesture, spilling the glass of milk on the fur coat in Mrs. Van Daan's lap. Margot rushes quickly over with a towel. Anne tries to brush the milk off with her skirt.)

Mrs. Van Daan. Now look what you've done! . . . you clumsy little fool! My beautiful fur coat my father gave me . . .

Anne. I'm so sorry.

Mrs. Van Daan. What do you care? It isn't yours . . . So go on, ruin it! Do you know what that coat cost? Do you? And now look at it! Look at it!

Anne. I'm very, very sorry.

Mrs. Van Daan. I could kill you for this. I could just kill you! (Mrs. Van Daan goes up the stairs, clutching the coat. Mr. Van Daan starts after her.)

Mr. Van Daan. Petronella . . . liefje! Liefje! . . .

Come back . . . the supper . . . come back!

Mrs. Frank. Anne, you must not behave in that way.

Anne. It was an accident. Anyone can have an accident.

Mrs. Frank. I don't mean that. I mean the answering back. You must not answer back. They are our guests. We must always show the
Margot. This is a surprise.

Mrs. Frank. When Mr. Kraler comes, the sun begins to shine.

Mr. Van Daan. Miep is coming?

Mr. Kraler. Not tonight.

(Kraler goes to Margot and Mrs. Frank and Anne, shaking hands with them.)

Mrs. Frank. Wouldn't you like a cup of coffee? . . .
Or, better still, will you have supper with us?

Mr. Frank. Mr. Kraler has something to talk over with us. Something has happened, he says, which demands an immediate decision.

Mrs. Frank (fearful). What is it?

(Mr. Kraler sits down on the couch. As he talks he takes bread, cabbages, milk, etc., from his briefcase, giving them to Margot and Anne to put away.)

Mr. Kraler. Usually, when I come up here, I try to bring you some bit of good news. What's the use of telling you the bad news when there's nothing that you can do about it? But today something has happened . . . Dirk . . . Miep's Dirk, you know, came to me just now. He tells me that he has a Jewish friend living near him. A dentist. He says he's in trouble. He begged me, could I do anything for this man? Could I find him a hiding place? . . . So I've come to you . . . I know it's a terrible thing to ask of you, living as you are, but would you take him in with you?

Mr. Frank. Of course we will.

Mr. Kraler (rising). It'll be just for a night or two . . . until I find some other place. This happened so suddenly that I didn't know where to turn.

Mr. Frank. Where is he?

Mr. Kraler. Downstairs in the office.

Mr. Frank. Good. Bring him up.

Mr. Kraler. His name is Dussel . . . Jan Dussel.

Mr. Frank. Dussel . . . I think I know him.

Mr. Kraler. I'll get him. (He goes quickly down the steps and out. Mr. Frank suddenly becomes conscious of the others.)

Mr. Frank. Forgive me. I spoke without consulting you. But I knew you'd feel as I do.

Mr. Van Daan. There's no reason for you to consult anyone. This is your place. You have a right to do exactly as you please. The only thing I feel . . . there's so little food as it is . . . and to take in another person . . .

(Peter turns away, ashamed of his father.)

Mr. Frank. We can stretch the food a little. It's only for a few days.

Mr. Van Daan. You want to make a bet?

Mrs. Frank. I think it's fine to have him. But, Otto, where are you going to put him? Where?

Peter. He can have my bed. I can sleep on the floor. I wouldn't mind.

Mr. Frank. That's good of you, Peter. But your room's too small . . . even for you.

Anne. I have a much better idea. I'll come in here with you and Mother, and Margot can take Peter's room and Peter can go in our room with Mr. Dussel.

Margot. That's right. We could do that.

Mr. Frank. No, Margot. You mustn't sleep in that room . . . neither you nor Anne. Mouschi has caught some rats in there. Peter's brave. He doesn't mind.

Anne. Then how about this? I'll come in here with you and Mother, and Mr. Dussel can have my bed.

Mrs. Frank. No. No. No! Margot will come in here with us and he can have her bed. It's the only way. Margot, bring your things in here. Help her, Anne.

(Margot hurries into her room to get her things.)

Anne (to her mother). Why Margot? Why can't I come in here?

Mrs. Frank. Because it wouldn't be proper for Margot to sleep with a . . . Please, Anne. Don't argue. Please. (Anne starts slowly away.)

Mr. Frank. (to Anne). You don't mind sharing your room with Mr. Dussel, do you, Anne?
Mr. and Mrs. Van Daan . . . their son, Peter . . .
and my daughters, Margot and Anne.
(Dussel shakes hands with everyone.)

**Mr. Kraler.** Thank you, Mr. Frank. Thank you all.
Mr. Dussel, I leave you in good hands. Oh . . .
Dirk’s coat.
(Dussel hurriedly takes off the raincoat, giving it to
Mr. Kraler. Underneath is his white dentist’s jacket,
with a yellow Star of David on it.)

**Dussel** (to Mr. Kraler). What can I say to thank you . . . ?

**Mrs. Frank** (to Dussel). Mr. Kraler and Miep . . .
They’re our life line. Without them we couldn’t
live.

**Mr. Kraler.** Please. Please. You make us seem very
heroic. It isn’t that at all. We simply don’t like
the Nazis. (to Mr. Frank, who offers him a drink)
No, thanks. (then going on) We don’t like their
methods. We don’t like . . .

**Mr. Frank** (smiling). I know. I know. “No one’s
going to tell us Dutchmen what to do with our
damn Jews!”

**Mr. Kraler** (to Dussel). Pay no attention to Mr.
Frank. I’ll be up tomorrow to see that they’re
treating you right. (to Mr. Frank) Don’t trouble
to come down again. Peter will bolt the door after
me, won’t you, Peter?

**Peter.** Yes, sir.

**Mr. Frank.** Thank you, Peter. I’ll do it.

**Mr. Kraler.** Good night. Good night.

**Group.** Good night, Mr. Kraler. We’ll see you
tomorrow, (etc., etc.)

(Mr. Kraler goes out with Mr. Frank. Mrs. Frank
gives each one of the “grownups” a glass of cognac.)

**Mrs. Frank.** Please, Mr. Dussel, sit down.

(Mr. Dussel sinks into a chair. Mrs. Frank gives
him a glass of cognac.)

**Dussel.** I’m dreaming. I know it. I can’t believe
my eyes. Mr. Otto Frank here! (to Mrs. Frank)

You’re not in Switzerland then? A woman told
me . . . She said she’d gone to your house . . . the
door was open, everything was in disorder, dishes
in the sink. She said she found a piece of paper in
the wastebasket with an address scribbled on it . . . an address in Zurich. She said you must
have escaped to Zurich.

**Anne.** Father put that there purposely . . .
just so people would think that very thing!

**Dussel.** And you’ve been here all the time?

**Mrs. Frank.** All the time . . . ever since July.
(Anne speaks to her father as he comes back.)

**Anne.** It worked, Pim . . . the address you left!
Mr. Dussel says that people believe we escaped
to Switzerland.

**Mr. Frank.** I’m glad . . . And now let’s have a little
drink to welcome Mr. Dussel. (Before they can
drink, Mr. Dussel bolts his drink. Mr. Frank smiles
and raises his glass.) To Mr. Dussel. Welcome.
We’re very honored to have you with us.

**Mrs. Frank.** To Mr. Dussel, welcome.
(The Van Daans murmur a welcome. The “grown-
ups” drink.)

**Mrs. Van Daan.** Um. That was good.

**Mr. Van Daan.** Did Mr. Kraler warn you that you
won’t get much to eat here? You can imagine . . .
three ration books among the seven of us . . . and
now you make eight.
(Peter walks away, humiliated. Outside a street
organ is heard dimly)

**Dussel** (rising). Mr. Van Daan, you don’t realize
what is happening outside that you should
warn me of a thing like that. You don’t realize
what’s going on . . . (As Mr. Van Daan starts
his characteristic pacing, Dussel turns to speak to
the others.) Right here in Amsterdam every day
hundreds of Jews disappear . . . They surround
a block and search house by house. Children
come home from school to find their parents
gone. Hundreds are being deported . . . people
that you and I know . . . the Hallensteins . . .
the Wessels . . .
Dussel. Let us hope so.

1350 (He takes some pills to fortify himself.)

Anne. That's Margot's bed, where you're going to sleep. I sleep on the sofa there. (indicating the clothes hooks on the wall) We cleared these off for your things. (She goes over to the window.) The best part about this room... you can look down and see a bit of the street and the canal. There's a houseboat... you can see the end of it... a bargeman lives there with his family... They have a baby and he's just beginning to walk and I'm so afraid he's going to fall into the canal some day. I watch him...

Dussel (interrupting). Your father spoke of a schedule.

Anne (coming away from the window). Oh, yes. It's mostly about the times we have to be quiet. And times for the w.c. You can use it now if you like.

Dussel (stiffly). No, thank you.

Anne. I suppose you think it's awful, my talking about a thing like that. But you don't know how important it can get to be, especially when you're frightened... About this room, the way Margot and I did... she had it to herself in the afternoons for studying, reading... lessons, you know... and I took the mornings. Would that be all right with you?

Dussel. I'm not at my best in the morning.

Anne. You stay here in the mornings then. I'll take the room in the afternoons.

Dussel. Tell me, when you're in here, what happens to me? Where am I spending my time? In there, with all the people?

Anne. Yes.

Dussel. I see. I see.

Anne. We have supper at half past six.

Dussel (going over to the sofa). Then, if you don't mind... I like to lie down quietly for ten minutes before eating. I find it helps the digestion.

Anne. Of course. I hope I'm not going to be too much of a bother to you. I seem to be able to get everyone's back up.

(Dussel lies down on the sofa, curled up, his back to her.)

Dussel. I always get along very well with children. My patients all bring their children to me, because they know I get on well with them. So don't you worry about that.

(Anne leans over him, taking his hand and shaking it gratefully.)

Anne. Thank you. Thank you, Mr. Dussel.

1400 (The lights dim to darkness. The curtain falls on the scene. Anne's Voice comes to us faintly at first, and then with increasing power.)

Anne's Voice. And yesterday I finished Cissy Van Marxvelt's latest book. I think she is a first-class writer. I shall definitely let my children read her. Monday the twenty-first of September, nineteen forty-two. Mr. Dussel and I had another battle yesterday. Yes, Mr. Dussel! According to him, nothing, I repeat... nothing, is right about me... my appearance, my character, my manners. While he was going on at me I thought... sometime I'll give you such a smack that you'll fly right up to the ceiling! Why is it that every grownup thinks he knows the way to bring up children? Particularly the grownups that never had any. I keep wishing that Peter was a girl instead of a boy. Then I would have someone to talk to. Margot's a darling, but she takes everything too seriously. To pause for a moment on the subject of Mrs. Van Daan. I must tell you that her attempts to flirt with Father are getting her nowhere. Pim, thank goodness, won't play.

(As she is saying the last lines, the curtain rises on the darkened scene. Anne's Voice fades out.)
Mr. Van Daan (to Dussel). What is it? What happened?

Dussel. A nightmare. She was having a nightmare!

Mr. Van Daan. I thought someone was murdering her.

Dussel. Unfortunately, no.

(He goes into the bathroom. Mr. Van Daan goes back up the stairs. Mr. Frank, in the main room, sends Peter back to his own bedroom.)

Mr. Frank. Thank you, Peter. Go back to bed.

(Peter goes back to his room. Mr. Frank follows him, turning out the light and looking out the window. Then he goes back to the main room, and gets up on a chair, turning out the center hanging lamp.)

Mrs. Frank (to Anne). Would you like some water? (Anne shakes her head.) Was it a very bad dream? Perhaps if you told me . . . ?

Anne. I'd rather not talk about it.

Mrs. Frank. Poor darling. Try to sleep then. I'll sit right here beside you until you fall asleep. (She brings a stool over, sitting there.)

Anne. You don't have to.

Mrs. Frank. But I'd like to stay with you . . . very much. Really.

Anne. I'd rather you didn't.

Mrs. Frank. Good night, then. (She leans down to kiss Anne. Anne throws her arm up over her face, turning away. Mrs. Frank, hiding her hurt, kisses Anne's arm.) You'll be all right? There's nothing that you want?

Anne. Will you please ask Father to come.

Mrs. Frank (after a second). Of course, Anne dear. (She hurries out into the other room. Mr. Frank comes to her as she comes in.) Sie verlangt nach Dir! 12

Mr. Frank (sensing her hurt). Edith, Liebe, schau . . . 13

Mrs. Frank. Es macht nichts! Ich danke dem lieben Herrgott, dass sie sich wenigstens an Dich wendet, wenn sie Tröst braucht! Geh hinein, Otto, sie ist ganz hysterisch vor Angst. 14 (as Mr. Frank hesitates) Geh zu ihr. 15 (He looks at her for a second and then goes to get a cup of water for Anne. Mrs. Frank sinks down on the bed, her face in her hands, trying to keep from sobbing aloud. Margot comes over to her, putting her arms around her.) She wants nothing of me. She pulled away when I leaned down to kiss her.

Margot. It's a phase . . . You heard Father . . .

Most girls go through it . . . they turn to their fathers at this age . . . they give all their love to their fathers.

Mrs. Frank. You weren't like this. You didn't shut me out.

Margot. She'll get over it . . . (She smooths the bed for Mrs. Frank and sits beside her a moment as Mrs. Frank lies down. In Anne's room Mr. Frank comes in, sitting down by Anne. Anne flings her arms around him, clinging to him. In the distance we hear the sound of ack-ack.)

Anne. Oh, Pim. I dreamed that they came to get us! The Green Police! They broke down the door and grabbed me and started to drag me out the way they did Jopie.

Mr. Frank. I want you to take this pill.

Anne. What is it?

Mr. Frank. Something to quiet you.

(Anne takes it and drinks the water. In the main room Margot turns out the light and goes back to her bed.)

Mr. Frank (to Anne). Do you want me to read to you for a while?

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12. Sie verlangt nach Dir (zö för-längt' näkh dët) German: She is asking for you.
13. Liebe, schau (lë'by shó pu) German: Dear, look.
14. Es macht . . . vor Angst (ës maht' . . . vör An'st) German: It's all right. I thank dear God that at least she turns to you when she needs comfort. Go in, Otto; she is hysterical with fear.
15. Geh zu ihr (gë' toó ir') German: Go to her.
Anne. No. Just sit with me for a minute. Was I awful? Did I yell terribly loud? Do you think anyone outside could have heard?

Mr. Frank. No. No. Lie quietly now. Try to sleep.

Anne. I'm a terrible coward. I'm so disappointed in myself. I think I've conquered my fear... I think I'm really grown-up... and then something happens... and I run to you like a baby... I love you, Father. I don't love anyone but you.

Mr. Frank (reproachfully). Annele!

Anne. It's true. I've been thinking about it for a long time. You're the only one I love.

Mr. Frank. It's fine to hear you tell me that you love me. But I'd be happier if you said you loved your mother as well... She needs your help so much... your love... A

Anne. We have nothing in common. She doesn't understand me. Whenever I try to explain my views on life to her she asks me if I'm constipated.

Mr. Frank. You hurt her very much just now. She's crying. She's in there crying.

Anne. I can't help it. I only told the truth. I didn't want her here... (then, with sudden change) Oh, Pim, I was horrible, wasn't I? And the worst of it is, I can stand off and look at myself doing it and know it's cruel and yet I can't stop doing it. What's the matter with me? Tell me. Don't say it's just a phase! Help me.

Mr. Frank. There is so little that we parents can do to help our children. We can only try to set a good example... point the way. The rest you must do yourself. You must build your own character.

Anne. I'm trying. Really I am. Every night I think back over all of the things I did that day that were wrong... like putting the wet mop in Mr. Dussel's bed... and this thing now with Mother. I say to myself, that was wrong. I make up my mind, I'm never going to do that again. Never!

Of course I may do something worse... but at least I'll never do that again!... I have a nicer side, Father... a sweeter, nicer side. But I'm scared to show it. I'm afraid that people are going to laugh at me if I'm serious. So the mean Anne comes to the outside and the good Anne stays on the inside, and I keep on trying to switch them around and have the good Anne outside and the bad Anne inside and be what I'd like to be... and might be... if only... only... (She is asleep. Mr. Frank watches her for a moment and then turns off the light, and starts out. The lights dim out. The curtain falls on the scene. Anne's Voice is heard dimly at first, and then with growing strength.)

Anne's Voice. ... The air raids are getting worse. They come over day and night. The noise is terrifying. Pim says it should be music to our ears. The more planes, the sooner will come the end of the war. Mrs. Van Daan pretends to be a fatalist. What will be, will be. But when the planes come over, who is the most frightened? No one else but Petronella!... Monday, the ninth of November, nineteen forty-two. Wonderful news! The Allies have landed in Africa. Pim says that we can look for an early finish to the war. Just for fun he asked each of us what was the first thing we wanted to do when we got out of here. Mrs. Van Daan longs to be home with her own things, her needle-point chairs, the Beckstein piano her father gave her... the best that money could buy. Peter would like to go to a movie. Mr. Dussel wants to get back to his dentist's drill. He's afraid he is losing his touch. For myself, there are so many things... to ride a bike again... to laugh till my belly aches... to have new clothes from the skin out... to have a hot tub filled to overflowing and wallow in it for hours... to be back in school with my friends...

(As the last lines are being said, the curtain rises on the scene. The lights dim on as Anne's Voice fades away.)
Margot. What I remember best is the presents we used to get when we were little... eight days of presents... and each day they got better and better.

Mrs. Frank (sitting down). We are all here, alive. That is present enough.

Anne. No, it isn’t. I’ve got something...

(She rushes into her room, hurriedly puts on a little hat improvised from the lamp shade, grabs a satchel bulging with parcels and comes running back.)

Mrs. Frank. What is it?

Anne. Presents!

Mrs. Van Daan. Presents!

Dussel. Look!

Mr. Van Daan. What’s she got on her head?

Peter. A lamp shade!

Anne (She picks out one at random). This is for Margot. (She hands it to Margot, pulling her to her feet.) Read it out loud.

Margot (reading).

“You have never lost your temper.

You never will, I fear,

You are so good.

But if you should,

Put all your cross words here.”

(She tears open the package.)

A new crossword puzzle book! Where did you get it?
Peter. I'm scared to. I know something's going to jump out and hit me.

Anne. No. It's nothing like that, really.

Mrs. Van Daan (as he is opening it). What is it, Peter? Go on. Show it.

Anne (excitedly). It's a safety razor!

Dussel. A what?

Anne. A razor!

Mrs. Van Daan (looking at it). You didn't make that out of odds and ends.

Anne (to Peter). Micq got it for me. It's not new. It's second-hand. But you really do need a razor now.

Dussel. For what?

Anne. Look on his upper lip... you can see the beginning of a mustache.

Dussel. He wants to get rid of that? Put a little milk on it and let the cat lick it off.

Peter (starting for his room). Think you're funny, don't you.

Dussel. Look! He can't wait! He's going in to try it!

Peter. I'm going to give Mouschi his present! (He goes into his room, slamming the door behind him.)

Mr. Van Daan (disgustedly). Mouschi, Mouschi, Mouschi.

(In the distance we hear a dog persistently barking. Anne brings a gift to Dussel.)

Anne. And last but never least, my roommate, Mr. Dussel.

Dussel. For me? You have something for me?

Anne. I made them myself.

Dussel (puzzled). Capsules! Two capsules!

Anne. They're ear-plugs!

Dussel. Ear-plugs?

Anne. To put in your ears so you won't hear me when I thrash around at night. I saw them advertised in a magazine. They're not real ones... I made them out of cotton and candle wax. Try them... See if they don't work...

Dussel (putting them in his ears). Wait now until I get them in... so.

Anne. Are you ready?

Dussel. Huh?

Anne. Are you ready?

Dussel. Good God! They've gone inside! I can't get them out! (They laugh as Mr. Dussel jumps about, trying to shake the plugs out of his ears. Finally he gets them out. Putting them away.)

Thank you, Anne! Thank you!

Mr. Van Daan. A real Hanukkah!

Mrs. Van Daan. Wasn't it cute of her?

Mrs. Frank. I don't know when she did it.

Margot. I love my present.

Anne (sitting at the table). And now let's have the song. Father... please... (to Dussel) Have you heard the Hanukkah song, Mr. Dussel? The song is the whole thing! (She sings.) "Oh, Hanukkah! Oh Hanukkah! The sweet celebration..."

Mr. Frank (quieting her). I'm afraid, Anne, we shouldn't sing that song tonight. (to Dussel) It's a song of jubilation, of rejoicing. One is apt to become too enthusiastic.

Anne. Oh, please, please. Let's sing the song. I promise not to shout!

Mr. Frank. Very well. But quietly now... I'll keep an eye on you and when...

(During Anne starts to sing, she is interrupted by Dussel, who is snoring and wheezing.)

Dussel (pointing to Peter). You... You! (Peter is coming from his bedroom, ostentatiously holding a bulge in his coat as if he were holding his cat, and...
Mr. Frank (interrupting). Or a thief, looking for money.

Mrs. Van Daan. We've got to do something... Quick! Quick! Before they come back.

Mr. Van Daan. There isn't anything to do. Just wait.

(Mr. Frank holds up his hand for them to be quiet. He is listening intensely. There is complete silence as they all strain to hear any sound from below.

Suddenly Anne begins to sway. With a low cry she falls to the floor in a faint. Mrs. Frank goes to her quickly, sitting beside her on the floor and taking her in her arms.)

Mrs. Frank. Get some water, please! Get some water!

(Margot starts for the sink.)

Mr. Van Daan (grabbing Margot). No! No! No one's going to run water!

Mr. Frank. If they've found us, they've found us.

Get the water. (Margot starts again for the sink. Mr. Frank, getting a flashlight) I'm going down.

(Margot rushes to him, clinging to him. Anne struggles to consciousness.)

Margot. No, Father, no! There may be someone there, waiting... It may be a trap!

Mr. Frank. This is Saturday. There is no way for us to know what has happened until Miep or Mr. Kraler comes on Monday morning. We cannot live with this uncertainty.

Margot. Don't go, Father!

Mrs. Frank. Hush, darling, hush. (Mr. Frank slips quietly out, down the steps and out through the door below.) Margot! Stay close to me.

(Margot goes to her mother.)

Mr. Van Daan. Shush! Shush!

(Mrs. Frank whispers to Margot to get the water. Margot goes for it.)

Mrs. Van Daan. Putti, where's our money? Get our money. I hear you can buy the Green Police off, so much a head. Go upstairs quick! Get the money!

Mr. Van Daan. Keep still!

Mrs. Van Daan (kneeling before him, pleading). Do you want to be dragged off to a concentration camp? Are you going to stand there and wait for them to come up and get you? Do something, I tell you!

Mr. Van Daan (pushing her aside). Will you keep still! (He goes over to the stairwell to listen. Peter goes to his mother, helping her up onto the sofa. There is a second of silence, then Anne can stand it no longer.)

Anne. Someone go after Father! Make Father come back!

Peter (starting for the door). I'll go.

Mr. Van Daan. Haven't you done enough?

(He pushes Peter roughly away. In his anger against his father Peter grabs a chair as if to hit him with it, then puts it down, burying his face in his hands.)

Mrs. Frank begins to pray softly.

Anne. Please, please, Mr. Van Daan. Get Father.

Mr. Van Daan. Quiet! Quiet!

(Anne is shocked into silence. Mrs. Frank pulls her closer, holding her protectively in her arms.)

Mrs. Frank (softly, praying). "I lift up mine eyes unto the mountains, from whence cometh my help. My help cometh from the Lord who made heaven and earth. He will not suffer thy foot to be moved... He that keepeth thee will not slumber..." (She stops as she hears someone coming. They all watch the door tensely. Mr. Frank comes quietly in. Anne rushes to him, holding him tight.)

Mr. Frank. It was a thief. That noise must have scared him away.

Mrs. Van Daan. Thank God.

Mr. Frank. He took the cash box. And the radio. He ran away in such a hurry that he didn't stop to shut the street door. It was swinging wide
Reading for Information

DIARY ENTRY Anne Frank's diary entries give readers an intimate understanding of what was going through her mind while she was in hiding. This entry from December 1943 describes her conflicting emotions about life in the Annex.

Friday, December 24, 1943

Dear Kitty,

As I've written you many times before, moods have a tendency to affect us quite a bit here, and in my case it's been getting worse lately. "Himmel hoch jauchzend, zu Tode betrübt" certainly applies to me. I'm "on top of the world" when I think of how fortunate we are and compare myself to other Jewish children, and "in the depths of despair" when, for example, Mrs. Kleiman comes by and talks about Jopie's hockey club, canoe trips, school plays and afternoon teas with friends.

I don't think I'm jealous of Jopie, but I long to have a really good time for once and to laugh so hard it hurts. We're stuck in this house like lepers, especially during winter and the Christmas and New Year's holidays. Actually, I shouldn't even be writing this, since it makes me seem so ungrateful, but I can't keep everything to myself, so I'll repeat what I said at the beginning: "Paper is more patient than people."

Whenever someone comes in from outside, with the wind in their clothes and the cold on their cheeks, I feel like burying my head under the blankets to keep from thinking, "When will we be allowed to breathe fresh air again?" I can't do that—on the contrary, I have to hold my head up high and put a bold face on things, but the thoughts keep coming anyway. Not just once, but over and over.

Believe me, if you've been shut up for a year and a half, it can get to be too much for you sometimes. But feelings can't be ignored, no matter how unjust or ungrateful they seem. I long to ride a bike, dance, whistle, look at the world, feel young and know that I'm free, and yet I can't let it show. Just imagine what would happen if all eight of us were to feel sorry for ourselves or walk around with the discontent clearly visible on our faces. Where would that get us? . . .

Yours, Anne

1. "Himmel hoch jauchzend, zu Tode betrübt": A famous line from Goethe: "On top of the world, or in the depths of despair."
THE DIARY OF ANNE FRANK – TEST Act I

1. Mr. Frank visits the warehouse in November 1945. Anne’s diary begins in July 1942. What important world event happened between those two dates?
   a. World War II began
   b. World War II ended
   c. The Berlin wall came down.
   d. The Vietnam war began.

2. In the opening scene, why is Mr. Frank visiting the warehouse rooms with Miep?
   a. He is looking for his daughter’s diary.
   b. He wants to get his scarf back.
   c. He is looking for a place to live.
   d. He wants one last look at the place where he last saw his family.

3. Why do the Frank family and the Van Daan family move into the rooms in the top floor of the warehouse?
   a. Their own homes have been destroyed by bombs.
   b. They are hiding from the Nazis, who have been persecuting Jews.
   c. The warehouse has more space than their old homes.
   d. The Nazis have taken over their homes, leaving them no place to live.

4. Why is it necessary for the Franks and the Van Daans to be quiet all day?
   a. because Anne, Margot, and Peter need to study.
   b. Because too much noise makes Mrs. Van Daan nervous.
   c. Because they don’t want the workers in the building to hear them.
   d. Because the Nazis ordered all Jews to be quiet during the day.
10. Why is Anne so upset to hear from Mr. Dussel that Jopie de Waal is gone?
   a. She thinks that Jopie has moved away and they might lose contact.
   b. She wonders why Jopie didn’t say good-bye to her first.
   c. She knows that Jopie and her family have been taken by the Nazis.
   d. She had been looking forward to a visit from Jopie.

11. Which fact about the setting is most difficult for Mr. Dussel?
   a. that he cannot get enough time alone.
   b. That there aren’t enough books to read.
   c. That they can’t play music during the daytime.
   d. That it gets too hot in the upper rooms of the warehouse.

12. Why are the people in the attic so afraid of the thief?
   a. He may return and try to break into the attic to steal their things or food.
   b. He may use his knowledge about the attic to blackmail the owner of the building and the Franks and Van Daans.
   c. If the Nazis catch the thief, he may betray the people in the attic in order to keep himself out of jail.
   d. He may go to the Nazis right away to report that there are people living in the attic.
ACT TWO

Scene 1

In the darkness we hear Anne’s Voice, again reading from the diary.

Anne’s Voice. Saturday, the first of January, nineteen forty-four. Another new year has begun and we find ourselves still in our hiding place. We have been here now for one year, five months and twenty-five days. It seems that our life is a standstill.

The curtain rises on the scene. It is late afternoon.

Everyone is bundled up against the cold. In the main room Mrs. Frank is taking down the laundry which is hung across the back. Mr. Frank sits in the chair down left, reading. Margot is lying on the couch with a blanket over her and the many-colored knitted scarf around her throat. Anne is seated at the center table, writing in her diary. Peter, Mr. and Mrs. Van Daan, and Dussel are all in their own rooms, reading or lying down.

As the lights dim on, Anne’s Voice continues, without a break.

Anne’s Voice. We are all a little thinner. The Van Daans’ “discussions” are as violent as ever. Mother still does not understand me. But then I don’t understand her either. There is one great change, however. A change in myself. I read somewhere that girls of my age don’t feel quite certain of themselves. That they become quiet within and begin to think of the miracle that is taking place in their bodies. I think that what is happening to me is so wonderful . . . not only what can be seen, but what is taking place inside. Each time it has happened I have a feeling that I have a sweet secret. (We hear the chimes and then a hymn being played on the carillon outside.) And in spite of any pain, I long for the time when I shall feel that secret within me again.

(The buzz of the door below suddenly sounds. Everyone is startled. Mr. Frank tiptoes cautiously to the top of the steps and listens. Again the buzz sounds, in Miep’s V-for-Victory signal.)

Mr. Frank. It’s Miep! (He goes quickly down the steps to unbolt the door. Mrs. Frank calls upstairs to the Van Daans and then to Peter.)

Mrs. Frank. Wake up, everyone! Miep is here! (Anne quickly puts her diary away. Margot sits up, pulling the blanket around her shoulders. Mr. Dussel sits on the edge of his bed, listening, disgruntled. Miep comes up the steps, followed by Mr. Kraler. They bring flowers, books, newspapers, etc. Anne rushes to Miep, throwing her arms affectionately around her.) Miep . . . and Mr. Kraler . . . What a delightful surprise!

Mr. Kraler. We came to bring you New Year’s greetings.

Mrs. Frank. You shouldn’t . . . you should have at least one day to yourselves. (She goes quickly to the stove and brings down teacups and tea for all of them.)

Anne. Don’t say that, it’s so wonderful to see them!

Miep (giving her the flowers). There you are. (then to Margot, feeling her forehead) How are you, Margot? . . . Feeling any better?

Margot. I’m all right.

Anne. We filled her full of every kind of pill so she won’t cough and make a noise. (She runs into her room to put the flowers in water. Mr. and Mrs. Van Daan come from upstairs. Outside there is the sound of a band playing.)

Mrs. Van Daan. Well, hello, Miep. Mr. Kraler.

Mr. Kraler (giving a bouquet of flowers to Mrs. Van Daan). With my hope for peace in the New Year.

Peter (anxiously). Miep, have you seen Mouschi? Have you seen him anywhere around?

Miep. I’m sorry, Peter. I asked everyone in the neighborhood had they seen a gray cat. But they said no.

(Mrs. Frank gives Miep a cup of tea. Mr. Frank comes up the steps, carrying a small cake on a plate.)

Mr. Frank. Look what Miep’s brought for us!

Mrs. Frank (taking it). A cake!
Mr. Van Daan. A cake! (He pinches Miep's cheeks gaily and hurries up to the cupboard.) I'll get some plates.

(Dussel, in his room, hastily puts a coat on and starts out to join the others.)

Mrs. Frank. Thank you, Miepia. You shouldn't have done it. You must have used all of your sugar ration for weeks. (giving it to Mrs. Van Daan)

It's beautiful, isn't it?

Mrs. Van Daan. It's been ages since I even saw a cake. Not since you brought us one last year. (without looking at the cake, to Miep) Remember? Don't you remember, you gave us one on New Year's Day? Just this time last year? I'll never forget it because you had "Peace in nineteen forty-three" on it. (She looks at the cake and reads.) "Peace in nineteen forty-four!"

Miep. Well, it has to come sometime, you know. (as Dussel comes from his room) Hello, Mr. Dussel.

Mr. Kraler. How are you?

Mr. Van Daan (bringing plates and a knife). Here's the knife, lieffe. Now, how many of us are there?

Miep. None for me, thank you.

Mr. Frank. Oh, please. You must.

Miep. I couldn't.

Mr. Van Daan. Good! That leaves one ... two ... three ... seven of us.

Dussel. Eight! Eight! It's the same number as it always is!

Mr. Van Daan. I left Margot out. I take it for granted Margot won't eat any.

Anne. Why wouldn't she?

Mrs. Frank. I think it won't harm her.

Mr. Van Daan. All right! All right! I just didn't want her to start coughing again, that's all.

Dussel. And please, Mrs. Frank should cut the cake.

Mr. Van Daan. What's the difference? (Together)

Mrs. Van Daan. It's not Mrs. Frank's cake, is it, Miep? It's for all of us.

Dussel. Mrs. Frank divides things better.

Mrs. Van Daan (going to Dussel). What are you trying to say?

Mr. Van Daan. Oh, come on! Stop wasting time!

Mrs. Van Daan (to Dussel). Don't I always give everybody exactly the same? Don't I?

Mr. Van Daan. Forget it, Kerli.

Mrs. Van Daan. No, I want an answer! Don't I?

Dussel. Yes. Yes. Everybody gets exactly the same ... except Mr. Van Daan always gets a little bit more.

(Mr. Van Daan advances on Dussel, the knife still in his hand.)

Mr. Van Daan. That's a lie!

(Dussel retreats before the onslaught of the Van Daans.)

Mr. Frank. Please, please! (then to Miep) You see what a little sugar cake does to us? It goes right to our heads!

Mr. Van Daan (handing Mrs. Frank the knife).

Here you are, Mrs. Frank.

Mrs. Frank. Thank you. (then to Miep as she goes to the table to cut the cake) Are you sure you won't have some?

Miep (drinking her tea). No, really, I have to go in a minute.

(The sound of the band fades out in the distance.)

Peter (to Miep). Maybe Mouschi went back to our house ... they say that cats ... Do you ever get over there ... ? I mean ... do you suppose you could ... ?

Miep. I'll try, Peter. The first minute I get I'll try. But I'm afraid, with him gone a week ... 

Dussel. Make up your mind, already someone has had a nice big dinner from that cat!

(Peter is furious, inarticulate. He starts toward Dussel as if to hit him. Mr. Frank stops him.

Mrs. Frank speaks quickly to ease the situation.)

Mrs. Frank (to Miep). This is delicious, Miep!

Mrs. Van Daan (eating hers). Delicious!
Mr. Frank (coming back, to Mr. Kraler). If it's something that concerns us here, it's better that we all hear it.

Mr. Kraler (turning to him, quietly). But . . . the children . . .?

Mr. Frank. What they'd imagine would be worse than any reality.

(As Mr. Kraler speaks, they all listen with intense apprehension. Mrs. Van Daan comes down the stairs and sits on the bottom step.)

Mr. Kraler. It's a man in the storeroom . . . I don't know whether or not you remember him . . . Carl, about fifty, heavy-set, near-sighted . . . He came with us just before you left.

Mr. Frank. He was from Utrecht?

Mr. Kraler. That's the man. A couple of weeks ago, when I was in the storeroom, he closed the door and asked me . . . how's Mr. Frank? What do you hear from Mr. Frank? I told him I only knew there was a rumor that you were in Switzerland. He said he'd heard that rumor too, but he thought I might know something more. I didn't pay any attention to it . . . but then a thing happened yesterday . . . He'd brought some invoices to the office for me to sign. As I was going through them, I looked up. He was standing staring at the bookcase . . . your bookcase. He said he thought he remembered a door there . . . Wasn't there a door there that used to go up to the loft? Then he told me he wanted more money. Twenty guilders more a week.

Mr. Van Daan. Blackmail!

Mr. Frank. Twenty guilders? Very modest blackmail.

Mr. Van Daan. That's just the beginning.

Dussel (coming to Mr. Frank). You know what I think? He was the thief who was down there that night. That's how he knows we're here.

Mr. Frank (to Mr. Kraler). How was it left? What did you tell him?

Mr. Kraler. I said I had to think about it. What shall I do? Pay him the money? . . . Take a chance on firing him . . . or what? I don't know.

Dussel (frantic). For God's sake don't fire him! Pay him what he asks . . . keep him here where you can have your eye on him.

Mr. Frank. Is it so much that he's asking? What are they paying nowadays?

Mr. Kraler. He could get it in a war plant. But this isn't a war plant. Mind you, I don't know if he really knows . . . or if he doesn't know.

Mr. Frank. Offer him half. Then we'll soon find out if it's blackmail or not.

Dussel. And if it is? We've got to pay it, haven't we? Anything he asks we've got to pay!

Mr. Frank. Let's decide that when the time comes.

Mr. Kraler. This may be all my imagination. You get to a point, these days, where you suspect everyone and everything. Again and again . . . on some simple look or word, I've found myself . . .

(The telephone rings in the office below.)

Mrs. Van Daan (hurrying to Mr. Kraler). There's the telephone! What does that mean, the telephone ringing on a holiday?

Mr. Kraler. That's my wife. I told her I had to go over some papers in my office . . . to call me there when she got out of church. (He starts out.) I'll offer him half then. Good-bye . . . we'll hope for the best!

(The group call their good-byes half-heartedly.)

Mr. Frank follows Mr. Kraler, to bolt the door below. During the following scene, Mr. Frank comes back up and stands listening, disturbed.)

Dussel (to Mr. Van Daan). You can thank your son for this . . . smashing the light! I tell you, it's just a question of time now. (He goes to the window at the back and stands looking out.)

Margot. Sometimes I wish the end would come . . . whatever it is.

Mrs. Frank (shocked). Margot!

(Anne goes to Margot, sitting beside her on the couch with her arms around her.)

Margot. Then at least we'd know where we were.

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1. guilders (gilders): the basic monetary unit of the Netherlands at the time.
Peter. I think you’re just fine . . . What I want to say . . . if it wasn’t for you around here, I don’t know. What I mean . . .

(Peter is interrupted by Dussel’s turning on the light. Dussel stands in the doorway, startled to see Peter. Peter advances toward him forbiddingly. Dussel backs out of the room. Peter closes the door on him.)

Anne. Do you mean it, Peter? Do you really mean it?

Peter. I said it, didn’t I?

Anne. Thank you, Peter!

(In the main room Mr. and Mrs. Frank collect the dishes and take them to the sink, washing them. Margot lies down again on the couch. Dussel, lost, wanders into Peter’s room and takes up a book, starting to read.)

Peter (looking at the photographs on the wall). You’ve got quite a collection.

Anne. Wouldn’t you like some in your room? I could give you some. Heaven knows you spend enough time in there . . . doing heaven knows what . . .

Peter. It’s easier. A fight starts, or an argument . . . I duck in there.

Anne. You’re lucky, having a room to go to. His lordship is always here . . . I hardly ever get a minute alone. When they start in on me, I can’t duck away. I have to stand there and take it.

Peter. You gave some of it back just now.

Anne. I get so mad. They’ve formed their opinions . . . about everything . . . but we . . . we’re still trying to find out . . . We have problems here that no other people our age have ever had. And just as you think you’ve solved them, something comes along and bang! You have to start all over again.

Peter. At least you’ve got someone you can talk to.

Anne. Not really. Mother . . . I never discuss anything serious with her. She doesn’t understand. Father’s all right. We can talk about everything . . . everything but one thing. Mother. He simply won’t talk about her. I don’t think you can be really intimate with anyone if he holds something back, do you?

Peter. I think your father’s fine.

Anne. Oh, he is, Peter! He is! He’s the only one who ever given me the feeling that I have any sense. But anyway, nothing can take the place of school and play and friends of your own age . . . or near your age . . . can it?

Peter. I suppose you miss your friends and all.

Anne. It isn’t just . . . (She breaks off, staring up at him for a second.) Isn’t it funny, you and I? Here we’ve been seeing each other every minute for almost half a year, and this is the first time we’ve ever really talked. It helps a lot to have someone to talk to, don’t you think? It helps you to let off steam.

Peter (going to the door). Well, any time you want to let off steam, you can come into my room.

Anne (following him). I can get up an awful lot of steam. You’ll have to be careful how you say that.

Peter. It’s all right with me.

Anne. Do you mean it?

Peter. I said it, didn’t I?

(He goes out. Anne stands in her doorway looking after him. As Peter gets to his door he stands for a minute looking back at her. Then he goes into his room. Dussel rises as he comes in, and quickly passes him, going out. He starts across for his room. Anne sees him coming, and pulls her door shut. Dussel turns back toward Peter’s room. Peter pulls his door shut. Dussel stands there, bewildered, forlorn.)

The scene slowly dims out. The curtain falls on the scene. Anne’s Voice comes over in the darkness . . . faintly at first, and then with growing strength.)

Anne’s Voice. We’ve had bad news. The people from whom Miep got our ration books have been arrested. So we have had to cut down on our food. Our stomachs are so empty that they rumble and make strange noises, all in different keys. Mr. Van Daan’s is deep and low, like a bass fiddle. Mine is high, whistling like a flute. As we all sit around
Mrs. Frank. Then may I ask you this much, Anne. Please don’t shut the door when you go in.

Anne. You sound like Mrs. Van Daan! (She throws the brassière back in Margot’s sewing basket and picks up her blouse, putting it on.)

540 Mrs. Frank. No. No. I don’t mean to suggest anything wrong. I only wish that you wouldn’t expose yourself to criticism . . . that you wouldn’t give Mrs. Van Daan the opportunity to be unpleasant.

Anne. Mrs. Van Daan doesn’t need an opportunity to be unpleasant!

Mrs. Frank. Everyone’s on edge, worried about Mr. Kräler. This is one more thing . . .

Anne. I’m sorry, Mother. I’m going to Peter’s room. I’m not going to let Petronella Van Daan spoil our friendship.

(Mrs. Frank hesitates for a second, then goes out, closing the door after her. She gets a pack of playing cards and sits at the center table, playing solitaire. In Anne’s room Margot hands the finished skirt to Anne. As Anne is putting it on, Margot takes off her high-heeled shoes and stuffs paper in the toes so that Anne can wear them.)

Margot (to Anne). Why don’t you two talk in the main room? It’d save a lot of trouble. It’s hard on Mother, having to listen to those remarks from Mrs. Van Daan and not say a word.

Anne. Why doesn’t she say a word? I think it’s ridiculous to take it and take it.

Margot. You don’t understand Mother at all, do you? She can’t talk back. She’s not like you. It’s just not in her nature to fight back.

Anne. Anyway . . . the only one I worry about is you. I feel awfully guilty about you.

570 (She sits on the stool near Margot, putting on Margot’s high-heeled shoes.)

Margot. What about?

Anne. I mean, every time I go into Peter’s room, I have a feeling I may be hurting you. (Margot shakes her head.) I know if it were me, I’d be wild. I’d be desperately jealous, if it were me.

Margot. Well, I’m not.

Anne. You don’t feel badly? Really? Truly? You’re not jealous?

580 Margot. Of course I’m jealous . . . jealous that you’ve got something to get up in the morning for . . . But jealous of you and Peter? No.

(Anne goes back to the mirror.)

Anne. Maybe there’s nothing to be jealous of. Maybe he doesn’t really like me. Maybe I’m just taking the place of his cat . . . (She picks up a pair of short white gloves, putting them on.) Wouldn’t you like to come in with us?

Margot. I have a book.

590 (The sound of the children playing outside fades out. In the main room Dussel can stand it no longer. He jumps up, going to the bedroom door and knocking sharply.)

Dussel. Will you please let me in my room!

Anne. Just a minute, dear, dear Mr. Dussel. (She picks up her Mother’s pink stole and adjusts it elegantly over her shoulders, then gives a last look in the mirror.) Well, here I go . . . to run the gauntlet. 4 (She starts out, followed by Margot.)

Dussel (as she appears—sarcastic). Thank you so much.

(Dussel goes into his room. Anne goes toward Peter’s room, passing Mrs. Van Daan and her parents at the center table.)

Mrs. Van Daan. My God, look at her! (Anne pays no attention. She knocks at Peter’s door.) I don’t know what good it is to have a son. I never see him. He wouldn’t care if I killed myself. (Peter opens the door and stands aside for Anne to come in.) Just a minute, Anne. (She goes to them at the door.) I’d like to say a few words to my son. Do you mind? (Peter and Anne stand waiting.) Peter, I don’t want you staying up till all hours tonight. You’ve got to have your sleep. You’re a growing boy. You hear?

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4. to run the gauntlet: to endure a series of troubles or difficulties.
(In his room Dussel takes his pajamas and toilet articles and goes into the bathroom to change.)

Anne. I'm glad you don't just hate me.

Peter. I never said that.

Anne. I bet when you get out of here you'll never think of me again.

Peter. That's crazy.

Anne. When you get back with all of your friends, you're going to say... now what did I ever see in that Mrs. Quack Quack.

Peter. I haven't got any friends.

Anne. Oh, Peter, of course you have. Everyone has friends.

Peter. Not me. I don't want any. I get along all right without them.

Anne. Does that mean you can get along without me? I think of myself as your friend.

Peter. No. If they were all like you, it'd be different.

(He takes the glasses and the bottle and puts them away. There is a second's silence and then Anne speaks, hesitantly, shyly.)

Anne. Peter, did you ever kiss a girl?

Peter. Yes. Once.

Anne (to cover her feelings). That picture's crooked. (Peter goes over, straightening the photograph.) Was she pretty?

Peter. Huh?

Anne. The girl that you kissed.

Peter. I don't know. I was blindfolded. (He comes back and sits down again.) It was at a party. One of those kissing games.

Anne (relieved). Oh. I don't suppose that really counts, does it?

Peter. It didn't with me.

Anne. I've been kissed twice. Once a man I'd never seen before kissed me on the cheek when he picked me up off the ice and I was crying. And the other was Mr. Koophuis, a friend of Father's who kissed my hand. You wouldn't say those counted, would you?

Peter. I wouldn't say so.

Anne. I know almost for certain that Margot would never kiss anyone unless she was engaged to them. And I'm sure too that Mother never touched a man before Pim. But I don't know... things are so different now... What do you think? Do you think a girl shouldn't kiss anyone except if she's engaged or something? It's so hard to try to think what to do, when we are with the whole world falling around our ears and you think... well... you don't know what's going to happen tomorrow and... What do you think?

Peter. I suppose it'd depend on the girl. Some girls, anything they do's wrong. But others... well... it wouldn't necessarily be wrong with them. (The carillon starts to strike nine o'clock.) I've always thought that when two people...

Anne. Nine o'clock. I have to go.

Peter. That's right.

Anne (without moving). Good night.

(There is a second's pause, then Peter gets up and moves toward the door.)

Peter. You won't let them stop you coming?

Anne. No. (She rises and starts for the door.) Sometime I might bring my diary. There are so many things in it that I want to talk over with you. There's a lot about you.

Peter. What kind of things?

Anne. I wouldn't want you to see some of it. I thought you were a nothing, just the way you thought about me.

Peter. Did you change your mind, the way I changed my mind about you?

Anne. Well... You'll see...
Frank and Margot are sleeping. He goes to the food safe and again lights a match. Then he cautiously opens the safe, taking out a half-loaf of bread. As he closes the safe, it creaks. He stands rigid. Mrs. Frank sits up in bed. She sees him.

Mrs. Frank (screaming). Otto! Otto! Komme schnell! (The rest of the people wake, hurriedly getting up.)

Mr. Frank. Was ist los? Was ist passiert? (Dussel, followed by Anne, comes from his room.)

Mrs. Frank (as she rushes over to Mr. Van Daan). Er stiehlt das Essen! (Dussel, grabbing Mr. Van Daan). You! You! Give me that.

Mrs. Van Daan (coming down the stairs). Putti . . . Putti . . . what is it?

Dussel (his hands on Van Daan's neck). You dirty thief . . . stealing food . . . you good-for-nothing . . .

Mr. Frank. Mr. Dussel! For God's sake! Help me, Peter! (Peter comes over, trying, with Mr. Frank, to separate the two struggling men.)

Peter. Let him go! Let go!

(Dussel drops Mr. Van Daan, pushing him away. He shows them the end of a loaf of bread that he has taken from Van Daan.)

Dussel. You greedy, selfish . . . ! (Margot turns on the lights.)

Mrs. Van Daan. Putti . . . what is it?

(All of Mrs. Frank's gentleness, her self-control, is gone. She is outraged, in a frenzy of indignation.)

Mrs. Frank. The bread! He was stealing the bread! Dussel. It was you, and all the time we thought it was the rats!

Mr. Frank. Mr. Van Daan, how could you!

Mr. Van Daan. I'm hungry.

Mrs. Frank. We're all of us hungry! I see the children getting thinner and thinner. Your own son Peter . . .

I've heard him moan in his sleep, he's so hungry. And you come in the night and steal food that should go to them . . . to the children!

Mrs. Van Daan (going to Mr. Van Daan protectively). He needs more food than the rest of us. He's used to more. He's a big man.

(Mr. Van Daan breaks away, going over and sitting on the couch.)

Mrs. Frank (turning on Mrs. Van Daan). And you . . . you're worse than he is! You're a mother, and yet you sacrifice your child to this man . . . this . . . this . . .

Mr. Frank. Edith! Edith!

(Margot picks up the pink woollen sole, putting it over her mother's shoulders.)

Mrs. Frank (paying no attention, going on to Mrs. Van Daan). Don't think I haven't seen you! Always saving the choicest bits for him! I've watched you day after day and I've held my tongue. But not any longer! Not after this! Now I want him to go!

I want him to get out of here!

Mr. Frank. Edith!

Mr. Van Daan. Get out of here? Together

Mrs. Van Daan. What do you mean?

Mrs. Frank. Just that! Take your things and get out!

Mr. Frank (to Mrs. Frank). You're speaking in anger. You cannot mean what you are saying.

Mrs. Frank. I mean exactly that!

(Mrs. Van Daan takes a cover from the Franks' bed, putting it about her.)

Mr. Frank. For two long years we have lived here, side by side. We have respected each other's rights . . . we have managed to live in peace. Are we now going to throw it all away? I know this will never happen again, will it, Mr. Van Daan?

5. Komme schnell! (komm'shnel) German: Come quickly!

6. Was ist los? Was ist passiert? (väs tist löś? väs tist päsērt?) German: What's the matter? What has happened?

7. Er stiehlt das Essen! (ör shiel't 'däss i's'en) German: He is stealing food!
Mr. Frank (as he starts down to unbolt the door). I beg you, don’t let her see a thing like this!

Mr. Dussel (counting without stopping). . . . Anne, Peter, Mrs. Van Daan, Mr. Van Daan, myself . . .

Margot (to Dussel). Stop it! Stop it!

Dussel . . . Mr. Frank, Margot, Anne, Peter, Mrs. Van Daan, Mr. Van Daan, myself, Mrs. Frank . . .

Mrs. Van Daan. You’re keeping the big ones for yourself! All the big ones . . . Look at the size of that! . . . And that! . . .

(Dussel continues on with his dividing. Peter, with his shirt and trousers on, comes from his room.)

Margot. Stop it! Stop it!

(We hear Miep’s excited voice speaking to Mr. Frank below.)

Miep. Mr. Frank . . . the most wonderful news! . . . The invasion has begun!

Mr. Frank. Go on, tell them! Tell them!

(Miep comes running up the steps, ahead of Mr. Frank. She has a man’s raincoat on over her nightclothes and a bunch of orange-colored flowers in her hand.)

Miep. Did you hear that, everybody? Did you hear what I said? The invasion has begun! The invasion!

(They all stare at Miep, unable to grasp what she is telling them. Peter is the first to recover his wits.)

Peter. Where?

Mrs. Van Daan. When? When, Miep?

Miep. It began early this morning . . .

(As she talks on, the realization of what she has said begins to dawn on them. Everyone goes crazy. A wild demonstration takes place. Mrs. Frank hugs Mr. Van Daan.)

Mrs. Frank. Oh, Mr. Van Daan, did you hear that?

(Dussel embraces Mrs. Van Daan. Peter grabs a frying pan and parades around the room, beating on it, singing the Dutch National Anthem. Anne and Margot follow him, singing, weaving in and out among the excited grompups. Margot breaks away to take the flowers from Miep and distribute them to everyone. While this pandemonium is going on

Mrs. Frank tries to make herself heard above the excitement.)

Mrs. Frank (to Miep). How do you know?

Miep. The radio . . . The B.B.C.! They said they landed on the coast of Normandy!

Peter. The British?

Miep. British, Americans, French, Dutch, Poles, Norwegians . . . all of them! More than four thousand ships! Churchill spoke, and General Eisenhower! D-Day they call it!

Mr. Frank. Thank God, it’s come!

Mrs. Van Daan. At last!

Miep (starting out). I’m going to tell Mr. Kraler. This’ll be better than any blood transfusion.

Mr. Frank (stopping her). What part of Normandy did they land, did they say?

Miep. Normandy . . . that’s all I know now . . . I’ll be up the minute I hear some more! (She goes hurriedly out.)

Mr. Frank (to Mrs. Frank). What did I tell you? What did I tell you?

(Mrs. Frank indicates that he has forgotten to bolt the door after Miep. He hurries down the steps. Mr. Van Daan, sitting on the couch, suddenly breaks into a convulsive sob. Everybody looks at him, bewildered.)

Mrs. Van Daan (hurrying to him). Putti! Putti! What is it? What happened?

Mr. Van Daan. Please. I’m so ashamed.

(Mr. Frank comes back up the steps.)

Dussel. Oh, for God’s sake!

Mrs. Van Daan. Don’t, Putti.

Margot. It doesn’t matter now!

Mr. Frank (going to Mr. Van Daan). Didn’t you hear what Miep said? The invasion has come! We’re going to be liberated! This is a time to celebrate!

(He embraces Mrs. Frank and then hurries to the cupboard and gets the cognac and a glass.)

Mr. Van Daan. To steal bread from children!
Mr. Frank. Please. Please.

Mr. Van Daan (to Dussel). You're wasting your breath.

Dussel. Something has happened, Mr. Frank. For three days now Miep hasn't been to see us! And today not a man has come to work. There hasn't been a sound in the building!

Mrs. Frank. Perhaps it's Sunday. We may have lost track of the days.

Mr. Van Daan (to Anne). You with the diary there. What day is it?

Dussel (going to Mrs. Frank). I don't lose track of the days! I know exactly what day it is! It's Friday, the fourth of August. Friday, and not a man at work. (He rushes back to Mr. Frank, pleading with him, almost in tears.) I tell you Mr. Kräler's dead. That's the only explanation. He's dead and they've closed down the building, and Miep's trying to tell us!

Mr. Frank. She'd never telephone us.

Dussel (frantically). Mr. Frank, answer that! I beg you, answer it!

Mr. Frank. No.

Mr. Van Daan. Just pick it up and listen. You don't have to speak. Just listen and see if it's Miep.

Dussel (speaking at the same time). For God's sake... I ask you.

Mr. Frank. No. I've told you, no. I'll do nothing that might let anyone know we're in the building.

Peter. Mr. Frank's right.

Mr. Van Daan. There's no need to tell us what side you're on.

Mr. Frank. If we wait patiently, quietly, I believe that help will come.

(There is silence for a minute as they all listen to the telephone ringing.)

Dussel. I'm going down. (He rushes down the steps, Mr. Frank tries ineffectually to hold him. Dussel runs to the lower door, unbolting it. The telephone stops ringing. Dussel bolts the door and comes slowly back up the steps.) Too late. (Mr. Frank goes to Margot in Anne's bedroom.)

Mr. Van Daan. So we just wait here until we die.

Mrs. Van Daan (hysterically). I can't stand it! I'll kill myself! I'll kill myself!

Mr. Van Daan. For God's sake, stop it! (In the distance, a German military band is heard playing a Viennese waltz.)

Mrs. Van Daan. I think you'd be glad if I did! I think you want me to die!

Mr. Van Daan. Whose fault is it we're here? (Mrs. Van Daan starts for her room. He follows, talking at her.) We could've been safe somewhere... in America or Switzerland. But no! No! You wouldn't leave when I wanted to. You couldn't leave your things. You couldn't leave your precious furniture.

Mrs. Van Daan. Don't touch me!

(She hurries up the stairs, followed by Mr. Van Daan. Peter, unable to bear it, goes to his room. Anne looks after him, deeply concerned. Dussel returns to his post at the window. Mr. Frank comes back into the main room and takes a book, trying to read. Mrs. Frank sits near the sink, starting to peel some potatoes. Anne quietly goes to Peter's room, closing the door after her. Peter is lying face down on the cot. Anne leans over him, holding him in her arms, trying to bring him out of his despair.)

Anne. Look, Peter, the sky. (She looks up through the skylight.) What a lovely, lovely day! Aren't the clouds beautiful? You know what I do when it seems as if I couldn't stand being cooped up for one more minute? I think myself out. I think myself on a walk in the park where I used to go with Pim. Where the jonquils and the crocus and the violets grow down the slopes. You know the most wonderful part about thinking yourself out? You can have it any way you like. You can have roses and violets and chrysanthemums all blooming at the same time... It's funny... I used to take it all for granted... and now I've gone crazy about everything to do with nature. Haven't you?
louder. Peter comes to Anne, kissing her good-bye, then he goes to his room to collect his things. The buzzer of their door starts to ring. Mr. Frank brings Mrs. Frank a bag. They stand together, waiting. We hear the thud of gun butts on the door, trying to break it down.

Anne stands, holding her school satchel, looking over at her father and mother with a soft, reassuring smile. She is no longer a child, but a woman with courage to meet whatever lies ahead.

The lights dim out. The curtain falls on the scene. We hear a mighty crash as the door is shattered.

After a second Anne's Voice is heard.

Anne's Voice. And so it seems our stay here is over. They are waiting for us now. They've allowed us five minutes to get our things. We can each take a bag and whatever it will hold of clothing. Nothing else. So, dear Diary, that means I must leave you behind. Good-bye for a while. P.S. Please, please, Miep, or Mr. Kräler, or anyone else. If you should find this diary, will you please keep it safe for me, because some day I hope . . .

(Her voice stops abruptly. There is silence. After a second the curtain rises.)

Scene 5

It is again the afternoon in November, 1945. The rooms are as we saw them in the first scene. Mr. Kräler has joined Miep and Mr. Frank. There are coffee cups on the table. We see a great change in Mr. Frank. He is calm now. His bitterness is gone. He slowly turns a few pages of the diary. They are blank.

Mr. Frank. No more. (He closes the diary and puts it down on the couch beside him.)

Miep. I'd gone to the country to find food. When I got back the block was surrounded by police . . .

Mr. Kräler. We made it our business to learn how they knew. It was the thief . . . the thief who told them.

(Miep goes up to the gas burner, bringing back a pot of coffee.)

Mr. Frank (after a pause). It seems strange to say this, that anyone could be happy in a concentration camp. But Anne was happy in the camp in Holland where they first took us. After two years of being shut up in these rooms, she could be out . . . out in the sunshine and the fresh air that she loved.

Miep (offering the coffee to Mr. Frank). A little more?

Mr. Frank (holding out his cup to her). The news of the war was good. The British and Americans were sweeping through France. We felt sure that they would get to us in time. In September we were told that we were to be shipped to Poland . . . The men to one camp. The women to another. I was sent to Auschwitz. They went to Belsen. In January we were freed, the few of us who were left. The war wasn't yet over, so it took us a long time to get home. We'd be sent here and there behind the lines where we'd be safe. Each time our train would stop . . . at a siding, or a crossing . . . we'd all get out and go from group to group . . . Where were you? Were you at Belsen? At Buchenwald? At Mauthausen? Is it possible that you knew my wife? Did you ever see my husband? My son? My daughter? That's how I found out about my wife's death . . . of Margot, the Van Daans . . . Dussel. But Anne . . . I still hoped . . . Yesterday I went to Rotterdam. I'd heard of a woman there . . . She'd been in Belsen with Anne . . . I know now.

(He picks up the diary again, and turns the pages back to find a certain passage. As he finds it we hear Anne's Voice.)

Anne's Voice. In spite of everything, I still believe that people are really good at heart.

(Mr. Frank slowly closes the diary.)

Mr. Frank. She puts me to shame. (They are silent.)

The Curtain Falls.
**Comprehension**

1. **Recall**  Who was stealing the bread in the Annex?
2. **Summarize**  Why does the man from the storeroom request extra money?

**Text Analysis**

3. **Make Inferences**  Mrs. Van Daan doesn’t need her fur coat in the attic. Why does she react so strongly when Mr. Van Daan wants to sell it?
4. **Analyze Plot**  What was the play’s climax, or the point of highest tension? Use a graphic to note the events that happen at each stage of the play’s plot.

- **Interpret a Drama**  Review the chart you made as you read. Anne grew up under the Nazi occupation. In your opinion, how did life in the attic affect her personality? How did life in the attic affect the personality of Mr. Van Daan?
- **Evaluate a Drama**  Reread lines 73–118 in Act One and 1308–1330 in Act Two. According to the stage directions, what is taking place on the stage at these times? Explain how this staging allows the playwrights to convey information that might not be revealed if all dialogue occurred only between characters.
- **Evaluate Theme**  At the end of Act Two, Anne shares with Peter her ideas about the tragic events they have been hearing about. She says, “I think the world may be going through a phase . . . it’ll pass.” How do Anne’s ideas illustrate the theme of the play? How does Peter react to her ideas?

**Extension and Challenge**

8. **Creative Project: Drama**  With a small group, choose a scene that supports the play’s theme and practice acting it out. When you perform for the class, explain why you chose the scene you did.

9. **Social Studies Connection**  Many Jews in Europe tried to save themselves when the Nazis came to power. Research one of the following people to find out how he or she survived: Yettie Mendels, Erika Van Hesteren, Alfred Lessing, and Joseph Heinrich.

**What IMPACT will you have on the world?**

Review the quickwrite activity on page 508. What effect has reading *The Diary of Anne Frank* had on the way you answer the questions?
Act 2 Scene 1-5 Exit Tickets
5 Items - 10 pts/item 50 pts Total
Act 2 - Scene 2 Exit Ticket

CCSS: Analyze Language
(LINES 854–868)
RL 4
Explain that in a play a character’s tone is the attitude he or she expresses toward a subject or another character. Point out that the speaker’s choice of words influences the tone.

CITE TEXT EVIDENCE

1. Have students reread lines 854–868 to determine Mrs. Van Daan’s tone.

2. What words does Mrs. Van Daan use to suggest the tone?

3. What is the impact of her tone?
Act 2 - Scene 4 Exit Ticket

CCSS: Analyze Dialogue in Drama
(LINES 1718–1734)
RL 3
Prompt students to evaluate Anne’s comments to Peter to determine what they reveal about her.

CITE TEXT EVIDENCE
Have students reread lines 1718–1734.

1. What evidence of good does Anne see in the world?

2. What does this part of the dialogue reveal about Anne?
The Diary of Anne Frank, Act Two

Multiple Choice
Identify the choice that best completes the statement or answers the question.
Comprehension

Read each of the following questions. Then choose the letter of the best answer.

1. Why do people in the Annex fight when Miep brings them a cake?
   A. Peter thinks his cat should get a piece of cake.
   B. Mr. Dussel says people unfairly divide food.
   C. People disagree about eating or saving the cake.
   D. Mrs. Van Daan thinks Miep should bring cake more often.

2. In Scene 1, what does Peter say he admires about Anne?
   A. her way of talking to adults
   B. her pride in being Jewish
   C. her skill at entertaining others
   D. her concern for Miep and Kraler

3. In what way has Anne and Peter’s relationship changed in Act Two?
   A. They disagree more and often find fault with each other.
   B. They ignore each other, but secretly want to be friends.
   C. They seldom speak, but send messages through Margot.
   D. They have become friends and can talk to each other.

4. The only time in the play when Mrs. Frank loses her temper is when
   A. Miep forgets to bring them books.
   B. Mr. Dussel criticizes Anne’s clothes.
   C. she sees Mr. Van Daan stealing food.
   D. she catches Peter and Anne kissing.

5. What character trait is revealed by Peter’s decision to stay with his parents if they are forced out of the annex?
   A. He is honest.
   B. He is responsible.
   C. He is loyal.
   D. He is kind.
CCSS.ELA-LITERACY.L.8.5
Demonstrate understanding of figurative language, word relationships, and nuances in word meanings

CCSS.ELA-LITERACY.L.8.2
Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Name of the song or poem:

- Find a school appropriate song or poem that relates to you.
- Identify five different types of Figurative Language. Explain what the author is trying to convey with each one.
- Explain how the song or poem relates to you.
- Please make sure that your grammar is correct!

<table>
<thead>
<tr>
<th>Figurative Language</th>
<th>5</th>
<th>4</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I was able to correctly identify five different types of Figurative Language</td>
<td>I was able to correctly identify four different types of Figurative Language</td>
<td>I was able to correctly identify three or less different types of Figurative Language</td>
</tr>
<tr>
<td>Conventions</td>
<td>My grammar is perfect.</td>
<td>I have between one to four errors.</td>
<td>I have five or more errors.</td>
</tr>
</tbody>
</table>

Total: ___/10 points
YEAR IN REVIEW PROJECT

This has been a crazy end of the school year. We know that this is not how you wanted to end your 8th grade year. You are not able to say good-bye to your friends, and those adults in the school that you feel made a difference in your world.

Your assignment is to create a poster, it can be done on 8.5” X 11” (standard) paper, that celebrates your 8th grade year. Students completing this project via remote learning, please complete via Google Slides and submit via Schoology.

This is what needs to be included:

- Your favorite thing that you ate for lunch
- Your favorite subject and why
- Your favorite teacher and why
- Two of your favorite moments
- The one thing that you wish you could redo
- One thing that you would like to pass on for the incoming 6th or 7th graders
8th Grade ELA Reflections

Please complete the following survey as a reflection of your 8th grade year. Your response will be used to better practices for future generations.
What lesson/project/activity did you most enjoy? Why?

"DIVERSITY IS THE ART OF THINKING INDEPENDENTLY together"

MALCOM FORBES

Your answer

Untitled Title
Explain a time in class in which you were able to overcome a struggle.

SUCCESS
DOESN'T JUST
COME AND
FIND YOU,
YOU HAVE TO
GO OUT
AND GET IT.

Your answer
What is one thing in class that made it difficult for you to learn? What is one thing in class that helped you to be more successful?

BE HAPPY
BE BRIGHT
BE YOU!

Your answer

Send me a copy of my responses.
Math
Grade 8
Covers week of May 4th –
week of June 16th
| 10 | June 2 (B)  | June 3 (G) | **Scientific Notation:** Adding and Subtracting | **Unit 7 Lesson 15**  
Lesson 15 Practice Problems |
|----|------------|----------|-----------------------------------------------|----------------------|
| 11 | June 4 (B) | June 5 (G) | **Square Roots**                              | **Unit 8 Family Support Materials**  
(Expose students to vocab and concepts, use examples from family support materials) |
| 12 | June 8 (B) | June 9 (G) | **Finding Unknown Side Lengths**              | **Unit 8 Lesson 8**  
Lesson 8 Practice Problems |
| 13-14 | June 10 (B) | June 11 (G)  
June 12 (B)  
June 15 (G) | **Applications of the Pythagorean Theorem** | **Unit 8 Lesson 10**  
Lesson 10 Practice Problems |
3. Jada knows she can rewrite the equation as \( r = 48 - 0.8p \). In Jada’s equation, which is the independent variable? Which is the dependent variable?

Solution:

1. 10 ounces of peanuts would cost $2 since \( 0.2 \times 10 = 2 \). 16 ounces of raisins would cost $4 since \( 0.25 \times 16 = 4 \). Together, they would cost Jada $6, leaving her with $6.

2. 35 ounces of peanuts. If Jada wants 20 ounces of raisins, then \( 0.2p + 0.25 \times 20 = 12 \) must be true, which means \( p = 35 \).

3. \( p \) is the independent variable and \( r \) is the dependent variable for Jada’s equation.
Solution:

1. Graph B, input is time in days, output is amount of milk in the bottle
2. Graph A, input is time in weeks, output is height of plant
3. Graph C, input is time in hours, output is temperature
4. Graph A, input is volume of water, output is height of water

In each case, the horizontal axis is labeled with the input, and the vertical axis is labeled with the output.
This cylinder has a height and radius of 5 cm. Leave your answers in terms of $\pi$.

1. What is the diameter of the base?

2. What is the area of the base?

3. What is the volume of the cylinder?

Solution:

1. 10 cm. The diameter is $2 \cdot r$, and $2 \cdot 5 = 10$.

2. $25\pi$ cm$^2$. The area is $\pi$ times the radius squared, or $5^2 \cdot \pi$.

3. $125\pi$ cm$^3$. The volume is the area of the base times the height. The area of the base here is $25\pi$, so the volume is $125\pi$ cm$^3$ since $25\pi \cdot 5 = 125\pi$. 
4. $\frac{256}{3} \pi$ or about 268 cm$^3$. Since the side length of the cube is 8 cm, the radius of the globe is half of that, or 4 cm. The volume of the globe is therefore $\frac{4}{3} \pi \cdot 4^3 = \frac{256}{3} \pi$. 
4.2: Equations and Graphs of Functions

The graphs of three functions are shown.

1. Match one of these equations to each of the graphs.
   a. \( d = 60t \), where \( d \) is the distance in miles that you would travel in \( t \) hours if you drove at 60 miles per hour.
   
   b. \( q = 50 - 0.4d \), where \( q \) is the number of quarters, and \( d \) is the number of dimes, in a pile of coins worth $12.50.
   
   c. \( A = \pi r^2 \), where \( A \) is the area in square centimeters of a circle with radius \( r \) centimeters.

2. Label each of the axes with the independent and dependent variables and the quantities they represent.

3. For each function: What is the output when the input is 1? What does this tell you about the situation? Label the corresponding point on the graph.

4. Find two more input-output pairs. What do they tell you about the situation? Label the corresponding points on the graph.
a. How long did it take Kiran to run 6 meters?

b. How far had he gone after 6 seconds?

c. Estimate when he had run 19.5 meters.

d. Estimate how far he ran in 4 seconds.

e. Is Kiran’s time a function of the distance he has run? Explain how you know.

2. Priya is running once around the track. The graph shows her time given how far she is from her starting point.

a. What was her farthest distance from her starting point?

b. Estimate how long it took her to run around the track.

c. Estimate when she was 100 meters from her starting point.

d. Estimate how far she was from the starting line after 60 seconds.

e. Is Priya’s time a function of her distance from her starting point? Explain how you know.
1. The graph and the table show the high temperatures in a city over a 10-day period.

<table>
<thead>
<tr>
<th>day</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>temperature (degrees F)</td>
<td>60</td>
<td>61</td>
<td>63</td>
<td>61</td>
<td>62</td>
<td>61</td>
<td>60</td>
<td>65</td>
<td>67</td>
<td>63</td>
</tr>
</tbody>
</table>

a. What was the high temperature on Day 7?

b. On which days was the high temperature 61 degrees?

c. Is the high temperature a function of the day? Explain how you know.

d. Is the day a function of the high temperature? Explain how you know.
Lesson 7: Connecting Representations of Functions

7.1: Which are the Same? Which are Different?

Here are three different ways of representing functions. How are they alike? How are they different?

\[ y = 2x \]

<table>
<thead>
<tr>
<th>p</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>q</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>-2</td>
<td>-4</td>
<td>-6</td>
</tr>
</tbody>
</table>
7.3: Comparing Volumes

The volume, $V$, of a cube with edge length $s$ cm is given by the equation $V = s^3$.

The volume of a sphere is a function of its radius (in centimeters), and the graph of this relationship is shown here.

1. Is the volume of a cube with edge length $s = 3$ greater or less than the volume of a sphere with radius 3?

2. If a sphere has the same volume as a cube with edge length 5, estimate the radius of the sphere.

3. Compare the outputs of the two volume functions when the inputs are 2.

Are you ready for more?

Estimate the edge length of a cube that has the same volume as a sphere with radius 2.5.
Lesson 7 Summary

Functions are all about getting outputs from inputs. For each way of representing a function—equation, graph, table, or verbal description—we can determine the output for a given input.

Let's say we have a function represented by the equation $y = 3x + 2$ where $y$ is the dependent variable and $x$ is the independent variable. If we wanted to find the output that goes with 2, we can input 2 into the equation for $x$ and finding the corresponding value of $y$. In this case, when $x$ is 2, $y$ is 8 since $3 \cdot 2 + 2 = 8$.

If we had a graph of this function instead, then the coordinates of points on the graph are the input-output pairs. So we would read the $y$-coordinate of the point on the graph that corresponds to a value of 2 for $x$. Looking at the graph of this function here, we can see the point $(2, 8)$ on it, so the output is 8 when the input is 2.

A table representing this function shows the input-output pairs directly (although only for select inputs).

<table>
<thead>
<tr>
<th>$x$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>-1</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>

Again, the table shows that if the input is 2, the output is 8.
2. Elena and Lin are training for a race. Elena runs her mile at a constant speed of 7.5 miles per hour.

Lin’s total distances are recorded every minute:

<table>
<thead>
<tr>
<th>time (minutes)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>distance (miles)</td>
<td>0.11</td>
<td>0.21</td>
<td>0.32</td>
<td>0.41</td>
<td>0.53</td>
<td>0.62</td>
<td>0.73</td>
<td>0.85</td>
<td>1</td>
</tr>
</tbody>
</table>

a. Who finished their mile first?

b. This is a graph of Lin’s progress. Draw a graph to represent Elena’s mile on the same axes.

c. For these models, is distance a function of time? Is time a function of distance? Explain how you know.
a. Name the two quantities in this situation that are in a functional relationship. Which did you choose to be the independent variable? What is the variable that depends on it?

b. Write an equation that represents the function.

c. Draw the graph of the function. Label at least two points with input-output pairs.

8.3: Is it Filling Up or Draining Out?

There are four tanks of water,

- The amount of water in gallons, $A$, in Tank A is given by the function $A = 200 + 8t$, where $t$ is in minutes.

- The amount of water in gallons, $B$, in Tank B starts at 400 gallons and is decreasing at 5 gallons per minute. These functions work when $t \geq 0$ and $t \leq 80$.

1. Which tank started out with more water?

2. Write an equation representing the relationship between $B$ and $t$.

3. One tank is filling up. The other is draining out. Which is which? How can you tell?
8.4: Which is Growing Faster?

Noah is depositing money in his account every week to save money. The graph shows the amount he has saved as a function of time since he opened his account.

Elena opened an account the same day as Noah. The amount of money $E$ in her account is given by the function $E = 8w + 60$, where $w$ is the number of weeks since the account was opened.

1. Who started out with more money in their account? Explain how you know.

2. Who is saving money at a faster rate? Explain how you know.

3. How much will Noah save over the course of a year if he does not make any withdrawals? How long will it take Elena to save that much?
1. Two cars drive on the same highway in the same direction. The graphs show the distance, $d$, of each one as a function of time, $t$. Which car drives faster? Explain how you know.

2. Two car services offer to pick you up and take you to your destination. Service A charges 40 cents to pick you up and 30 cents for each mile of your trip. Service B charges $1.10 to pick you up and charges $c$ cents for each mile of your trip.

   a. Match the services to the Lines $l'$ and $m$.

   b. For Service B, is the additional charge per mile greater or less than 30 cents per mile of the trip? Explain your reasoning.
Assessment

8-F Modeling with a Linear Function

Task

Which of the following could be modeled by \( y = 2x + 5 \)? Answer YES or NO for each one.

a. There are initially 5 rabbits on the farm. Each month thereafter the number of rabbits is 2 times the number in the month before. How many rabbits are there after \( x \) months?

YES NO

b. Joaquin earns $2.00 for each magazine sale. Each time he sells a magazine he also gets a five-dollar tip. How much money will he earn after selling \( x \) magazines?

YES NO

c. Sandy charges $2.00 an hour for babysitting. Parents are charged $5.00 if they arrive home later than scheduled. Assuming the parents arrived late, how much money does she earn for \( x \) hours?

YES NO

d. I have a sequence of integers. The first term of the sequence is 7 and the difference between any consecutive terms is always equal to 2.

YES NO

e. Sneak Preview is a members-only video rental store. There is a $2.00 initiation fee and a $5.00 per video rental fee. How much would John owe on his first visit if he
1. This table shows a linear relationship between the amount of water in a tank and time.

<table>
<thead>
<tr>
<th>time (minutes)</th>
<th>water (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Which of these statements is true?

A. The water in the tank is increasing at a rate of 2 gallons per minute.
B. The water in the tank is increasing at a rate of 10 gallons per minute.
C. The water in the tank is decreasing at a rate of 2 gallons per minute.
D. The water in the tank is decreasing at a rate of 10 gallons per minute.
Solution:

1. Jada is correct. Rewriting $10^4 \cdot 10^5$ to show all the factors looks like
   $(10 \cdot 10 \cdot 10 \cdot 10) \cdot (10 \cdot 10 \cdot 10 \cdot 10 \cdot 10)$. We can see that there are a total of 9 10s being multiplied. This helps us understand what’s going on when we use the rule to write $10^4 \cdot 10^5 = 10^{4+5} = 10^9$.

2. This time, Noah is correct. When we look at $(10^4)^5$, the outside exponent of 5 tells us that there are 5 $10^4$s being multiplied together. So
   $(10^4)^5 = 10^4 \cdot 10^4 \cdot 10^4 \cdot 10^4 \cdot 10^4$. This means there are 5 groups of 4 10s being multiplied together. We could write this out the long way as
   $(10^4)^5 = (10 \cdot 10 \cdot 10 \cdot 10)(10 \cdot 10 \cdot 10 \cdot 10)(10 \cdot 10 \cdot 10 \cdot 10)(10 \cdot 10 \cdot 10 \cdot 10)(10 \cdot 10 \cdot 10 \cdot 10)$. This helps us understand what’s going on when we use the rule to write
   $(10^4)^5 = 10^{4\cdot5} = 10^{20}$.  

1. The order is: Apollo CSM, autonomous drone, jet boat, sports car. Since all of these values are in scientific notation, we can look at the power of 10 to compare. The speeds of the Apollo CSM and autonomous drone both have the highest power of 10 ($10^4$), so they are fastest. The Apollo CSM is faster than the drone because 3.99 is greater than 2.1. Similarly, the jet boat is faster than the sports car because their speeds both have the same power of 10 ($10^3$) but 5.1 is greater than 4.15.

2. The autonomous drone is faster than the rocket sled. In scientific notation, the rocket sled’s speed is $1.0326 \cdot 10^4$, and the drone’s speed is $2.1 \cdot 10^4$ and 2.1 is greater than 1.0326.

3. To find how many times as fast the Apollo CSM is than the sports car, we are trying to find out what number times $4.15 \cdot 10^2$ equals $3.99 \cdot 10^4$. So we are trying to compute $\frac{3.99 \cdot 10^4}{4.15 \cdot 10^2}$. Since we are estimating, we can simplify the calculation to $\frac{4.1 \cdot 10^4}{4.1 \cdot 10^2}$. Using exponent rules and our understanding of fractions, we have $\frac{4.1 \cdot 10^4}{4.1 \cdot 10^2} = 1 \cdot 10^{4-2} = 10^2$, so the Apollo CSM is about 100 times as fast as the sports car!
2.2: Picture a Power of 10

In the diagram, the medium rectangle is made up of 10 small squares. The large square is made up of 10 medium rectangles.

1. How could you represent the large square as a power of 10?

2. If each small square represents \(10^2\), then what does the medium rectangle represent? The large square?

3. If the medium rectangle represents \(10^5\), then what does the large square represent? The small square?

4. If the large square represents \(10^{100}\), then what does the medium rectangle represent? The small square?
3. The state of Georgia has roughly $10^7$ human residents. Each human has roughly $10^{13}$ bacteria cells in his or her digestive tract. How many bacteria cells are there in the digestive tracts of all the humans in Georgia?

**Are you ready for more?**

There are four ways to make $10^4$ by multiplying powers of 10 with smaller, positive exponents.

\[
10^1 \cdot 10^1 \cdot 10^1 \cdot 10^1 \\
10^1 \cdot 10^1 \cdot 10^2 \\
10^1 \cdot 10^3 \\
10^2 \cdot 10^2
\]

(This list is complete if you don’t pay attention to the order you write them in. For example, we are only counting $10^1 \cdot 10^3$ and $10^3 \cdot 10^1$ once.)

1. How many ways are there to make $10^6$ by multiplying smaller powers of 10 together?

2. How about $10^7$? $10^8$?

**Lesson 2 Summary**

In this lesson, we developed a rule for multiplying powers of 10: multiplying powers of 10 corresponds to adding the exponents together. To see this, multiply $10^5$ and $10^2$. We know that $10^5$ has five factors that are 10 and $10^2$ has two factors that are 10. That means that $10^5 \cdot 10^2$ has 7 factors that are 10.

\[
10^5 \cdot 10^2 = (10 \cdot 10 \cdot 10 \cdot 10 \cdot 10) \cdot (10 \cdot 10) = 10^7.
\]

This will work for other powers of 10 too. So $10^{14} \cdot 10^{47} = 10^{61}$.

This rule makes it easier to understand and work with expressions that have exponents.
3. If you took the amount of oil consumed in 2 months in 2013 worldwide, you could make a cube of oil that measures $10^3$ meters on each side. How many cubic meters of oil is this? Do you think this would be enough to fill a pond, a lake, or an ocean?

### 3.3: How Do the Rules Work?

Andre and Elena want to write $10^2 \cdot 10^2 \cdot 10^2$ with a single exponent.

- Andre says, "When you multiply powers with the same base, it just means you add the exponents, so $10^2 \cdot 10^2 \cdot 10^2 = 10^{2+2+2} = 10^6$.”

- Elena says, "$10^2$ is multiplied by itself 3 times, so $10^2 \cdot 10^2 \cdot 10^2 = (10^2)^3 = 10^{2+3} = 10^5$.”

Do you agree with either of them? Explain your reasoning.

### Are you ready for more?

$2^{12} = 4,096$. How many other whole numbers can you raise to a power and get 4,096? Explain or show your reasoning.

### Lesson 3 Summary

In this lesson, we developed a rule for taking a power of 10 to another power: Taking a power of 10 and raising it to another power is the same as multiplying the exponents. See what happens when raising $10^4$ to the power of 3.

$$ (10^4)^3 = 10^4 \cdot 10^4 \cdot 10^4 = 10^{12} $$

This works for any power of powers of 10. For example, $(10^6)^{11} = 10^{66}$. This is another rule that will make it easier to work with and make sense of expressions with exponents.
3. It is predicted that by 2050, there will be $10^{10}$ people living on Earth. At that time, it is predicted there will be approximately $10^{12}$ trees. How many trees will there be for each person?

Are you ready for more?

<table>
<thead>
<tr>
<th>expression</th>
<th>expanded</th>
<th>single power</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10^4 \div 10^6$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3: Zero Exponent
So far we have looked at powers of 10 with exponents greater than 0. What would happen to our patterns if we included 0 as a possible exponent?

1. a. Write $10^{12} \cdot 10^0$ with a power of 10 with a single exponent using the appropriate exponent rule. Explain or show your reasoning.

b. What number could you multiply $10^{12}$ by to get this same answer?

2. a. Write $\frac{10^8}{10^6}$ with a single power of 10 using the appropriate exponent rule. Explain or show your reasoning.

b. What number could you divide $10^8$ by to get this same answer?

3. If we want the exponent rules we found to work even when the exponent is 0, then what does the value of $10^0$ have to be?

4. Noah says, "If I try to write $10^0$ expanded, it should have zero factors that are 10, so it must be equal to 0." Do you agree? Discuss with your partner.
5.2: Negative Exponent Table

Complete the table to explore what negative exponents mean.

<table>
<thead>
<tr>
<th>using exponents</th>
<th>$10^3$</th>
<th>$10^2$</th>
<th>$10^1$</th>
<th>$10^0$</th>
<th>$10^{-1}$</th>
<th>$10^{-2}$</th>
<th>$10^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>as a decimal</td>
<td>1000.0</td>
<td></td>
<td>1.0</td>
<td></td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>as a fraction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. As you move toward the left, each number is being multiplied by 10. What is the multiplier as you move right?

2. How does a multiplier of 10 affect the placement of the decimal in the product? How does the other multiplier affect the placement of the decimal in the product?

3. Use the patterns you found in the table to write $10^{-7}$ as a fraction.

4. Use the patterns you found in the table to write $10^{-5}$ as a decimal.

5. Write $\frac{1}{100,000,000}$ using a single exponent.

6. Use the patterns in the table to write $10^{-n}$ as a fraction.
3. a. Match each exponential expression with an equivalent multiplication expression:

\[ 10^4 \cdot 10^3 \quad (10 \cdot 10 \cdot 10 \cdot 10) \cdot \left( \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \right) \]

\[ 10^4 \cdot 10^{-3} \quad \left( \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \right) \cdot \left( \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \right) \]

\[ 10^{-4} \cdot 10^3 \quad \left( \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \right) \cdot (10 \cdot 10 \cdot 10) \]

\[ 10^{-4} \cdot 10^{-3} \quad (10 \cdot 10 \cdot 10 \cdot 10) \cdot (10 \cdot 10 \cdot 10) \]

b. Write \(10^{-4} \cdot 10^3\) as a power of 10 with a single exponent. Be prepared to explain your reasoning.

---

**Are you ready for more?**

Priya, Jada, Han, and Diego stand in a circle and take turns playing a game.

Priya says, SAFE. Jada, standing to Priya's left, says, OUT and leaves the circle. Han is next: he says, SAFE. Then Diego says, OUT and leaves the circle. At this point, only Priya and Han are left. They continue to alternate. Priya says, SAFE. Han says, OUT and leaves the circle. Priya is the only person left, so she is the winner.

Priya says, "I knew I'd be the only one left, since I went first."

1. Record this game on paper a few times with different numbers of players. Does the person who starts always win?

2. Try to find as many numbers as you can where the person who starts always wins. What patterns do you notice?
Lesson 6: What about Other Bases?

6.1: True or False: Comparing Expressions with Exponents

Is each statement true or false? Be prepared to explain your reasoning.

1. \(3^5 < 4^6\)
2. \((-3)^2 < 3^2\)
3. \((-3)^3 = 3^3\)
4. \((-5)^2 > -5^2\)

6.2: What Happens with Zero and Negative Exponents?

Complete the table to show what it means to have an exponent of zero or a negative exponent.

<table>
<thead>
<tr>
<th>value</th>
<th>exponent form</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>(2^4)</td>
</tr>
</tbody>
</table>

1. As you move toward the left, each number is being multiplied by 2. What is the multiplier as you move toward the right?

2. Use the patterns you found in the table to write \(2^{-6}\) as a fraction.

3. Write \(\frac{1}{32}\) as a power of 2 with a single exponent.

4. What is the value of \(2^0\)?

5. From the work you have done with negative exponents, how would you write \(5^{-3}\) as a fraction?

6. How would you write \(3^{-4}\) as a fraction?
3. Diego's original expression is $x^4$ and his list is:
\[
\begin{align*}
\frac{x^8}{x^4} & \quad x \cdot x \cdot x \cdot x \\
(x^2)^2 & \quad 4 \cdot x \\
\frac{x^4}{x^8} & \quad x \cdot x^3
\end{align*}
\]

4. Elena's original expression is $8^0$ and her list is:
\[
\begin{align*}
1 & \quad 0 \\
\frac{8^2}{8^7} & \quad 10^0 \\
8^3 \cdot 8^{-3} & \quad 11^0
\end{align*}
\]

Lesson 6 Summary

Earlier we focused on powers of 10 because 10 plays a special role in the decimal number system. But the exponent rules that we developed for 10 also work for other bases. For example, if $2^0 = 1$ and $2^n = \frac{1}{2^n}$, then

\[
\begin{align*}
2^m \cdot 2^n &= 2^{m+n} \\
(2^m)^n &= 2^{m\cdot n} \\
\frac{2^m}{2^n} &= 2^{m-n}.
\end{align*}
\]

These rules also work for powers of numbers less than 1. For example, \(\left(\frac{1}{3}\right)^2 = \frac{1}{3} \cdot \frac{1}{3}\) and \(\left(\frac{1}{3}\right)^4 = \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3}\). We can also check that \(\left(\frac{1}{3}\right)^2 \cdot \left(\frac{1}{3}\right)^4 = \left(\frac{1}{3}\right)^{2+4}\).

Using a variable $x$ helps to see this structure. Since $x^2 \cdot x^5 = x^7$ (both sides have 7 factors that are $x$), if we let $x = 4$, we can see that $4^2 \cdot 4^5 = 4^7$. Similarly, we could let $x = \frac{2}{3}$ or $x = 11$ or any other positive value and show that these relationships still hold.
4. Andre sets up a rain gauge to measure rainfall in his back yard. On Tuesday, it rains off and on all day.

- He starts at 10 a.m. with an empty gauge when it starts to rain.
- Two hours later, he checks, and the gauge has 2 cm of water in it.
- It starts raining even harder, and at 4 p.m., the rain stops, so Andre checks the rain gauge and finds it has 10 cm of water in it.
- While checking it, he accidentally knocks the rain gauge over and spills most of the water, leaving only 3 cm of water in the rain gauge.
- When he checks for the last time at 5 p.m., there is no change.

Graph A

Graph B

a. Which of the two graphs could represent Andre's story? Explain your reasoning.

b. Label the axes of the correct graph with appropriate units.

c. Use the graph to determine how much total rain fell on Tuesday.

(From Unit 5, Lesson 6.)
8.3: How Many Ways Can You Make 3,600?

Your teacher will give your group tools for creating a visual display to play a game. Divide the display into 3 columns, with these headers:

\[ a^n \cdot a^m = a^{n+m} \quad \frac{a^n}{a^m} = a^{n-m} \quad a^n \cdot b^n = (a \cdot b)^n \]

How to play:

When the time starts, you and your group will write as many expressions as you can that equal a specific number using one of the exponent rules on your board. When the time is up, compare your expressions with another group to see how many points you earn.

- Your group gets 1 point for every unique expression you write that is equal to the number and follows the exponent rule you claimed.
- If an expression uses negative exponents, you get 2 points instead of just 1.
- You can challenge the other group’s expression if you think it is not equal to the number or if it does not follow one of the three exponent rules.

Are you ready for more?

You have probably noticed that when you square an odd number, you get another odd number, and when you square an even number, you get another even number. Here is a way to expand the concept of odd and even for the number 3. Every integer is either divisible by 3, one more than a multiple of 3, or one less than a multiple of 3.

1. Examples of numbers that are one more than a multiple of 3 are 4, 7, and 25. Give three more examples.

2. Examples of numbers that are one less than a multiple of 3 are 2, 5, and 32. Give three more examples.

3. Do you think it’s true that when you square a number that is a multiple of 3, your answer will still be a multiple of 3? How about for the other two categories? Try squaring some numbers to check your guesses.
Unit 7 Lesson 8 Cumulative Practice Problems

1. Select all the true statements:
   A. $2^8 \cdot 2^9 = 2^{17}$
   B. $8^2 \cdot 9^2 = 72^2$
   C. $8^2 \cdot 9^2 = 72^4$
   D. $2^8 \cdot 2^9 = 4^{17}$

2. Find $x$, $y$, and $z$ if $(3 \cdot 5)^4 \cdot (2 \cdot 3)^5 \cdot (2 \cdot 5)^7 = 2^x \cdot 3^y \cdot 5^z$.

3. Han found a way to compute complicated expressions more easily. Since $2 \cdot 5 = 10$, he looks for pairings of 2s and 5s that he knows equal 10. For example, $3 \cdot 2^4 \cdot 5^5 = 3 \cdot 2^4 \cdot 5^4 \cdot 5 = (3 \cdot 5) \cdot (2 \cdot 5)^4 = 15 \cdot 10^4 = 150,000$. Use Han's technique to compute the following:
   a. $2^4 \cdot 5 \cdot (3 \cdot 5)^3$
   b. $\frac{2^3 \cdot 5^2 \cdot (2 \cdot 3)^2 \cdot (3 \cdot 5)^2}{3^2}$
Exponents and Scientific Notation: End-of-Unit Assessment (A)

Do not use a calculator.

2. Select all the expressions that equal $6^{-10}$.
   
   A. $6^{-3} \cdot 6^{2}$
   
   B. $\left( \frac{1}{6^{2}} \right)^{5}$
   
   C. $(6^{-5})^{2}$
   
   D. $\frac{6^{3}}{6^{7}}$
   
   E. $\frac{6^{3} \cdot 6^{-1}}{6^{8}}$

6. Place a number in each box so that each equation is true and each equation has at least one negative number.

   a. $2^{\square} \cdot 2^{\square} = 2^{0}$

   b. $\frac{3^{i}}{2^{\square}} = 2^{\square}$

   c. $2^{-3} \cdot \square^{-3} = 10^{\square}$
13.3: Scientific Notation Matching

Your teacher will give you and your partner a set of cards. Some of the cards show numbers in scientific notation, and other cards show numbers that are not in scientific notation.

1. Shuffle the cards and lay them facedown.

2. Players take turns trying to match cards with the same value.

3. On your turn, choose two cards to turn faceup for everyone to see. Then:
   a. If the two cards have the same value and one of them is written in scientific notation, whoever says "Science!" first gets to keep the cards, and it becomes that player's turn. If it's already your turn when you call "Science!", that means you get to go again. If you say "Science!" when the cards do not match or one is not in scientific notation, then your opponent gets a point.
   b. If both partners agree the two cards have the same value, then remove them from the board and keep them. You get a point for each card you keep.
   c. If the two cards do not have the same value, then set them facedown in the same position and end your turn.

4. If it is not your turn:
   a. If the two cards have the same value and one of them is written in scientific notation, then whoever says "Science!" first gets to keep the cards, and it becomes that player's turn. If you call "Science!" when the cards do not match or one is not in scientific notation, then your opponent gets a point.
   b. Make sure both of you agree the cards have the same value.
      If you disagree, work to reach an agreement.

5. Whoever has the most points at the end wins.
Lesson 13 Summary

The total value of all the quarters made in 2014 is 400 million dollars. There are many ways to express this using powers of 10. We could write this as $400 \cdot 10^6$ dollars, $40 \cdot 10^7$ dollars, $0.4 \cdot 10^9$ dollars, or many other ways. One special way to write this quantity is called scientific notation. In scientific notation,

$400 \text{ million}$

dollars would be written as

$4 \times 10^8$

dollars. For scientific notation, the $\times$ symbol is the standard way to show multiplication instead of the \cdot symbol. Writing the number this way shows exactly where it lies between two consecutive powers of 10. The $10^8$ shows us the number is between $10^8$ and $10^9$. The 4 shows us that the number is 4 tenths of the way to $10^9$.

Some other examples of scientific notation are $1.2 \times 10^{-8}$, $9.99 \times 10^{16}$, and $7 \times 10^{12}$. The first factor is a number greater than or equal to 1, but less than 10. The second factor is an integer power of 10.

Thinking back to how we plotted these large (or small) numbers on a number line, scientific notation tells us which powers of 10 to place on the left and right of the number line. For example, if we want to plot $3.4 \times 10^{11}$ on a number line, we know that the number is larger than $10^{11}$, but smaller than $10^{12}$. We can find this number by zooming in on the number line:
3. Jada is making a scale model of the solar system. The distance from Earth to the Moon is about \(2.389 \times 10^5\) miles. The distance from Earth to the Sun is about \(9.296 \times 10^7\) miles. She decides to put Earth on one corner of her dresser and the Moon on another corner, about a foot away. Where should she put the Sun?

- On a windowsill in the same room?
- In her kitchen, which is down the hallway?
- A city block away?

Explain your reasoning.

4. Here is the graph for one equation in a system of equations.

![Graph](image)

a. Write a second equation for the system so it has infinitely many solutions.

b. Write a second equation whose graph goes through \((0, 2)\) so that the system has no solutions.

c. Write a second equation whose graph goes through \((2, 2)\) so that the system has one solution at \((4, 3)\).

(From Unit 4, Lesson 12.)
Lesson 14: Multiplying, Dividing, and Estimating with Scientific Notation

14.1: True or False: Equations

Is each equation true or false? Explain your reasoning.

1. $4 \times 10^5 \times 4 \times 10^4 = 4 \times 10^{20}$

2. $\frac{7 \times 10^6}{2 \times 10^4} = (7 \div 2) \times 10^{(6-4)}$

3. $8.4 \times 10^3 \times 2 = (8.4 \times 2) \times 10^{(3\times2)}$
14.3: Info Gap: Distances in the Solar System

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.

If your teacher gives you the problem card:    If your teacher gives you the data card:

1. Silently read your card and think about what information you need to answer the question.

2. Ask your partner for the specific information that you need.

3. Explain to your partner how you are using the information to solve the problem.

4. Solve the problem and explain your reasoning to your partner.

1. Silently read the information on your card.

2. Ask your partner "What specific information do you need?" and wait for your partner to ask for information. Only give information that is on your card. (Do not figure out anything for your partner!)

3. Before telling your partner the information, ask "Why do you need that information?"

4. After your partner solves the problem, ask them to explain their reasoning and listen to their explanation.

Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.
3. Estimate how much money all police officers make put together.

4. Who makes more money, all enlisted military put together or all military officers put together? Estimate how many times more.

**Lesson 14 Summary**

Multiplying numbers in scientific notation extends what we do when we multiply regular decimal numbers. For example, one way to find \((80)(60)\) is to view 80 as 8 tens and to view 60 as 6 tens. The product \((80)(60)\) is 48 hundreds or 4,800. Using scientific notation, we can write this calculation as

\[(8 \times 10^1)(6 \times 10^1) = 48 \times 10^2.
\]

To express the product in scientific notation, we would rewrite it as \(4.8 \times 10^3\).

Calculating using scientific notation is especially useful when dealing with very large or very small numbers. For example, there are about 39 million or \(3.9 \times 10^7\) residents in California. Each Californian uses about 180 gallons of water a day. To find how many gallons of water Californians use in a day, we can find the product

\[(180)(3.9 \times 10^7) = 702 \times 10^7,\]

which is equal to \(7.02 \times 10^9\). That's about 7 billion gallons of water each day!

Comparing very large or very small numbers by estimation also becomes easier with scientific notation. For example, how many ants are there for every human? There are \(5 \times 10^{16}\) ants and \(7 \times 10^9\) humans. To find the number of ants per human, look at \(\frac{5 \times 10^{16}}{7 \times 10^9}\).

Rewriting the numerator to have the number 50 instead of 5, we get \(\frac{50 \times 10^{15}}{7 \times 10^9}\). This gives us \(\frac{50}{7} \times 10^6\). Since \(\frac{50}{7}\) is roughly equal to 7, there are about \(7 \times 10^6\) or 7 million ants per person!
3. The graph represents the closing price per share of stock for a company each day for 28 days.

   a. What variable is represented on the horizontal axis?

   b. In the first week, was the stock price generally increasing or decreasing?

   c. During which period did the closing price of the stock decrease for at least 3 days in a row?

   (From Unit 5, Lesson 5.)

4. Write an equation for the line that passes through (-8.5, 11) and (5, -2.5).

   (From Unit 3, Lesson 11.)
Lesson 15: Adding and Subtracting with Scientific Notation

15.1: Number Talk: Non-zero Digits
Mentally decide how many non-zero digits each number will have.

\((3 \times 10^9)(2 \times 10^7)\)

\((3 \times 10^9) \div (2 \times 10^7)\)

\(3 \times 10^9 + 2 \times 10^7\)

\(3 \times 10^9 - 2 \times 10^7\)
15.3: A Celestial Dance

<table>
<thead>
<tr>
<th>object</th>
<th>diameter (km)</th>
<th>distance from the Sun (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>$1.392 \times 10^6$</td>
<td>$0 \times 10^0$</td>
</tr>
<tr>
<td>Mercury</td>
<td>$4.878 \times 10^3$</td>
<td>$5.79 \times 10^7$</td>
</tr>
<tr>
<td>Venus</td>
<td>$1.21 \times 10^4$</td>
<td>$1.08 \times 10^8$</td>
</tr>
<tr>
<td>Earth</td>
<td>$1.28 \times 10^4$</td>
<td>$1.47 \times 10^8$</td>
</tr>
<tr>
<td>Mars</td>
<td>$6.785 \times 10^3$</td>
<td>$2.28 \times 10^8$</td>
</tr>
<tr>
<td>Jupiter</td>
<td>$1.428 \times 10^5$</td>
<td>$7.79 \times 10^8$</td>
</tr>
</tbody>
</table>

1. When you add the distances of Mercury, Venus, Earth, and Mars from the Sun, would you reach as far as Jupiter?

2. Add all the diameters of all the planets except the Sun. Which is wider, all of these objects side by side, or the Sun? Draw a picture that is close to scale.

Are you ready for more?

The emcee at a carnival is ready to give away a cash prize! The winning contestant could win anywhere from $1 to $100. The emcee only has 7 envelopes and she wants to make sure she distributes the 100 $1 bills among the 7 envelopes so that no matter what the contestant wins, she can pay the winner with the envelopes without redistributing the bills. For example, it's possible to divide 6 $1 bills among 3 envelopes to get any amount from $1 to $6 by putting $1 in the first envelope, $2 in the second envelope, and $3 in the third envelope (Go ahead and check. Can you make $4? $5? $6?).

How should the emcee divide up the 100 $1 bills among the 7 envelopes so that she can give away any amount of money, from $1 to $100, just by handing out the right envelopes?
Lesson 15 Summary

When we add decimal numbers, we need to pay close attention to place value. For example, when we calculate 13.25 + 6.7, we need to make sure to add hundredths to hundredths (5 and 0), tenths to tenths (2 and 7), ones to ones (3 and 6), and tens to tens (1 and 0). The result is 19.95.

We need to take the same care when we add or subtract numbers in scientific notation. For example, suppose we want to find how much further Earth is from the Sun than Mercury. Earth is about $1.5 \times 10^8$ km from the Sun, while Mercury is about $5.8 \times 10^7$ km. In order to find

$$1.5 \times 10^8 - 5.8 \times 10^7$$

we can rewrite this as

$$1.5 \times 10^8 - 0.58 \times 10^8$$

Now that both numbers are written in terms of $10^8$, we can subtract 0.58 from 1.5 to find

$$0.92 \times 10^8$$

Rewriting this in scientific notation, Earth is

$$9.2 \times 10^7$$

km further from the Sun than Mercury.
3. Apples cost $1 each. Oranges cost $2 each. You have $10 and want to buy 8 pieces of fruit. One graph shows combinations of apples and oranges that total to $10. The other graph shows combinations of apples and oranges that total to 8 pieces of fruit.

a. Name one combination of 8 fruits shown on the graph that whose cost does not total to $10.

b. Name one combination of fruits shown on the graph whose cost totals to $10 that are not 8 fruits all together.

c. How many apples and oranges would you need to have 8 fruits that cost $10 at the same time?

(From Unit 4, Lesson 10.)

4. Solve each equation and check your solution.

\[-2(3x - 4) = 4(x + 3) + 6\]
\[\frac{1}{2}(z + 4) - 6 = -2z + 8\]

\[4w - 7 = 6w + 31\]

(From Unit 4, Lesson 5.)
Family Support Materials

Pythagorean Theorem and Irrational Numbers

Side Lengths and Areas of Squares

Family Support Materials 1

This week your student will be working with the relationship between the side length and area of squares. We know two main ways to find the area of a square:

- Multiply the square’s side length by itself.
- Decompose and rearrange the square so that we can see how many square units are inside. For example, if we decompose and rearrange the tilted square in the diagram, we can see that its area is 10 square units.

But what is the side length of this tilted square? It cannot be 3 units since $3^2 = 9$ and it cannot be 4 units since $4^2 = 16$. In order to write “the side length of a square whose area is 10 square units,” we use notation called a square root. We write “the square root of 10” as $\sqrt{10}$ and it means “the length of a side of a square whose area is 10 square units.” All of these statements are true:

- $\sqrt{9} = 3$ because $3^2 = 9$
- $\sqrt{16} = 4$ because $4^2 = 16$
- $\sqrt{10}$ is the side length of a square whose area is 10 square units, and $\left(\sqrt{10}\right)^2 = 10$
The Pythagorean Theorem
Family Support Materials 2

This week your student will work with the Pythagorean Theorem, which describes the relationship between the sides of any right triangle. A right triangle is any triangle with a right angle. The side opposite the right angle is called the hypotenuse, and the two other sides are called the legs. Here we have a triangle with hypotenuse \( c \) and legs \( a \) and \( b \). The Pythagorean Theorem states that for any right triangle, the sum of the squares of the legs are equal to the square of the hypotenuse. In other words, \( a^2 + b^2 = c^2 \).

We can use the Pythagorean Theorem to tell if a triangle is a right triangle or not, to find the value of one side length of a right triangle if we know the other two, and to answer questions about situations that can be modeled with right triangles. For example, let’s say we wanted to find the length of this line segment:

We can first draw a right triangle and determine the lengths of the two legs:
1. The length of the hypotenuse is $\sqrt{50}$ units. With legs $a$ and $b$ both equal to 5 and an unknown value for the hypotenuse, $c$, we know the relationship $5^2 + 5^2 = c^2$ is true. That means $50 = c^2$, so $c$ must be $\sqrt{50}$ units.

2. The length of $p$ is $\sqrt{25}$ or 5 units. If we draw in the right triangle, we have legs of length 3 and 4 and hypotenuse $p$, so the relationship $3^2 + 4^2 = p^2$ is true. Since $3^2 + 4^2 = 25 = p^2$, $p$ must equal $\sqrt{25}$ or 5 units.
Since $3^3 = 27$ means $\sqrt{27} = 3$, we can plot $\sqrt{27}$ at 3. $\sqrt{50}$ is between 3 and 4 because 50 is between $3^3 = 27$ and $4^3 = 64$. $\sqrt{28}$ is between 5 and 6 because 28 is between $5^2 = 25$ and $6^2 = 36$. 

\[
\begin{array}{cccc}
\sqrt{27} & \cdot & \sqrt{50} & \cdot & \sqrt{28} \\
1 & & 3 & & 5 \\
0 & & 2 & & 4 & & 5 & & 6 & & 7 & & 8 & & 9 & & 10 \\
\end{array}
\]
8.3: Find the Missing Side Lengths

1. Find $c$.

2. Find $b$.

3. A right triangle has sides of length 2.4 cm and 6.5 cm. What is the length of the hypotenuse?

4. A right triangle has a side of length $\frac{1}{4}$ and a hypotenuse of length $\frac{1}{3}$. What is the length of the other side?

5. Find the value of $x$ in the figure.
Lesson 8 Summary

There are many examples where the lengths of two legs of a right triangle are known and can be used to find the length of the hypotenuse with the Pythagorean Theorem. The Pythagorean Theorem can also be used if the length of the hypotenuse and one leg is known, and we want to find the length of the other leg. Here is a right triangle, where one leg has a length of 5 units, the hypotenuse has a length of 10 units, and the length of the other leg is represented by $g$.

![Right Triangle Diagram]

Start with $a^2 + b^2 = c^2$, make substitutions, and solve for the unknown value. Remember that $c$ represents the hypotenuse: the side opposite the right angle. For this triangle, the hypotenuse is 10.

\[
\begin{align*}
  a^2 + b^2 &= c^2 \\
  5^2 + g^2 &= 10^2 \\
  g^2 &= 10^2 - 5^2 \\
  g^2 &= 100 - 25 \\
  g^2 &= 75 \\
  g &= \sqrt{75}
\end{align*}
\]

Use estimation strategies to know that the length of the other leg is between 8 and 9 units, since 75 is between 64 and 81. A calculator with a square root function gives $\sqrt{75} \approx 8.66$. 
2. A right triangle has side lengths of $a$, $b$, and $c$ units. The longest side has a length of $c$ units. Complete each equation to show three relations among $a$, $b$, and $c$.

- $c^2 =$
- $a^2 =$
- $b^2 =$

(From Unit 8, Lesson 7.)

3. What is the exact length of each line segment? Explain or show your reasoning. (Each grid square represents 1 square unit.)

a.  

![Diagram](image1)

b.  

![Diagram](image2)

c.  

![Diagram](image3)

(From Unit 8, Lesson 7.)
Lesson 10: Applications of the Pythagorean Theorem

10.1: Closest Estimate: Square Roots

Which estimate is closest to the actual value of the expression? Explain your reasoning.

1. \( \sqrt{24} \)
   - 4
   - 4.5
   - 5

2. \( \sqrt{7} \)
   - 2
   - 2.5
   - 3

3. \( \sqrt{42} \)
   - 6
   - 6.5
   - 7

4. \( \sqrt{10} + \sqrt{97} \)
   - 13
   - 13.25
   - 13.5
10.3: Internal Dimensions

Here are two rectangular prisms:

1. Which figure do you think has the longer diagonal? Note that the figures are not drawn to scale.

2. Calculate the lengths of both diagonals. Which one is actually longer?
Unit 8 Lesson 10 Cumulative Practice Problems

1. A man is trying to zombie-proof his house. He wants to cut a length of wood that will brace a door against a wall. The wall is 4 feet away from the door, and he wants the brace to rest 2 feet up the door. About how long should he cut the brace?

![Diagram](image)

2. At a restaurant, a trash can’s opening is rectangular and measures 7 inches by 9 inches. The restaurant serves food on trays that measure 12 inches by 16 inches. Jada says it is impossible for the tray to accidentally fall through the trash can opening because the shortest side of the tray is longer than either edge of the opening. Do you agree or disagree with Jada’s explanation? Explain your reasoning.

3. Select all the sets that are the three side lengths of right triangles.
5. A line contains the point (3, 5). If the line has negative slope, which of these points could also be on the line?

A. (2, 0)
B. (4, 7)
C. (5, 4)
D. (6, 5)

(From Unit 3, Lesson 10.)

6. Noah and Han are preparing for a jump rope contest. Noah can jump 40 times in 0.5 minutes. Han can jump $y$ times in $x$ minutes, where $y = 78x$. If they both jump for 2 minutes, who jumps more times? How many more?

(From Unit 3, Lesson 4.)
Pythagorean Theorem and Irrational Numbers: End-of-Unit Assessment (A)

Do not use a calculator.

2. Select all the right triangles, given the lengths of the sides.

\[ \sqrt{2} \quad \sqrt{3} \quad \sqrt{5} \quad \sqrt{5} \quad \sqrt{6} \quad \sqrt{8} \quad \sqrt{9} \quad \sqrt{15} \quad \sqrt{25} \]

A. A  
B. B  
C. C  
D. D  
E. E

4. Plot these numbers on the number line:
\[ \sqrt{2}, \sqrt{5}, \sqrt{8}, \sqrt{9}, \sqrt{15}, \sqrt{25} \]

5. Find the length of the segment that joins the points \((-5, 4)\) and \((6, -3)\).
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Science
Grade 8
Covers week of May 4\textsuperscript{th} –
week of June 16th
Grade 8
Science
Pencil-Paper Packet
### 8th Grade Science-New Learning Schedule

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<tr>
<th>Session</th>
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| 1 | May 6  
   May 7 | Local Climate & Surface Materials Affect Local Climate |
| 2 | May 8  
   May 11 | Factors that Affect Local Climate-Topography, Vegetation, and Urbanization |
| 3 | May 12  
   May 13 | History of Earth's Climate & Why Climate Changes Naturally Over Time |
| 4 | May 14  
   May 15 | Earth's Climate Since 1880, Climate Changes in Modern Times, & Enhanced Greenhouse Effect |
| 5 | May 18  
   May 19 | Living Things Need Resources & How Competition Affects Populations & Ecosystems |
| 6 | May 20  
   May 21 | Interactions Among Organisms- Predator/Prey |
| 7 | May 22  
   May 26 | Ecosystem Changes Over Time-Living & Nonliving |
| 8 | May 27  
   May 28 | Producers Capture Energy & Matter and Use Photosynthesis |
| 9 | May 29  
   June 1 | Consumers & Sources of Matter and Energy |
| 10 | June 2  
    June 3 | Cellular Respiration & Its Connection to Photosynthesis |
| 11 | June 4  
    June 5 | Food Webs & Biomass |
Climate at the Local Level

It's summer in the northeastern United States. People in New York City are sweltering in the heat. Vacationers at Bethany Beach, Delaware, are enjoying a refreshing ocean breeze. Meanwhile, hikers atop the White Mountains, New Hampshire, need jackets to stay warm. How can the climates of areas in the same region be so different?

Figure 11.1 shows the Northeast region of the United States, which includes New York City, Bethany Beach, and the White Mountains. Regional climate is the climate of a large area with similar precipitation and rainfall patterns. The regional climate of the Northeast tends to be warm and humid in the summer and cold and snowy in the winter.

Figure 11.1 The map shows the northeastern United States, which shares the same regional climate. However, each location in the photos has a different local climate. Local climate is the climate of a particular area such as a city, town, or portion of a state.

Local climate is the climate of a particular area such as a city, town, or portion of a state. Although New York City, Bethany Beach, and the White Mountains share the same regional climate, they have different local climates from each other. Summers in New York may be humid while winters may be cold. Bethany Beach can be slightly
How does the albedo of a surface change depending on the type of material and the color? Bright, white snow or ice has a high albedo, up to 90 percent, while asphalt has a low albedo, in the range of 7 percent to 10 percent. These values indicate that snow reflects more sunlight than asphalt.

**Figure 11.2** This model shows how different surface materials affect the amount of sunlight that is reflected. More sunlight is reflected from surfaces with higher albedos than surfaces with lower albedos. A low albedo means that the surface absorbs more sunlight, which heats the material. This raises the air temperature above the surface.

The albedo of a surface affects local climate because absorbed sunlight heats surfaces unevenly. So, materials with a low albedo absorb most of the sunlight that strikes them. The sunlight heats the material, and the material then transfers the energy to the air above it. Thus, the air temperature increases. So, the air above asphalt surfaces is likely to have a slightly higher average temperature than the air above grass and trees.
Topography Affects Local Climate

You might see snow all year round on the top of tall mountains in New Hampshire because temperature decreases as you travel up a mountain. However, one side of the mountain may have more snow than the other side. How do mountains affect local climate?

The shape of the natural features of a land surface is called topography. Topography includes the height, shape, number, and arrangement of mountains, hills, and valleys. It can result in the formation of lakes when water flows into large depressions, which is how the Great Lakes formed. The topography of an area affects its local climate by altering temperature, wind, and precipitation patterns.

Topography affects local climate, including precipitation and wind patterns. Chinook winds are warm winds that blow down from the mountains, quickly increasing temperatures and melting snow. They can also produce unusual cloud formations like these seen over the Rocky Mountains in Banff National Park in Canada.

Strong winds blow in places that are very flat, such as the plains in Montana, because winds are not slowed by hills or mountains.

Mountains affect climate because moving air is forced upwards when it meets a mountain. You have already learned about the rain shadow effect. Because of this effect, the local climate on the windward side of a mountain tends to be much wetter than the local climate on the leeward side. The air flowing down the leeward side of the mountain may also form strong winds. Wind forms when the dry air sinks and warms quickly. The resulting warm winds are called Chinook winds. Strong gusts and high drifts of snow are frequently produced by Chinook
Check for Understanding:

1. How can mountains affect climate?

2. The Delaware Bay acts like a large lake. How would this affect a town that's close to the water (like Bowers Beach) as compared to a town that's further away (like Marydel)?
1. How can plants increase the humidity of local climate?

2. How do plants decrease air temperature?

3. How do forests affect wind?

Urbanization Affects Local Climate

When you turn the corner on a city street, a strong wind might blow in your face. You are less likely to experience such a wind in a small town. As you walk along, you might be shaded from the sun by a tall building instead of a tree. You will see fewer plants in the city than in the country. Trees may be concentrated in some areas such as city parks, but missing in areas where buildings take up a lot of space. How much influence do buildings, sidewalks, and roadways have on climates in urban areas compared to vegetation?

One way tall buildings affect the local climate in cities is through their effects on air temperature and by influencing wind patterns. When the wind blows into the side of a building, it is forced upward and downward. As a result, it can feel very windy for people walking on the sidewalk next to the buildings. Long streets that are lined by tall buildings can act as wind tunnels that produce much stronger winds than winds in rural areas.

The design of urban areas affects the local climate of the city. Gaps between tall buildings cause winds. Surfaces with low albedos, such as building rooftops and asphalt, cause warmer air temperatures because they absorb a lot of
Urban heat islands form when asphalt and other building materials heat up during the day and cool off slowly at night. Sunlight strikes buildings, on both the top and sides. So, even though it may be shady on some of their sides, buildings absorb this energy. As a result, less sunlight is reflected and less energy escapes back into the atmosphere. Because the total mass of building materials releases the absorbed energy slowly, urban areas stay much warmer than rural areas at night. In contrast, open land cools down more quickly at night. The energy that is released by the ground in an open area is transferred upward into the atmosphere because nothing absorbs it on its way up.

Urban heat islands can intensify the effects of a heatwave, increase air pollution, and affect human health. Higher temperatures can make certain chemicals, such as ozone, form more quickly. Higher amounts of ozone near the ground can make breathing more difficult for people with asthma. Hotter air temperatures also increase the risk of heat-related illnesses.

People can take steps to reduce the harmful effects of urban heat islands. One way is to plant more vegetation ground cover and trees to provide shade, including rooftop parks. Installing light-colored rooftops and walls that increase the albedo and reduce the absorption of energy is also effective in reducing temperatures.

Check for Understanding:

1. How do buildings affect winds in urban areas?

2. How do rooftops and roads affect the temperature in urban areas?

3. How does the lack of plants in urban areas affect local climate?
byproduct. In the process, these organisms decreased carbon dioxide levels. Rising and falling carbon dioxide levels have affected Earth's climate throughout its history.

Earth also went through periods of extreme cold, with ice covering much of the planet. An ice age is a long period of particularly cool climate when large masses of ice cover vast areas of Earth. There is evidence that there were at least two ice age events between 717 and 630 million years ago, each of which lasted for millions of years. Scientists hypothesize that during these two events, glaciers, or enormous masses of ice, may have covered all of Earth's continents, even those at the equator, to form a "Snowball Earth."

Over its history, Earth has experienced very cold and very warm periods caused by changes to the Earth system. Rather than being cold the entire time, during an ice age, Earth's climate cycles between cooler and warmer periods. During glacial periods, the climate cools and glaciers grow and cover more land. During interglacial periods, the climate warms and glaciers melt. In contrast, when Earth is not experiencing an ice age, most or all of Earth's glaciers melt and temperatures are much warmer, even at the poles.

Changes to Earth's climate have played a major role in the history of life. The largest mass extinction in Earth's history occurred about 252 million years ago at the end of a period of global warming and affected most species on land and in the sea. Some scientists hypothesize the mass extinction was caused by millions of years of unusually high rates of volcanic eruptions. The carbon dioxide and methane from these eruptions may have warmed the climate so much that it was too hot for most species to survive.

By 145 million years ago, after a period of cooling, Earth was again warming up—even the poles were ice-free and warm enough for creatures to survive there. Dinosaurs, flowering plants, and many other living things thrived. However, evidence supports the idea that 66 million years ago, a giant asteroid caused another mass extinction. The asteroid impact would have caused sudden changes to climate. Dust from the impact and smoke from forest fires would have blocked sunlight for a long time, leading to rapid cooling. Eventually, increased levels of carbon dioxide caused the climate to warm again.

The climate from 2.6 million years ago to the present has been dominated by yet another ice age, which we are still in. We have been in an interglacial period for about the last 11,500 years—a small slice of Earth's history. The current climate is just right for humans to thrive.
Global climate changes due to energy received from the sun, energy radiated back to space, and how energy is distributed around Earth. Various conditions such as volcanic eruptions, changes in atmospheric composition due to life forms, and the location and shape of land masses all affect how these processes occur.
Earth's Climate Since 1880

Changes in Earth's climate throughout its history have shaped the world you live in. Recent changes in climate today are affecting your future world. What is happening with Earth's climate that affects your future?

Since 1880, scientists like the one featured in the beginning of the lesson have collected surface temperature data from weather stations around the world. Surface temperature is the temperature of the atmosphere near Earth's surface. Scientists have used these data to calculate the average yearly global temperature. Before 1880, there were not enough data to calculate a reliable average temperature. How do scientists use these data to conclude how Earth's temperature has changed in modern times?

In Figure 12.3, the graph compiled with data from NASA shows a pattern of increasing global average temperatures each year. The overall trend illustrates that Earth has warmed by more than 0.9°C (1.6°F) since 1880. The surface temperature increase shown in the graph is evidence that Earth is getting warmer.

Figure 12.3 This graph shows how Earth's yearly global average temperature has increased between 1880 and 2015. The data, from analysis by NASA's Goddard Institute for Space Studies (GISS), is scientific evidence that Earth's climate has changed.
and are mostly stored carbon. The combustion, or burning, of fossil fuels releases that carbon into the atmosphere.

More and more carbon dioxide has been released into the atmosphere since the beginning of the Industrial Revolution. This sudden event in Earth’s history began in Great Britain in 1760 and spread to other countries. The Industrial Revolution generated a period of great advances in technology and manufacturing. However, increased cement production from the rise in construction, as well as new inventions, increased the amount of carbon dioxide released into the atmosphere. Inventions in the late 19th and early 20th centuries included cars with gasoline-powered engines and electricity distribution to homes. Human population has also grown to more than 7 billion people today. Both increases in population and per person use of fossil fuels have led to greater carbon dioxide emissions.

Since the Industrial Revolution, humans have been increasing the amount of greenhouse gases. The Industrial Revolution led to more industry like this steel factory (circa 1860). This era was driven by manufacturing and new inventions, many of which burned fossil fuels. Burning fossil fuels releases carbon dioxide into the air.

Humans have also increased carbon dioxide in the air by deforestation, or the permanent removal of forests by humans to make land available for other uses. Between 2000 and 2010, an area a little larger than the size of Mississippi was deforested worldwide. It occurred mostly in tropical areas where forests were cleared by burning them. This burning released carbon dioxide. Additionally, with the forest gone, it is no longer there to remove carbon dioxide from the atmosphere. Deforestation accounts for between 15 and 30 percent of the carbon dioxide people add to the atmosphere.

The rise in global average temperatures is directly linked with the rise in carbon dioxide levels. As carbon dioxide levels change, Earth’s temperature changes. The graph in Figure 12.4 shows carbon dioxide levels from 1880 to 2015. The portion of the line from 1958 to the present is called the Keeling Curve because the data was collected by scientist Charles Keeling. Keeling developed an accurate and precise way to measure the amount of carbon dioxide in the atmosphere and began recording the data in 1958. Since then, carbon dioxide has been measured daily atop a mountain in Mauna Loa, Hawaii. Other scientists have added carbon dioxide data to Keeling’s data based on measurements of air bubbles trapped in ice core samples. These
Check for Understanding:
1. Why did the Industrial Revolution lead to an increase in greenhouse gases?

2. Write three questions you have about the causes of the increase in carbon dioxide in Earth's atmosphere.

The Enhanced Greenhouse Effect

You know Earth's climate has changed in the past due to natural factors, such as changes in solar output, changes in Earth's orbit, and asteroid impacts. But what is causing Earth's recent climate change?

Greenhouse gases have been an important part of Earth's atmosphere for most of its history. Earlier, you learned that greenhouse gases warm the atmosphere by absorbing the infrared light that is given off by
Check for Understanding:

1. What is the enhanced greenhouse effect?

2. What is the connection between the enhanced greenhouse effect and climate change?

3. How do scientists predict the enhanced greenhouse effect will change in the future?
Check for Understanding:

1. Name three nonliving resources from your local ecosystem.

2. What's an example of a living resource?

Competition for Resources Affects Populations

In everyday language we use the word *competition* to describe a race or a struggle against a rival to win an event. Organisms, like wild horses, experience competition, too. They must compete to get resources that other organisms might also use. But the prize in this competition is not a trophy, it is survival. What happens when individuals of the same species compete for the same resource?

Organisms of the same species need the same resources. But there is a limit to how much of any one resource there is in an area. When living things require the same limited resource, an interaction called *competition* can arise. For example, there may be competition among wild horses for the limited amount of grass in an area. Horses that find and eat more grasses are more successful in the competition for this limited resource. They are able to get enough food to survive, to grow, and to reproduce. Individuals that are not successful go hungry and may die. In this way, competition changes the number of individuals that can survive in an area.

Unlike species, a *population* is a group of individuals of a species that lives and reproduces in the same area. Competition for limited resources can change the size of populations. When there is an abundance of a resource that a population depends on, the population can grow. For example, if a meadow has a lot of grass, it can support the survival of many horses. As a result, the horse population grows. Sparse resources cause a decrease in population size. When there is not a lot of grass, fewer horses get enough nourishment. Fewer horses survive and the population shrinks.

This link between the amount of a limited resource and the size of a population that depends on it is a cause and effect relationship. The limited resource, grass abundance, is the *cause* and the change in wild horse
Competition for Resources Affects Ecosystems

A herd of yaks grazes in a mountain meadow while wild horses look on. Every mouthful of grass eaten by a yak is a mouthful of grass that a horse cannot eat. What happens when different species compete for the same resource?

Yaks and wild horses interact with each other through competition for grass.

When grazing animals use a resource in slightly different ways, such as by eating grass differently, competition is reduced.

Populations of different species can compete for the same limited resources, which limits the size of both populations. Wild horses and yaks depend on grass for food. In dry years, grass populations will be low.
Predators

Predation is a relationship between a predator, like this eagle owl, and prey, like this deer mouse.

The eagle owl gets resources that it needs to survive, grow, and reproduce from the prey.

A kitten crouches low. It waits for the right moment and then, playing at being a lethal hunter, it pounces on a toy. Kittens practice this hunting behavior because, when they are adult cats, they may need to sneak up on their food. Pet cats do not have to hunt, but cats in the wild must be able to capture and kill other animals to eat so that they have the resources they need to survive. How do scientists describe the relationship between the organism that eats and the organism being eaten?

**Predation** is a relationship in which one organism, the predator, benefits by eating another organism, the prey. An eagle owl is a predator that feeds on prey, such as a mouse. The mouse provides resources that allow the eagle owl to survive, grow, and reproduce.

There are countless examples of feeding relationships across ecosystems on Earth, but scientists have observed patterns to these relationships. One pattern scientists have observed in feeding relationships is that predators can be organized into three large categories depending on the type of organism that they eat. Some predators eat animals, others eat plants, and still others eat both animals and plants.

**Carnivores** Wild cats, eagle owls, and panther chameleons are examples of a type of predator called a carnivore. A **carnivore** is an organism that mainly eats other animals. Eagle owls and panther chameleons are good examples of carnivores because they rarely, if ever, eat anything other than animals. Most carnivores are animals or unicellular organisms, but even plants can be carnivores. Venus flytraps are plants that catch insects to eat.
Mona monkeys are considered omnivores. Raccoons are also omnivores. In cities and suburbs, raccoons often go through people’s garbage in search of discarded meat and vegetable scraps. In the wild, they eat a variety of prey, including frogs, mice, eggs, insects, fruits, and nuts. Most humans are omnivores because they eat both plant foods, like grains and vegetables, and animal foods, like eggs or fish.

**Predators in Ecosystems** In nearly every ecosystem on Earth, you will find every kind of predator: carnivores, omnivores, and herbivores. The species that occupy those roles are different between ecosystems, but patterns in feeding relationships are similar. Because patterns are similar across ecosystems, scientists can make predictions about a population based on its feeding relationships with other populations. For example, the populations of both predators and prey change as a result of their interaction. How do populations of predators impact populations of their prey?

**Check for Understanding:**
1. What are carnivores? What are omnivores? What are herbivores?

2. What are predators? Which organism is the predator in this image? How do you know?

**Interacting Populations Affect One Another**

*Squeak!* A stray cat gobbles up a mouse. Every stray cat needs to get enough resources to survive, and it does this by hunting and eating prey, such as mice. If the stray cat population increases, then what happens to the mouse population? If mice become rare and stray cats cannot find enough prey, what happens to the cat population?
population. In the early 2000s, the moose population on the island was shrinking. Many moose weakened and died because they were infected with ticks. When the moose population decreased, there was less food for the wolves. By 2007, the wolf population had also decreased. There were fewer prey to support so many wolves. By observing populations of predators and prey over time, scientists gather data on population size. The numbers show a pattern observed in many ecosystems. When prey become a limited resource, predator populations decrease.

A Scarcity of Carnivores Increases Prey Populations A scarcity of carnivores also has an effect on prey populations. It causes them to increase. As the wolf population on Isle Royale decreased, dropping to only three wolves in the spring of 2015, the moose population grew. There were fewer predators killing them off, so more moose survived each year and their population increased.

Carnivore and prey populations are closely linked so that their populations grow and decline together. Because of this cause and effect relationship between populations, scientists can analyze population data in ecosystems and make predictions. The graph in Figure 2 shows this pattern in wolf and moose populations. In the graph, you see that an increase in the moose population causes the wolf population to increase a little later. With this increase in the wolf population, the moose population will decrease after a period of time. The wolf population then decreases as well, which causes an increase in the moose population. This pattern happens over and over again in a cycle. Each rise in the moose population is followed by a rise in the wolf population. Also each rise in the wolf population is followed by a fall in the moose population. This is because living things in an ecosystem are affected by each other. Scientists see this pattern between carnivore and prey populations all over the world.

**Figure 2** When scientists graph the size of carnivore and prey populations in an ecosystem, they observe a repeating pattern. Wolf population size is affected by the size of the moose population, increasing when moose are abundant and decreasing when moose are scarce.
Ecosystems Change Over Time

In a pond full of aquatic plants and animals, decayed matter from these organisms sinks to the bottom. Over time, this layer gets thicker and the water gets shallower until there is no longer a pond. What happens to populations of aquatic organisms as the pond disappears?

The living and nonliving parts of the pond are always changing, because ecosystems are dynamic. A dynamic system is any system characterized by constant change. These can be small or large changes, and they can happen gradually or suddenly. However, there is always something changing in a dynamic system, like an ecosystem.

**Figure 1**

Ecosystems can change in predictable ways. One pattern of change in ecosystems is the gradual change from a pond to a wetland to a meadow and then to a forest. As the physical conditions change in an area, so do the populations of organisms that live there.

Gradual Change Change in ecosystems often takes place gradually as resources fluctuate, and populations rise and fall as a result. Look at Figure 1. Without a constant source of water, like a stream, the pond can become shallower over time. Populations of aquatic organisms, like fish and ducks, decline. Meanwhile, cattails and other wetland plants thrive.

A wetland is an ecosystem that is saturated with water, like a swamp or marsh. Wetland plants, like reeds and cattails, support populations of wetland animals, such as dragonflies, frogs, and turtles. Over many years, the wetland continues to fill in, and new plants colonize the area, such as grasses, shrubs, and trees. The ecosystem transforms into a meadow, which attracts animals like voles, rabbits, and foxes. As meadow plants grow and die, they create thicker layers of soil. The ecosystem now supports the growth of large trees and attracts forest animals, such as deer and birds that nest in trees. Over many years, a pond ecosystem can turn into a tall forest.
ecosystem that was there before the sudden change. Other times, the ecosystem is different after the period of recovery.

Sudden changes to ecosystems can be natural or human-caused. Volcanic eruptions are natural events, as are hurricanes, droughts, fires, landslides, and floods. Human activity can also cause sudden changes to ecosystems. Humans clear large areas of land for farming and construction, generate pollution during industrial accidents and oil spills, and introduce new species to an area, sometimes unintentionally. All of these events can cause rapid changes that disrupt ecosystems and change them temporarily or permanently.

Check for Understanding:

1. What is a dynamic system? Give an example of a dynamic system.

2. What usually happens to an ecosystem after a sudden catastrophic change? List two natural and two man-made causes for sudden catastrophic change to an ecosystem.
rattlesnakes, and black-footed ferrets, use the burrows as shelters. Prairie dogs change grassland ecosystems in ways that have a positive impact on bison, rattlesnakes, burrowing owls, rabbits, and black-footed ferrets. Populations of those species decrease when prairie dog populations decrease.

Prairie dogs thrive in grassland ecosystems, forming large colonies. There are many animals that prey on prairie dogs, including black-footed ferrets, badgers, coyotes, eagles, and hawks. When prairie dogs are present, they form an important and abundant resource for these predators. Black-footed ferrets prey almost exclusively on prairie dogs. As prairie dog populations have declined, populations of their predators, especially black-footed ferrets, have also declined. This is evidence that populations of many species in grassland ecosystems are dependent on the presence of prairie dogs.

Some Species Do Not Benefit from Prairie Dogs Not all species benefit from prairie dogs. When prairie dog populations increase, they reduce the population of the flowering plants and shrubs because prairie dogs eat them. This means there are fewer flowering plants and shrubs for pronghorn antelope to eat, and pronghorn antelope populations decrease.

Prairie Dog Populations Change Prairie Ecosystems By gathering evidence from grassland ecosystems under different conditions, scientists have observed a pattern. When prairie dog populations are found in an ecosystem, they change the resources available in the ecosystem. This then changes populations of other living things in the ecosystem. Prairie dogs illustrate that changes in the living parts of ecosystems cause changes in the available resources in the ecosystem. These changes impact other populations of organisms in the ecosystem. Some species, like prairie dogs, are linked through interactions to so many others that the stability of the entire ecosystem depends on them.

Check for Understanding:
1. Why are prairie dogs endangered?

2. Name two species that benefit from prairie dogs and explain how. Name two species that benefit from prairie dogs being absent and explain how.
Check for Understanding:
1. How can a beaver change an ecosystem?

2. Label two examples of populations in this image that change in response to a beaver dam being created.
Producers in Terrestrial Ecosystems: All ecosystems contain producers of many kinds. In terrestrial ecosystems, the most familiar producers are plants, which include trees, mosses, and ferns. Many have leaves that absorb energy from sunlight. Some absorb water from soil through roots. Some of the largest producers in terrestrial ecosystems are trees, such as pines and maples. Grasses are the main producers found in grassland ecosystems.

Some producers in terrestrial ecosystems are not plants. Instead, they are single-celled organisms that can capture energy from the sun. For example, cyanobacteria are single-celled producers that are found nearly everywhere on the planet.

Producers in Aquatic Ecosystems: Aquatic ecosystems also have producers. There are some aquatic plants, such as eelgrasses, which inhabit both marine and freshwater ecosystems. Most producers in aquatic ecosystems are algae, which can be multicellular or single-celled. Volvox are a group of single-celled green algae that live in spherical colonies of thousands of cells in freshwater ecosystems. Single-celled algae called phytoplankton are the main producers in the open ocean. Phytoplankton, such as the diatom pictured here, survive only in the topmost layer of the ocean where sunlight penetrates. Cyanobacteria are single-celled producers found in many different aquatic ecosystems. Some live in frozen lakes, while others live in hot springs that have boiling-hot temperatures.

Producers are found in ecosystems all over the world, converting the sun’s energy into molecules of sugar, which store energy for later use.

Check for Understanding:

1. Why do all organisms need matter and energy? How do organisms get matter and energy?

2. What are producers? What is an example of a producer in a terrestrial ecosystem? What is an example of a producer in an aquatic ecosystem?
Producers Get Matter from Air and Water Producers also need matter, which they get from their surroundings. Photosynthesis requires water, which many plants absorb through their roots. It also requires carbon dioxide, a gas found in air. Aquatic plants use carbon dioxide dissolved in water. With carbon dioxide, water, and sunlight, producers have everything they need for photosynthesis.

Light Causes a Chemical Reaction The process of photosynthesis begins when chlorophyll absorbs the energy of sunlight. This input of energy causes a chemical reaction to occur in the chloroplast. Chlorophyll can transfer the sun’s energy to the bonds of molecules of sugar through a chemical reaction.

In photosynthesis, energy is captured from sunlight and is used to produce sugar molecules from water and carbon dioxide. The chemical equation representing this process is:

\[ \text{carbon dioxide + water + energy} \rightarrow \text{sugar + oxygen} \]

The equation in Figure 2B is a model that describes the reaction as a chemical formula. Chemical formulas have reactants, or the molecules used in the reaction on the left side. Products, the molecules produced in the reaction, appear on the right side. The reactants in this chemical equation are carbon dioxide (CO₂) and water (H₂O), and the products are sugar (C₆H₁₂O₆) and oxygen (O₂). Notice how energy is placed on the left side of the arrow. That is because this chemical reaction requires an input of energy, which is then transferred to the molecules of the products. The chemical bonds that hold together the atoms in the sugar molecule store that energy. Notice that in Figure 2B the reaction is balanced on each side. Because sugar has six carbon atoms in it (C₆H₁₂O₆), the reaction requires six carbon dioxide molecules on the reactant side. Review the reaction. Are all of the atoms balanced on each side?

**Figure 2B** Photosynthesis is a chemical reaction that captures energy from the sun to convert carbon dioxide and water into sugars and oxygen. The energy from sunlight is stored in the chemical bonds of the sugar molecule.
8th Grade Science Materials for Session 9

Consumers

What if you could take a nap in the sun to get energy instead of shopping for and preparing three meals a day? While many kinds of organisms can use photosynthesis to produce their own food, you cannot, and neither can a dolphin. However, all organisms, including humans and dolphins, need matter and energy to live, grow, and reproduce. How do organisms that cannot use sunlight to capture energy get the energy needed for life?

Consumers cannot produce their own food. Instead they get their food by eating other organisms. These dolphins are consumers that live in aquatic ecosystems and eat mostly fish.

Organisms that cannot produce their own food using photosynthesis are consumers. A consumer is an organism that gets matter and energy by eating or absorbing other organisms as food. All predators—whether they are herbivores, carnivores, or omnivores—are consumers. Some consumers eat producers, while others eat other consumers. A dolphin, for example, is a consumer, and so is a single-celled amoeba, like the one shown in the photograph. Dolphins consume fish and other aquatic animals. Amoebas consume smaller unicellular organisms.

This amoeba is a consumer. Amoebas are unicellular organisms that eat other unicellular organisms. The extend a part of the cell around another cell and completely engulf it. They then use the matter and energy of that cell.

Whether they are producers or consumers, all organisms use the energy stored in food as fuel support everyday activities as well as growth and reproduction. Producers use the sugars
Sources of Matter and Energy

A tree produces its own food. A squirrel consumes food produced by the tree. Both kinds of organisms—producers and consumers—use food as a source of matter and energy. But do they use food in the same way? And how are other sources of matter and energy involved?

Once an organism has obtained food, it can use it for different purposes. It can use food for energy, for growth (adding matter to the organism’s body), or for reproduction (making another organism). Each process happens through chemical reactions that involve matter and energy.

The table in Figure 2 is one way to model and compare the sources of matter and energy that are required to carry out those reactions. Notice that the exact source of matter and energy is different for producers and consumers.

<table>
<thead>
<tr>
<th>Where Consumers and Producers Get Energy and Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Producers</strong></td>
</tr>
<tr>
<td>Capture energy from the sun to make sugars</td>
</tr>
<tr>
<td>Use sugars for energy</td>
</tr>
<tr>
<td>Obtain matter from the air, water, and soil</td>
</tr>
<tr>
<td>Obtain matter from eating other organisms</td>
</tr>
</tbody>
</table>

Figure 2 Use the table to compare how producers and consumers get the matter and energy they need. Both types of organisms use sugars for energy and as a source of matter. Producers are able to make those sugars through photosynthesis. Consumers must get sugars by eating other organisms.

Sources of Energy Producers and consumers get energy their cells need from sugar molecules. While producers capture energy from sunlight, they cannot use that energy directly to carry out cell processes. For the captured energy to be useful to the cells of a producer, it must first be stored in the chemical bonds of sugar molecules. The
Cellular Respiration

Lunch is served! If you are a producer, you get your sugar molecule “lunch” by carrying out photosynthesis. As a consumer, you get sugar molecules by eating a producer or another consumer. The squirrel at the beginning of this lesson is getting sugar molecules from the acorn that it is eating. Once you consume this energy, your cells can use the energy stored in sugars to carry out all of your cellular activities. How do the cells of a producer get energy from the sugars it makes? And, how do the cells of a consumer get energy from the sugars it eats?

Both producers and consumers carry out a process called cellular respiration. Cellular respiration is the process that cells use to release energy stored in sugars. This process gives cells the energy they need to carry out chemical reactions important for life.

The Site of Cellular Respiration Cellular respiration takes place in structures inside cells, Mitochondria, illustrated in Figure 3A, are structures in cells that convert energy in sugar molecules into energy that the cell can use. In multicellular organisms, every cell in the body has mitochondria to carry out cellular respiration. Most unicellular organisms, such as amoebas and diatoms, also have mitochondria that carry out cellular respiration.

Diagram: Mitochondria in Cells

Figure 3A Cellular respiration happens in the mitochondria of every cell in an organism’s body, including both consumers and producers. The function of mitochondria is to provide energy that cells can use to carry out life processes.

The Process of Cellular Respiration

Cellular respiration generates energy when molecules of sugar are broken apart and react with oxygen to produce carbon dioxide and water. This process releases the energy that was stored in the bonds of sugar molecules during photosynthesis. You cannot directly observe the changes in the molecules and energy in this reaction, but you can use a chemical equation to model the process and keep track of the reactants and products. The equation representing cellular respiration is:

\[
sugar + oxygen \rightarrow carbon dioxide + water + energy
\]
2. Which organisms use mitochondria to conduct cellular respiration?

3. Where do producers get the oxygen they use in cellular respiration?

Comparing Photosynthesis and Cellular Respiration

Your body has used up energy just learning about photosynthesis and cellular respiration! Before eating a snack to refresh your energy supply, think about how the two processes are alike. Both processes involve storing or releasing energy and both can be modeled by chemical equations. How else do these two processes compare?

When you compare the equations for photosynthesis and cellular respiration, you notice a pattern.

**Photosynthesis**

\[
\text{carbon dioxide} + \text{water} + \text{energy} \rightarrow \text{sugar} + \text{oxygen}
\]

**Cellular respiration**

\[
\text{sugar} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water} + \text{energy}
\]

The reactants of each chemical reaction are the products of the other. The amount and kind of matter that make up the molecules in each process is exactly the same. The carbon, oxygen, and hydrogen atoms on each side of the equations remain balanced, but they are rearranged to form different kinds of molecules. Only the energy has a different source for each equation. Photosynthesis captures energy from the sun to form sugars that store energy in chemical bonds. Cellular respiration releases the energy stored in the
Food Webs

When coaches strategize to win a game, they might use arrows that show how players should move. Could you use a diagram with arrows to show how energy and matter move in ecosystems?

Scientists use diagrams as models to study complex systems. A food web is a model that shows feeding relationships between populations in an ecosystem. Food webs, like Figure 1A, use arrows to represent the transfer of energy and matter from one organism to another. An arrow points away from prey and toward the predator because, when a predator eats prey, the energy and matter from the prey becomes energy and matter for the predator. Food web models help scientists understand how energy and matter move among populations in ecosystems.

Figure 1A Scientists use food webs as models to analyze the roles organisms play in an ecosystem. Many organisms are prey to more than one species of predator. Matter and energy transferred through a food web can follow different arrows and take more than one path.
populations of mice, voles, and rabbits would increase as a direct effect. The populations of other predators of these prey, such as foxes, rattlesnakes, and owls, would increase as an indirect effect.

Check for Understanding:

1. What do the arrows in a food web represent? Why do they point in the direction they do?

2. Circle one food chain in the food web here.

3. What is an example of a direct effect that would result from an increase in deer mouse in this food web?
This pattern of loss of biomass is repeated between every level of the food web. This is why the bison at the beginning of this lesson may eat 8 kilograms of grass in a day, but does not weigh 8 kilograms more at the end of the day!

Check for Understanding:

1. What patterns have scientists identified while observing the amount of biomass at each level of a food chain?

2. What happens to the matter that is lost between each level of a food chain?

3. Why does a bison that eats 8 kg of grass in a day not gain 8 kg of mass by the end of the day?
units of phytoplankton energy is needed to supply 10 units of tuna energy. That is a lot of energy lost as heat or lost to decomposers at every level of a trophic pyramid!

Check for Understanding:

1. How does energy enter a food chain?

2. What is a trophic pyramid?

3. What happens to the energy in producers?
The Importance of Biodiversity

You slide the diving mask over your eyes and slide into the clear, blue water. What you see is amazing! A sea turtle glides past and you spot brilliantly colored corals and anemones, each a different species. Small orange fish flit about like confetti in the breeze. A dizzying array of other fish species, of all colors and sizes, also feeds and hides in the coral. If you counted all the different types of living things in this place, you would find thousands, or even tens of thousands, of unique species. How do these species interact to form healthy and stable ecosystems?

Different ecosystems have different natural levels of biodiversity. Coral reef ecosystems have many species, including many kinds of fish, corals, sponges, and turtles.

Every ecosystem on Earth has a set of species that is found there naturally. That set of species differs from one ecosystem to another. Some places naturally have more species than others. In other words, every ecosystem has its own biodiversity. Biodiversity is the variety of organisms on Earth or in a particular habitat or ecosystem. How do scientists learn about natural levels of biodiversity on Earth?

Scientists for centuries have been exploring Earth’s ecosystems and systematically describing the species they find there. This information is compiled and stored so that scientists of the future have access to it. This information includes the numbers of species in different ecosystems and the number of species of different kinds of organisms. What have scientists discovered about patterns of biodiversity on Earth from this information?
Figure 1 A circle graph representing Earth's biodiversity shows that some groups of related species are more numerous than others. Insects and other animals make up 75 percent of the total species on Earth.

Check for Understanding:

1. What is biodiversity? Why is biodiversity important for a healthy ecosystem?

2. What are two patterns of biodiversity that scientists have discovered?

3. What kind of organism makes up over half of all known species?
PENNY BOAT CHALLENGE

Problem: Can the shape of a boat affect the amount of buoyancy it has?

Research: Buoyancy is the upward force that keeps things afloat. When placed in water, an object will float if its buoyancy is greater than its weight. And it will sink if its weight is greater than its buoyancy.

"People have been aware of objects floating on water (or sinking) since before recorded history. But it was not until Archimedes of Syracuse came along, that the theory of flotation and the buoyancy principle were defined." Archimedes was a mathematician born in 287 BCE, in the city of Syracuse on the island of Sicily. Archimedes is best remembered for a discovery involving the crown of King Hiero II.

Procedure:
- Cut three pieces of 15 cm by 15 cm (square) aluminum foil.
- Think up a boat design and construct your boat using only one piece of the heavy duty aluminum foil.
- Pennies are the only item you may add to your boat. Your boat cannot be attached to anything.
- Slowly add pennies to your boat. Once water enters the boat, or any part of the boat touches the bottom of the container, your boat is considered sunk! (The boat must remain floating for 5 seconds before it is considered a successfully added penny... after 5 seconds you may then add another penny)
- The last penny added (that sunk the boat) will not count in the total amount held.
- Use the chart below to make sketches of your boat and to keep track of your trials, errors, and successes.

<table>
<thead>
<tr>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction:</td>
<td>Prediction:</td>
<td>Prediction:</td>
</tr>
<tr>
<td>Number of pennies:</td>
<td>Number of pennies:</td>
<td>Number of pennies:</td>
</tr>
<tr>
<td>Sketch 1</td>
<td>Sketch 2</td>
<td>Sketch 3</td>
</tr>
</tbody>
</table>

Outcome: Successful? (Y/N)

Actual # of pennies:

Outcome: Successful? (Y/N)

Actual # of pennies:

Outcome: Successful? (Y/N)

Actual # of pennies:
**Session 15**

**Science A to Z Puzzle**

Can you find 26 science terms in the puzzle? 

A  
B  
C  
D  
E  
F  
G  
H  
I  
J*  
K  
L  
M  
N  
O  
P  
Q  
R  
S*  
T  
U*  
V  
W  
X  
Y  
Z  

* Indicates two words!

Challenge: Research 3 terms from the puzzle and create a trivia question for each to share with your classmates!