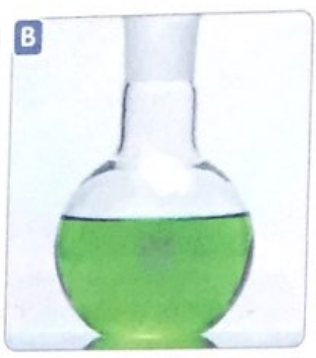
7.1 lab apparatus

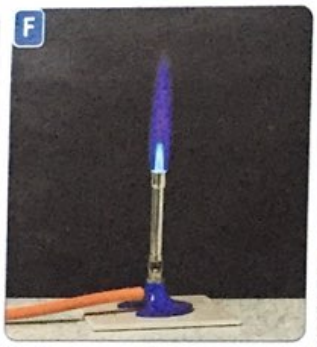
vocabulary	grammar	reading	writing	speaking
laboratory apparatus (equipment)	*to be going to*, future simple: *will*, & prepositions of place	instructions for experiments	a memo to a lab technician	a role-play about an experiment

learning objective: can talk about simple laboratory apparatus

vocabulary

1 Discuss in pairs. Look at the pictures. What do we use each apparatus for?





2 Match the pictures and the words.

1 flask	B	2 autoclave	G
3 Bunsen burner	F	4 incubator	D E
5 litmus paper	B H	6 beaker	C
7 test tube	A	8 petri dish	D

3 Listen and check your answers. Then listen and repeat.

4 Discuss in pairs. Do we need to wear gloves when we work with each apparatus? Why?

We need gloves when we work with...

We don't need gloves when we work with...

listening

5 Listen to a conversation between two students. What are they going to do in the afternoon? Tick.

a finish a math report and count bacteria

b inventory the lab and do experiments

c finish a math report and help in the lab

review units 7–9

vocabulary

1 Circle the correct word.

2 Listen and check your answers.

3 Choose the correct word.

cut expand tripod vibration contract
conductor insulator wire pitch
E F G

a A scale is a piece of lab equipment that measures the mass of something.

b A ~~stand~~ tripod is a piece of equipment with three legs that hold things up.

c contract means to get smaller in size.

d expand means to get bigger in size.

e A conductor is something that is good at transferring energy.

f An insulator is something that is bad at transferring energy.

g pitch is how high or low a sound is.

h vibration is a continuous slight shaking movement.

i A cut is a division that separates something that was whole in two.

grammar

4 Circle the correct preposition of place.

a Pour the solution into / under the test tubes.

b She's sitting behind / in front of me, so I can't see her.

c You need to wear a mask. There are some over / on the table.

d Use the tongs to take the beakers through / out of the autoclave.

5 Complete the sentences with the words below.

much time any a lot of

a How much time do we have to finish our experiment?

b Do you have any idea how to do this assignment? I am very confused!

c There are a lot of people here. I am not sure we'll find a seat.

d I'd love to study together with Monday or Tuesday would work for me.

6 Combine the phrases using the zero condition.

a You freeze water. Get ice.
If you freeze water, you get ice.

b Get thirsty. You don't drink enough water.

c You mix blue and yellow. Get orange.

d Can't sleep. He drinks too much tea.

e It rains. Land floods.

reading

7 Read and choose the correct answer.

1 ~~have to~~ don't have to / can't
2 have to don't have to / can't
3 will be going to be / has been
4 do / can are going to
5 have finished / finished / will finish
6 don't have to / can't / don't

Guided visit to the Science Museum

There are short guided tours of parts of the Science Museum three times a week. People who want to join a tour have to book by telephone (004-458213) at least two days in advance, but you don't have to pay as the museum is free.

On the tour, our first stop is the physics department. This was renovated recently and now contains exhibitions about light and energy, which your children are going to love.

Since we have to be there, we have got a surprise for you – a high-tech 3-D movie about volcanoes.

However, you don't have to bring children under five to this, as it can be frightening. If you are visiting with small children, you will be given drinks in our cafe during this part of our tour.

speaking

9 Work in pairs. Tell your partner about yourself using the phrases below.

a I never play on my phone in class

b I often ...

c I always forget to ...

d This weekend I want to ...

e I hope to ... when I finish university.

8 Read again and write T (true) or F (false).

a You have to book guided tours of the museum. T

b The museum costs ten dollars. F

c The chemistry department was renovated recently. T

d The tour features a movie about volcanoes. F

e Children aged five and over can watch the film. T

writing

10 Write five sentences about your plans for the weekend. Use going to.

On Saturday, I'm going to work on my physics project.

11 Choose any experiment you know well. Write 2 short paragraphs describing the experiment.

Include:

- the chemicals you need
- the apparatus you need
- the steps you need to take
- the result of the experiment

vocabulary | grammar | a paragraph explaining moles | a role-play about the pH scale | listening

ions, thermometers & acids & bases | want to/need to, present simple: is, will/ may, might

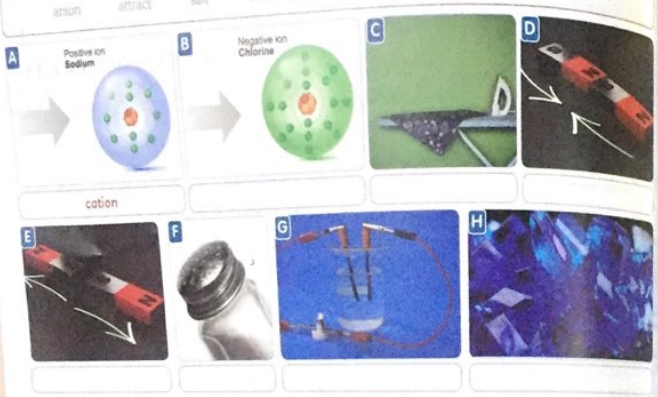
learning objective: can talk about ions and what you want and need to do

vocabulary

1 Work in pairs. Look at the pictures. Which photos show the forces that act between charges that are like (the same) and unlike (not the same)?

2 Label the pictures.

anion | attract | salt | electrolyte | cation | iron | repel | crystal



3 Listen and check your answers. Then listen and repeat.

listening

4 Listen to a conversation between two students. Why does one say that the other has been reading his textbook?

a because he knows all about irons ☐
b because he knows all about ions ☐
c because he knows the difference between irons and ions ☐

5 Listen again and write T (true) or F (false).

a An ion has the same number of protons and electrons. F
b Anions have a negative charge. ☐
c Cations attract other cations. ☐
d Anions repel other anions. ☐
e Cations attract anions and form ionic compounds, for example salts. ☐
f Electrolytes are salt solutions that can conduct electricity. ☐

6 Listen again and check your answers.

- We use *want* to talk about our wishes. After *want*, we normally use an infinitive with *to*:
  I don't want to talk to her again.
  I want to see him tomorrow.
  Do you want to have dinner?
  Yes, I do. / No, I don't.
- We can also use an object before the to infinitive:
  She wants me to fetch her after class.
  He doesn't want me to help him.
  Do you want me to help you?
  Yes, I do. / No, I don't.
- We use the verb *need* to talk about something we are required to or have to do. *Need* is often followed by an infinitive with *to*:
  He needs to be on time.
  Everybody needs to be kind.
  He needed some more time to decide on his answer.
- We form questions and negatives with *do*:
  Do you need to leave now?
  Yes, we do. / No, we don't.
  I don't need to read that book again.

7 Listen and repeat.

a I want to go shopping. But I need to study for my exam.
b She doesn't need to come today if she doesn't want to. I think we can manage without her.
c Does he need to finish his paper on ions today? Yes, he does. / No, he doesn't.
d Do they want to come over for dinner? Yes, they do. / No, they don't.

practice

8 Circle the correct word.

a He needs / wants to watch TV.
b She needs / wants to be on time for class, or she won't be allowed in.
c They need / want to go on holiday.
d I need / want to live by the coast. I love the ocean.
e The student needs / wants to study for his exam tomorrow, or else he might not pass.
f She needs / wants to eat three pancakes.

9 Write the sentences in the correct order.

a my need I to on work project
I need to work on my project.
b learn students to more The want
c wants The students to professor the help
d refuel needs He car to his
e ions to He know wants about more .
f you to Do become a doctor want ?

10 Tell your partner what you need to and want to do.

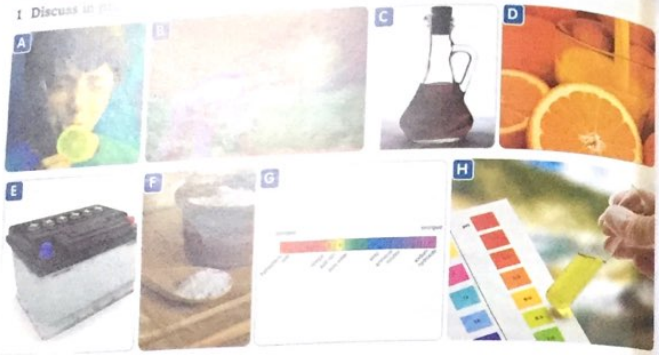
I want to go shopping, but I need to help my mom.
I really want to become a nurse!

checkpoint

learning objective: can talk about ions and what you want and need to do

vocabulary

1 Discuss in pairs. ...lated to acids?



2 **Match the pictures and the words.**

1 release	B	2 battery	E	3 neutral	H	4 pH scale	G
5 vinegar	C	6 vitamin C	D	7 baking soda	F	8 sour	A

3 **Listen and check your answers. Then listen and repeat.**

listening

4 **Listen to a conversation between a student and a professor. Circle the answers.**

a Acids release *hydrogen / hydroxide* ions in water.
b Bases release *hydrogen / hydroxide* ions in water.

5 **Listen again and complete the sentences.**

sulfuric acid | sodium bicarbonate | ~~ascorbic acid~~ | sour | acetic acid | sodium hydroxide

a People take ascorbic acid to stay healthy.
b Car batteries contain sulfuric
c The acid in vinegar is acetic acid
d Most soaps contain sodium hydroxide
e Sodium bicarbonate is often used in baking.
f Most acids taste sour

6 **Listen again and check your answers.**

grammar

will/may/might

...an also use *may* and *might*
...ure
...ght + a verb in its base form:
...might rain
...dary actions, promises, and
...ngs that we are sure will

...*will always help you.*

...ng possibilities:
... We ***may*** *go to France in June.*
...ssibilities that are less likely
... (unreal) situations:
... *I* ***might*** *discover a new*

...ese words in other ways.
...se *will* to make requests:
... ***won't***
... permission:
... you?
May *I buy you lunch?* ✗ *No, you* ***may not****.*
...never use *may* to make requests:
May you buy me lunch? ✗
...avoid *might* in questions:
Might I buy you lunch? ✗

Listen and repeat.

...ne day I **might** travel around the world.
...**may** come to visit this afternoon. **Will** you be ...come?
May I use your phone, please? I **may** need to go ...some soon.

practice

...write the sentences using *may / might / ...*. More than one answer might be ...ssible.

...There is definitely a test in class tomorrow.
There will be a test in class tomorrow.
...m thinking about going to France next year.
c Majed promised to help me fix my car this weekend.
d I don't think she's going to be late tomorrow, but there's a chance.
e I want to borrow your book.
f I am thinking of going to the beach tomorrow if the weather is nice.

speaking

9 **Listen to a professor explaining the pH scale.**

10 **Work in pairs. Research one of the liquids below.**

- milk
- lemon juice
- ammonium hydroxide
- salt water

11 **Now plan a conversation between a lecturer and a student. Answer the questions below.**

- How does the pH scale work?
- What is the difference between an acid and a base?
- What is the liquid's pH?
- Is it acidic or basic?

12 **Practice your conversation as a role-play.**

checkpoint

learning objective: can talk about acids and bases

11.1 biology 102

vocabulary | grammar | reading | writing | speaking | listening

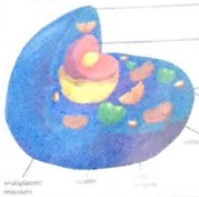
learning objective: can talk about cell structure

vocabulary

Read the descriptions below and label the pictures. Then listen and check your answers.

B nucleus | E lipid layer | C cytoplasm | cell membrane | D organelles | F protein layer | G semipermeable

Anatomy of an Animal Cell

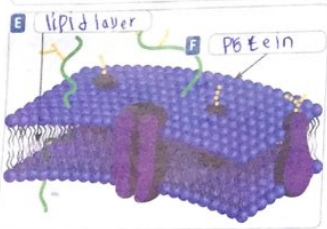


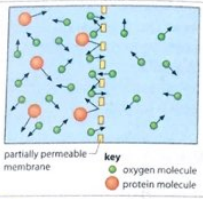
A cell membrane

B nucleus

C cytoplasm

D organelles





G semipermeable

1 The nucleus is shown in pink with a yellow nucleolus. B

2 The cell membrane is the light blue layer on the outside of the cell. A

3 The mitochondria, lysosomes, vacuoles, Golgi complex, and endoplasmic reticulum are all organelles. D

4 The cytoplasm is the blue area inside the cell surrounding the nucleus and organelles. C

5 These are the protein layers of the cell membrane. F

6 This is the lipid or fat layer of the cell membrane. E

7 These images show how the cell membrane is semipermeable. G

2 **Listen and repeat the words.**

listening

3 **Listen to part of a lecture. Which words does the professor use? Circle.**

a nucleus ✓ b nucleolus ✗ c vacuoles ✗
d cytoplasm ✓ e DNA ✗ f organelles ✓
g mitochondria ✓ h lysosomes ✓

Listen

cell membrane is surrounded by

organelles / *cell membrane*

is made up of lipid molecules

layers of protein.

let some / no chemicals in and out

is *the nucleus* / *an organelle* of a cell.

cytoplasm plays a role in keeping

Listen again and check your answers.

grammar — superlatives

- We use superlative adjectives to compare three or more people or things.
- We use the before the superlative adjective.
- For most short adjectives, we use *-est*.
  Cells are the smallest unit of life.
- For short adjectives ending in *-y*, we use *-iest*.
  He's the funniest boy I've ever met!
- In one-syllable adjectives that end with a vowel and a consonant, we double the consonant and add *-est*.
  That's the fattest cat I've ever seen!
- For longer adjectives (three syllables or more), we use *the most*. We don't add *-est* or *-iest*.
  Which is **the most important** organelle?

Listen and repeat.

a This is **the hardest course** of the three.
b She is **the most intelligent** student in her class.
c It was **the most fun** I had all day.

practice

7 **Circle the correct comparative or superlative.**

a Nadia is *taller than* / *the tallest* Kim.
b What is *taller* / *the tallest* building in the world?
c That's *funnier* / *the funniest* story I've ever heard!
d Mount Everest is *higher* / *the highest* mountain in the world.
e I think biology is *more interesting* / *the most interesting* than chemistry. What do you think?
f Is Jeddah *hotter than* / *the hottest* Riyadh?

8 **Complete the sentences with the superlative form of the adjective.**

a I can climb the highest out of my three brothers. (high)
b He's the most clever of all the men. (strong)
c What is the biggest country in the world? (big)
d The happiest children are those eating ice cream! (happy)
e That is the most news I've heard this week. (interesting)
f Which of the equations is the most difficult? (difficult)
g This is the fastest I've run in months! (fast)
h Her kitchen was the cleanest of them all. (clean)

9 **Work in pairs. Ask and answer six questions using the superlative.**

What is the most interesting book you've ever read?

Ahmed the tallest brother

checkpoint

learning objective: can talk about cell structure

11.2 biology 102

learning objective: can talk and write about organelles

...at the pictures. Which show things that humans consume (eat) to

2 Match the pictures and the words.

1 enzymes	C	2 nutrients	E	3 carbohydrates	F	4 oxidize	D
5 chromosome	A	6 fats	H	7 blueprints	B	8 proteins	G

3 Listen and check your answers. Then listen and repeat.

reading

4 Before you read, make a list of all the organelles you know. What do you know about each organelle? Discuss in pairs.

Lysosomes are organelles.

5 Read the article.

ORGANELLES

Nucleus

The nucleus of a cell is an organelle. It controls all the cell's activities and is surrounded by the nuclear membrane. Inside the nuclear membrane is a substance called the nucleoplasm. This contains the nucleolus and chromosomes. The nucleolus contains ribonucleic acid (RNA), and makes RNA and protein. Chromosomes are thread-like structures made of deoxyribonucleic acid (DNA). They carry genetic information in the form of genes, and are the blueprints for the cell's structure.

Mitochondria

All animal cells have at least one mitochondrion and usually many more. Mitochondria are the power houses of a cell because they generate or make the energy a cell needs to live. The mitochondria contain enzymes, which extract energy by oxidizing nutrients. The nutrients come from food. Carbohydrates, fats, and proteins are broken down into nutrients by enzymes in the digestive system. When these nutrients reach a cell, they are oxidized by the mitochondria. Energy is released in the form of ATP (adenosine triphosphate). This oxidization process is called cellular respiration.

6 Read again and write T (true) or F (false).

a The nucleolus is inside the nucleoplasm. T

b Chromosomes are made of ribonucleic acid. F

c Most animal cells have only one mitochondrion. F

d Mitochondria generate energy by oxidizing nutrients.

e Carbohydrates, fats, and proteins are first broken down by the digestive system.

grammar — Latin plurals

...s come from Latin. They usually ... Latin rules.

...ends in *-on* or *-um*, change the ...

...on > many *mitochondria*

...many *bacteria*

...ends in *-a*, add an *-e*

...a > *larvae*

...ends in *-is*, change ...

...axes

...ends in *-us*, change the ending ...

...us > many *radii*

...ions.

...virus > many *viruses*

...many *aquaria* or *aquariums*

...many *formulae* or *formulas*

Listen and repeat.

a There's only one larva on top of the leaf, but lots of **larvae** under it.

b This cell has only one mitochondrion. But that one has many **mitochondria**.

c Draw two **axes**: an *x*-axis and a *y*-axis.

d Measure the **radii** of all the circles, please. Remember, the radius is half the diameter.

11.2

practice

8 Complete the sentences with the plural.

a There are more than 100 viruses that can cause a cold. (virus)

b In some countries, people eat the pupae of larvae as a snack. (pupa)

c The fish are swimming around in new aquaria (aquarium)

d What are the formulae for those scientific rules? (formula)

e The nuclei of cells are surrounded by nuclear membranes. (nucleus)

writing

9 Read the article in Activity 5 again and then the paragraph below. Can you find any mistakes? Underline.

Vacuoles

A vacuole is a nucleus with an important role in the cell. It is surrounded by a membrane and floats freely in the nucleoplasm. Vacuoles contain water, food, or metabolic waste. They can also contain enzymes in solution. They are found only in plant cells and never in animal cells. A vacuole's function or role depends on the type of cell it is in. Vacuoles can grow in size to help the leaves of plants grow very quickly.

10 Do some research on vacuoles. Then rewrite the paragraph with the correct information.

checkpoint

learning objective: can talk and write about organelles

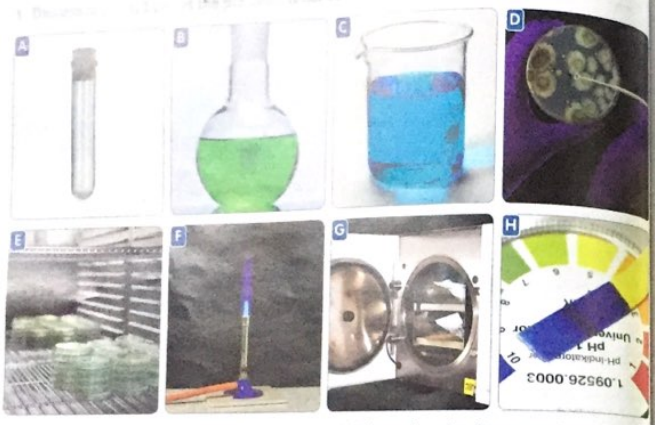
writing | speaking | listening

a role-play about an experiment

laboratory apparatus

vocabulary

each apparatus for?



2 Match the pictures and the words.

1 flask	B	2 autoclave	G
3 Bunsen burner	F	4 incubator	E
5 litmus paper	H	6 beaker	C
7 test tube	A	8 petri dish	D

3 Listen and check your answers. Then listen and repeat.

4 Discuss in pairs. Do we need to wear gloves when we work with each apparatus? Why?

We need gloves when we work with...

We don't need gloves when we work with...

listening

5 Listen to a conversation between two students. What are they going to do in the afternoon? Tick.

a finish a math report and count bacteria ☐

b inventory the lab and do experiments ☐

c finish a math report and help in the lab ☐

6 Listen again and complete the sentences.

a Test tubes, beakers, flasks, and petri dishes are all made of glass.

b Bunsen burners are small gas burners.

c An autoclave is a chamber used for chemical reactions using high temperatures and pressures, such as sterilization.

d An incubator maintains the right conditions (like temperature) for growth.

e Litmus paper tests for acids and bases.

7 Listen again and check your answers.

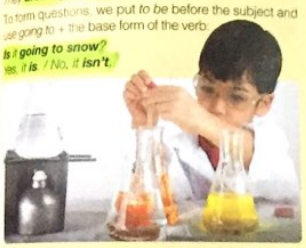
grammar — to be going to

We use to be + going to + the base form of a verb to talk about the future. We use it to:

- talk about future plans and intentions: *I'm going to be a scientist.*
- make predictions: *It's going to snow.*
- give commands/instructions: *You're going to count the beakers.*

To form negative statements, we use: *I'm not / isn't / aren't + going to +* the base form of verb: *They aren't going to study tonight.*

To form questions, we put *to be* before the subject and use *going to +* the base form of the verb: *Is it going to snow?* *Yes, it is. / No, it isn't.*



8 Listen and repeat.

a He's going to walk to campus.
He isn't going to take the bus.

b We're going to go to the lab.
They're going to study in the library.

c Are you going to do the inventory?
Yes, I am. / No, I'm not.

7.1

practice

9 Complete the sentences with *be going to* and the verb in brackets.

a You're going to put the petri dish in the autoclave. (put)

b He isn't going dinner tonight! He always forgets. (not make) to make

c She is going to the test tube over the Bunsen burner. (heat) heat

d I'm going to the beaker with water. (fill)

e We are going to fill on the incubator. (switch) to switch

f Is it going to be a hot day today? (be)

g I hope we aren't going to pieces of litmus paper. There are too many! (not count)

h Your beaker is going to off the table! (fall)

i I think the litmus paper is going to ed. (turn) fall

j Are we going to do any experiments tomorrow, Professor? (do)

10 Discuss in pairs. What are you going to do for the rest of the day and tomorrow?

I'm going to eat lunch...

I'm going to study...

I'm going to watch...

checkpoint

learning objective: can talk about simple laboratory apparatus

7.2 lab apparatus

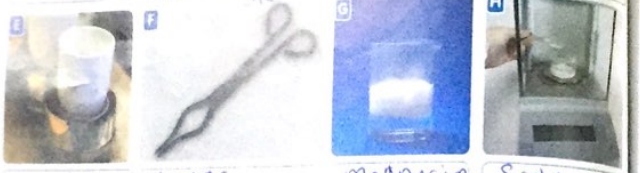
about doing experiments

vocabulary

bacteria?

pipeclay triangle

ethanol | pipeclay triangle | flame | tripod



crucible | tongs | magnesium | scale

3 Listen and check your answers. Then listen and repeat.

reading

4 Work in pairs. Answer the questions. Give reasons for your answers.

a Will wet paper burn?

b Is magnesium oxide heavier than magnesium?

5 Read about the experiments. Were you right?

Simple Bunsen Burner Experiments

1 Will wet paper burn?

Put one beaker with water, one with ethanol, and one with half water / half ethanol.

Soak (make completely wet) a piece of paper in the water. Use tongs and hold it over the Bunsen burner flame. The paper will not ignite (catch fire). Soak a second piece of paper in the ethanol. The paper will ignite and burn away. Soak a third piece of paper in the water / ethanol mix. The ethanol will burn away, but the paper won't ignite.

2 Is magnesium oxide heavier than magnesium?

Weigh a piece of magnesium on a scale. Put it in a crucible and put the lid on. Place the crucible on a pipeclay triangle, on a tripod over the Bunsen burner. Heat. Lift the lid with tongs. The magnesium will burn brightly. Heat until the reaction stops. Wait for it to cool, then weigh it again. It will be heavier.

50

7.2

Read a... and write T (true) or F (false).

a ...a liquid — T

b ...ed only in ethanol will not ignite. — F

c ...k paper in ethanol and water, only ...burns away. — T

d ...can be heated to high temperatures. — T

e ...heat a pipeclay triangle. — F

f ...gnesium is a chemical reaction. — T

g ...n oxide is heavier than magnesium. — T

grammar — future simple: will

- We use ... + a verb in its base form to talk about ...uture.
- ...ll watch, will eat, will burn
- will ... change when the person changes.
- Will ...? ...e/it/We/They will sleep this afternoon.
- We can ... the contraction 'll instead of will.
- They'll ... this afternoon.
- To form ...ative statements, we use will not or the ...action won't.
- We will ...t/won't get home before 8 pm.
- To form ...estions, we put will before the subject and use ... base form of the verb.
- Will he ... the tongs? Yes, he will. / No, he won't.

7 Listen and repeat.

a Will ... do an experiment?
Yes, ... will. / No, we won't.

b She'll get the tripod. Will you get the crucible?

c ... won't be able to come this afternoon. Will you take notes for me, please?

practice

8 Complete the sentences using will or won't.

a I will light the Bunsen burner.

b He won't lift the lid of the crucible. He's scared.

c She will weigh the magnesium. It's her job.

d Will you get a set of tongs, please?

e They won't pass the exam. They missed all the lectures!

9 Circle the correct answer.

a He did not train well and will / won't be able to compete.

b She is tired and will / won't sleep this afternoon.

c I have my own books, so I will / won't need yours.

d Will you be home? No, I will / won't.

e If we don't hurry, we will / won't be late!

speaking

10 Listen to a conversation between two students doing the first experiment in Activity 5.

...Plan a short ...o students ...nent in ...es below.

...tion in pairs. Then present it to the class.

Will → سوف

Won't → لن

يعني يدخل الفعل بدون إضافات

checkpoint

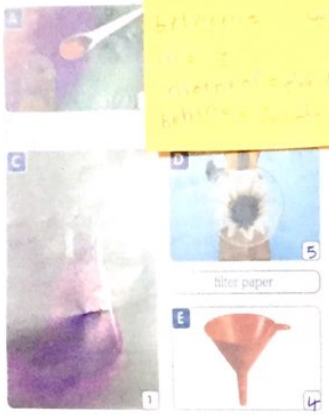
learning objective: can talk about doing experiments

51

7.3 lab apparatus

learning objective: can talk and write about the lab apparatus needed for an experiment

vocabulary



1 a glass stick used to stir chemicals, liquids, and mixtures
2 a dry substance in the form of small particles
3 a long metal spoon that is flat on one end
4 a tube that is wide at one end and narrow at the other
5 a kind of paper used for separating liquids and solids

2 102 **Listen and repeat the words.**

3 **Work in pairs. Write a list of glass lab apparatus. Discuss why you think they are made of glass.**

beakers...

grammar — prepositions of place

repositions of place to say where someone or something is in relation to something else. Common prepositions of place are:

er/below, above/over, behind, in front of, next to/beside, through, around, across

4 102 **Listen and repeat.**

a Put the Bunsen burner **under** the tripod. Then place the pipeclay triangle **on** the tripod.
b Hold the test tube **above** the flame, not **in** it.
c Pour the solutions **into** beakers and place them **next to** the others.

practice

5 **Circle the correct preposition of place.**

a Put the magnesium *(in)* / *through* the crucible. Then heat it up.
b Pour the solution *through* / *behind* some filter paper.
c The test tube rolled *between* / *under* the table.
d He's standing *behind* / *in front of* me so I can't see the professor.
e You can't find the spatula because it's *behind* / *on* the funnels.
f Take the samples *into* / *out of* the incubator. They should be ready.

listening

6 **Listen to a professor explaining an experiment. What two chemicals do they need and how much of each? Circle.**

a ... copper oxide powder
b ... copper oxide powder
c ... of diluted sulfuric acid
d ... of concentrated sulfuric acid

7 **Listen again and complete the sentences.**

a ... students are making a copper sulfate solution.
b ... need to be careful because copper sulfate is an acid.
c ... usually dilute liquids by adding water.
d ... add the copper oxide powder when the sulfuric ... is nearly boiling.
e ... color of copper sulfate is blue clear.

writing

8 **Read the memo from a professor (Professor Gibran) to the lab technician (Mr. Amjad).**

MEMO

To: Mr. Amjad
From: Professor Gibran
Date: May 18
Subject: Prepare lab apparatus for class experiment

We're going to make copper sulfate in class tomorrow. Please prepare these chemicals before 3 pm tomorrow:

- copper oxide
- diluted sulfuric acid

We will also need the following apparatus:

- beakers
- Bunsen burners
- tripods
- spatulas
- glass stirring rods
- filter paper
- funnels
- flasks

9 **Discuss in pairs. Read again and answer the questions.**

a What experiment is Professor Gibran's class going to do?
b When is he going to need the chemicals and apparatus?
c What chemicals is he going to need?
d Which apparatus is he going to need?

10 **Now write a memo to Mr. Amjad about another experiment. Use one from page 50 (Activity 5), or research your own. Use the plan below.**

In the body of the memo include:

- what experiment you are going to do
- what chemicals you need
- what apparatus you need
- when you need it by, e.g. tomorrow at 3 pm

11 **Share your memo with a partner. Did you write about the same experiment? Were your instructions similar?**

checkpoint

learning objective: can talk and write about the lab apparatus needed for an experiment

8.1 Using a ...

vocabulary | grammar | reading | writing | speaking

learning objective: can talk about lab safety when doing experiments

vocabulary

1 Label the pictures.

glove mask face shield accident hazard safety goggles extinguisher

A hazard

2 Listen and check your answers. Then listen and repeat.

3 Discuss in pairs. Which pictures show equipment that keep you safe? What other safety equipment can you name?

listening

4 Listen to a conversation between two students. Point to the pictures as you hear the words. What are the students about to do?

5 Listen again and write T (true) or F (false).

a One student thinks that wearing goggles and a mask looks silly.

b They need to wear gloves for the experiment.

c Accidents like explosions can't happen in a lab.

d One student says that masks protect your skin.

e One student asks for a face shield.

6 Listen again and check your answers.

grammar have to/don't have to

- We use *have to* to show a strong sense of obligation. This means that something must be done for some external reason, because it is a rule or because a person in authority says it has to happen.

I/You/We/They **have to** finish the report today. Professor Gibran wants it tomorrow!
He/She **has to** wear a lab coat. It's one of the laboratory safety rules.

- To form the negative, we use *don't/doesn't + have to* + the base form of the verb:

I/You/We/They **don't have to** take extra classes.
He/She **doesn't have to** take extra lessons.

- To form questions and answers, we use *do/don't/does/doesn't + the subject + have/has to + the base form of the verb*:

Do/Don't you **have to** wash the beakers after an experiment? Yes, we **do**. / No, we **don't**.
Does/Doesn't he **have to** wear a mask? Yes, he **does**. / No, he **doesn't**.

7 Listen and repeat.

a We **have to** wear gloves for this experiment.
We **don't have to** wear goggles.

b He **has to** wear goggles for this experiment.
He **doesn't have to** wear a mask.

c **Do** they **have to** wear face shields for every experiment? No, they **don't**.

practice

8 **Circle the correct answer.**

a She *(has)* / *have* to make her bed every day.

b The essay *has* / *have* to be done by Thursday.

c They *don't* / *doesn't* have to go to class today.

d He *don't* / *doesn't* have to make his own dinner.

e We *don't* / *has* to read the next chapter yet.

f *Don't* / *Doesn't* she have to work this afternoon?

9 **Complete the sentences with the correct form of *has to/ have to*.**

a We have to clean the lab after each experiment. (✓)

b We [illegible] gloves. (✗)

c Do [illegible] your lab coats?

d Does [illegible] to bed early?

e On Saturdays, we [illegible] up early. (✓)

10 **Work in pairs. What do you have to do this week? What don't you have to do?**

I have to write a chemistry report.
I don't have to study for a test.

11 **Join another pair. Tell them what your partner has to/doesn't have to do this week.**

Nadia has to write a chemistry report.
She doesn't have to study for a test.

checkpoint

learning objective: can talk about lab safety when doing experiments

8.2 using a lab

learning objective: can talk about lab safety rules

vocabulary

1 **Read the definitions below and number the pictures. Then listen and check your answers.**

eyewash station | fire extinguisher | first aid kit | toxic substance | fume hood | forceps

1 used to pick up chemicals or small things
2 a place to wash your eyes with water
3 used to put out fires
4 poisonous or likely to make you very ill
5 a set of medical equipment
6 a working area that draws toxic air away from the scientist

2 **Listen and repeat the words.**

3 **Discuss in pairs. How many toxic substances can you think of?**

sulfuric acid, mercury...

reading

4 **Work in pairs. Write a list of five laboratory safety rules.**

5 **Read the laboratory safety rules. How many rules did you have on your list?**

LABORATORY SAFETY RULES

ALWAYS follow these rules and **NEVER** mess around.

- Always wear lab coats in the lab.
- Always follow the professor's instructions. Never do your own experiments.
- Always wear goggles when heating substances.
- Always wear a mask and use a fume hood when working with toxic gases.
- Know where to find the first aid kit.
- Know how to use the eyewash station.
- Never smoke, eat, or drink in the lab.
- Never drink from beakers or flasks, even when clean.
- Do not taste or smell any chemicals.
- Wear gloves and always use forceps to pick up chemicals.
- Always check the labels of chemicals twice before using.
- Never take chemicals out of the lab.

6 **Read again and write T (true) and F (false).**

a It's OK to drink water from a clean beaker. F
b Goggles protect you from toxic gases.
c You must smell a chemical before you use it.
d You can take certain chemicals home.

grammar — adverbs of frequency

We use some adverbs to say how frequently we do something. An adverb of frequency goes before the main verb (except *to be*). Some adverbs of frequency (*always* and *never*) can start a sentence for a stronger message.

always go to bed at 9 pm.
Mon ✓ Tue ✓ Wed ✓ Thur ✓ Fri ✓ Sat ✓ Sun ✓

usually go to bed at 9 pm.
Mon ✓ Tue ✓ Wed ✓ Thur ✓ Fri ✗ Sat ✗ Sun ✓

often go to bed at 9 pm.
Mon ✓ Tue ✓ Wed ✗ Thur ✓ Fri ✗ Sat ✗ Sun ✓

sometimes go to bed at 9 pm.
Mon ✓ Tue ✗ Wed ✗ Thur ✓ Fri ✗ Sat ✗ Sun ✓

seldom go to bed at 9 pm.
Mon ✗ Tue ✗ Wed ✗ Thur ✗ Fri ✗ Sat ✗ Sun ✓

never go to bed at 9 pm.
Mon ✗ Tue ✗ Wed ✗ Thur ✗ Fri ✗ Sat ✗ Sun ✗

7 **Listen and repeat.**

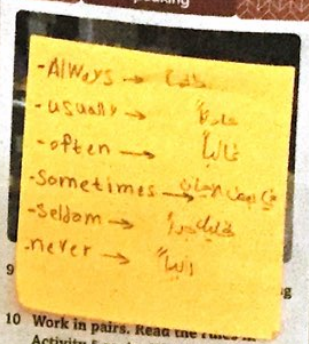
a We **often** watch our professor do experiments. **Sometimes** we do them ourselves.
b I **always** use my forceps and I **never** take chemicals home.
c He's **usually** on time. He's **seldom** late.

practice

8 **Circle the correct adverb of frequency.**

a I *always* / *usually* wake up at 6 am. On the weekends, I sleep in!
b He *often* / *never* forgets his textbook. And then he wants to share mine!
c She *never* / *seldom* cooks—only when her parents come to dinner.
d *Sometimes* / *Never* play with fire. It's dangerous.
e He is *always* / *sometimes* wearing his lab coat. He never takes it off.
f They *never* / *sometimes* order pizza, but they usually order hotdogs.
g I've *never* / *seldom* read this book. Is it good?
h Do you *often* / *seldom* have class with Professor Nasser? Yes, four times a week!

speaking



10 **Work in pairs. Read the rules in Activity 5 again. Which do you think is the most important?**

11 **Now listen again. Plan a role-play between a new student and a professor explaining some lab rules. Use the useful phrases below.**

You must / have to ...
Do you understand that ...?
Do I have to ...?
Here is ...
Do you know how to use it?

12 **Practice your role-play. Then present it to the class.**

checkpoint

learning objective: can talk about lab safety rules

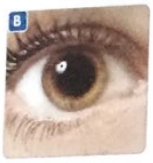
8.3 Using a lab

learning objective: can talk and write about a lab accident

vocabulary

1 Discuss in pairs. Look at the pictures. Which pictures show something getting bigger or smaller?

2 Match the pictures and the words.



1 expand	B
2 contract	A
3 centrifuge	D
4 damage	E
5 cut	C

3 Listen and check your answers. Then listen and repeat.

grammar

quantifiers

- Some nouns are countable (you can count them): *three* **elements** ✓
  Some nouns are uncountable (you can't count them): *three* **magnesiums** ✗
- We use quantifiers with nouns when we want to talk about quantity (how many or how much) without using numbers or exact amounts.
- We use these quantifiers only with countable nouns: *many, both, each, either, a few*
- We use these quantifiers only with uncountable nouns: *much, a little*
- We use these quantifiers with both countable and uncountable nouns: *all, any, enough, a lot of/lots of, some, more/most, no/none, less/least*

4 Listen and repeat.

a **All** the students use the lab, but only **a few** of them clean it.

b **Most** of the sand is in the bucket, but **some** is on the floor.

c **Lots of** experiments use the Bunsen burner. **Many** of them use tripods.

practice

5 Circle the correct quantifier.

a Let's have dinner on the 13th or the 14th. *Either* / *All* date is good for me.

b Please can I use a pen? *Some* / *None* of mine are working.

c There are *much* / *a lot of* people here today. There must be 200 or more!

d I have *a few* / *a little* books on experiments you can do at home.

e *Each* / *Enough* student got his own microscope.

f *How many* / *much* milk do we have?

listening

6 Listen to a conversation between two doctors. What is the memo about?

a an explosion and lab rules students are breaking

b what was damaged in a lab accident

7 Listen again and complete the sentences.

centrifuge cuts explosion expand eye wash station lecture rules goggles apparatus contract

a The centrifuge was damaged.

b Students didn't follow the rules.

c There was an explosion in the lab.

d They forgot that most things contract when cooled and expand when heated.

e None of the students wore coats or goggles.

f Some of them got small cuts from the glass.

g All the students used the eyewash station.

h The students must pay for the broken apparatus.

i They will have to attend a special lecture.

writing

8 Listen to the conversation again.

9 Work in pairs. Which rules did the students break? Which did they follow?

The students didn't follow the 52 rules

LABORATORY SAFETY RULES

ALWAYS follow these rules and NEVER mess around.

- ⚠ Always wear lab coats in the lab. F
- ⚠ Know where the fire extinguisher is and how to use it.
- ⚠ No smoking.
- ⚠ Always follow the lecturer's instructions. Never do your own experiments. F
- ⚠ Always wear goggles when doing an experiment. F
- ⚠ Always wear a mask and use a fume hood when working with toxic gases.
- ⚠ Know where to find the first aid kit.
- ⚠ Use the eye wash station after an accident.

10 Write a memo of two or three short paragraphs from the professor (Professor Abadi) to the other professors. Use the information and model below.

Mention:

- the explosion
- the rules that students are breaking
- the lab safety lecture

MEMO

To: All teaching staff

From: Professor Abadi

Date: May 18

Subject: Students breaking lab rules

checkpoint

learning objective: can talk and write about a lab accident

9.1 physics 102

vocabulary | grammar | reading | writing | speaking | listening

forms of energy | to-infinitive; zero conditional & present perfect | an academic article about light | a paragraph about sound | a presentation on sound waves | a conversation

learning objective: can talk about heat energy

vocabulary

1 Discuss in pairs. Look at the pictures. Which pictures show ways that heat energy can be transferred (moved from one object to another)?

2 Match the pictures and the words.

1 conduction	A	2 convection	E
3 radiation	C	4 conductor	F
5 insulator	G	6 rubber	D
7 smoke	B		

3 Listen and check your answers. Then listen and repeat.

listening

4 Listen to the start of a lecture. Why does the professor talk about a campfire?

a It's a good example of light energy. ☐
b It shows how heat energy is transferred. ☐
c It shows how sound is conducted. ☐

5 Listen again and complete the sentences.

a A campfire is a source of heat energy.
b Water in a pot on a fire will _____ because heat is conducted through the pot.
c _____ happens through direct contact, like the fire touching the pot.
d Convection is the heat transfer in liquids and gazes.
e Hot air like smoke rises because it is lighter than the cold air around it.
f The transfer of heat through space in the form of waves is called radiation.

6 Listen again and check your answers.

grammar — to-infinitive

- We use the *to*-infinitive to talk about our reasons for doing something (to answer the question *Why...?*).
  Why did he boil water on the fire?
  He boiled water on the fire **to make** *hot chocolate.*
  Why did she work hard?
  She worked hard **to get** *good grades.*
- We also use the *to*-infinitive after certain verbs that talk about what we're thinking or feeling:
  choose / decide / forget / hope / learn / like / love / plan / remember / want / would like
  want to make *a campfire.*
  Don't **forget to give** *him the book.*
  Remember to bring *your flashlight on the camping trip!*
- *To* is always followed by the verb in its base form.

Listen and repeat.

a He made a fire **to keep** warm, **to cook** his dinner, and **to boil** water for coffee.
b We decided **to stay** at home **to finish** our reports.
c I forgot **to write** a note **to tell** him what **to do**.

practice

1 Complete the sentences with the correct *to*-infinitive.

~~to take~~ | to bring | ~~to do~~ | to keep | to speak | to travel

a He loves to do experiments in the lab.
b They would like to take a vacation.
c She locked the door to keep everyone out.
d I hope to travel the world one day.
e He phoned to speak to his father.
f Remember bringing your lab coat!

9 Work in pairs. Use your own ideas to complete these sentences.

a I love to eat food
b I hope to English-Speak
c I study to go shopping
d I always make time on the weekends to be doc
e When I finish my studies, I want to
f One day, I would like to

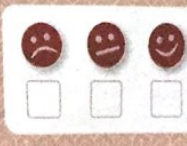
10 Write five sentences using the *to*-infinitive. Use the verbs below.

want | decide | like | remember | learn

In math, we learn to measure triangles.

checkpoint

learning objective: can talk about heat energy



9.2 physics 102

learning objective: can talk about light energy and write about sound energy

vocabulary

1 Discuss in pairs. Look at the pictures. Which picture shows how light travels in a single medium like air? Which picture shows how light travels from one medium to another?

2 Label the pictures.

reflect refract absorb medium straight line prism spectrum bounce

reflect

3 125 Listen and check your answers. Then listen and repeat.

reading

4 Work in pairs. Discuss what you think light, sound, and heat wave energy have in common. Tick the answers.

a can be reflected ☐ b can be refracted ☐
c can be absorbed ☐ d can be created ☐

5 127 Read the article. Did you tick the correct items?

6 Read again and circle the answer.

a If you look in the mirror, what do you see?
your reflection / your refraction

b What reflects light?
mirrors and water / everything

c How does light travel through a single medium?
it bends / in a straight line

d Does light travel faster through water or air?
air / water

e What color does a red apple reflect?
yellow / green / red

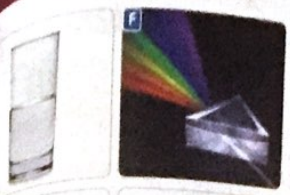
f What does a black object do?
absorbs light / reflects light

Light Energy

Light is the only form of energy we can see. Just like heat and sound waves, light waves can be reflected, absorbed, and refracted.

If you look in the mirror, you see your reflection. A reflection is light waves bouncing back to you. It's not only mirrors that reflect light. Everything reflects light. White light is made up of seven different colors. The color of an object is the light reflected by that object. It absorbs all the other colors of the light spectrum. For example, a banana reflects yellow light, but absorbs the other colors. All colors are reflected if an object looks white. All colors are absorbed if an object looks black.

Energy waves can also be refracted or bent. Light always travels in a straight line through a single medium. In some mediums such as air, light travels quickly. But through other mediums such as water or glass, light travels more slowly. When light travels from one medium to another, it changes speed and is refracted. A glass prism refracts light to form a rainbow spectrum showing all seven colors of light. A rainbow in nature is light refracting through drops of water.



grammar — zero conditional

- We use *if* to talk about the result of a specific event.
  Glass **breaks if** *you* **drop** *it.*
  If you **touch** *a hot stove, your hand* **burns.**
- In zero conditional sentences, both parts of the sentence are in the present simple tense, because we talk about facts and known results.
- We can use *when* instead of *if*.
  If/When *you* **look** *in the mirror, you* **see** *your reflection.*
  You **see** *your reflection* ***if/when*** *you* **look** *in the mirror.*
  If/When *water* **boils**, *it bubbles.*
  Water bubbles ***if/when*** *you* **boil** *it.*

Listen and repeat.

a Ice **forms when** you freeze water. Ice **melts if** you heat it.

b **If** it **rains**, the road **gets** wet. My car's tires **get** wet **if** the road **is** wet.

c **When** I **get** sick, I **go** to the doctor. **If** he **gives** me medication, I **take** it.

practice

8 Combine the phrases using the zero conditional.

a You mix red and blue. Get purple.
If you mix red and blue, you get purple.

b I mix yellow and blue. Get green.

c He walks on wet grass. Gets wet shoes.

d I drink too much coffee. Can't sleep.

e Get hot. You sit in the sun.

f Get hungry. You don't eat.

g They don't work hard. Don't pass the course.

writing

9 Use your own knowledge and do some research to answer the questions below.

Sound waves

- What is sound energy?
- What are sound waves?
- What is an echo?
- How do things sound when we hear them from under water?
- How do sound waves move in hot air?
- Why do we hear sounds differently at night?
- Why do libraries have carpets?
- What kind of materials absorb sound?

10 Now write a short paragraph about sound energy and how sound waves are reflected, refracted, and absorbed.

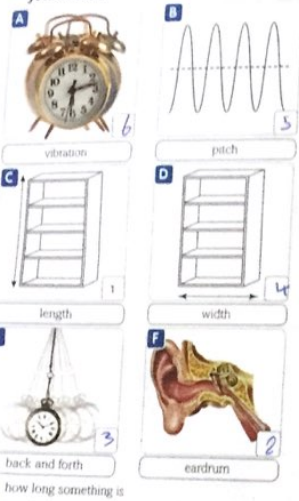
checkpoint

learning objective: can talk about light energy and write about sound energy

learning objective: can talk about pitch and vibration

vocabulary

1 **Read the definitions below and number the pictures. Then listen and check your answers.**



1 how long something is
2 a part of your middle ear that vibrates in response to sound waves
3 moving one way and then the other way
4 how wide something is
5 how high or low a sound is
6 a continuous slight shaking movement

2 **Listen and repeat the words.**

3 ***Discuss in pairs.* Which two words above do we use when we measure things? Think of other English words used for measuring.**

diameter

grammar

present perfect

The present perfect tense formed with *has/have* + the past participle of a verb.

We use it for:

- something that started in the past and continues now (often with *for*)
  (I've studied science for the last five years.
  And I'm still studying it now.)
  I haven't studied science for the last five years.
  (I stopped five years ago and I'm still not studying it.)
- something we've done in the past and still do now (often with *since*)
  He's played football since he was ten years old.
  He hasn't played football since he was ten years old.
- for talking about our experience up to now (often with *ever* and *never*)
  I've never played soccer.
- for something that happened in the past, but is important now.
  I've lost my keys, so I can't get into the house.
  I haven't lost my keys, so I can get into the house.

Questions and answers:
Have you seen Abdul today?
Yes, I have. / No, I haven't.

4 **Listen and repeat.**

a Susan isn't here. She**'s gone** to the mall.
b That was the longest lecture I**'ve ever listened** to.
c They**'ve lived** in the UK since 1984. They**'ve never thought** of moving.

practice

5 **Complete the sentences with the present perfect. Use the words in brackets.**

a I'm so tired. I 've worked really hard all day. (work)
b He hasn't played soccer since he was five. (not play)
c You have watched that movie so many times! (watch)
d She has written five books already. (write)
e Have you seen Adam today? (you / see)
f Has he eaten breakfast yet? (he / eat)

6 **Work in pairs. Ask and answer questions using the present perfect. Use the verbs below, and *ever / never / for / since*.**

a go eat travel read play

Have you ever been to Medina?
No, I haven't. But I've been to Jeddah!

listening

7 **Listen to a conversation between two students. What do their two questions have in common? Tick.**

a They are both about drums. F F
b They are both about falling trees. T
c They are both about sound. T

8 **Listen again and write T (true) or F (false).**

a Pitch means how high or low a sound is. T
b The bigger the drum, the higher the pitch. F
c Sound makes particles vibrate. T
d A tree falling causes air particles to vibrate. T
e Vibrations stay only in one place. F
f You hear sound when your eardrum vibrates. T

speaking

9 **Listen again to the conversation.**

10 **Work in pairs. Write your own definitions for the words below. Use your own knowledge and the glossary at the back of the book.**

a pitch
b frequency
c vibration
d sound waves

11 **Now write a short presentation explaining how pitch changes, and how it is related to the frequency of vibrations of sound waves.**

- ask the question
- explain what *pitch*, *frequency*, *vibration*, and *sound waves* mean
- explain the difference between frequency and speed
- answer the question
- give an example
- check for understanding

12 **Practice your talk and then present it to the class.**

checkpoint

learning objective: can talk about pitch and vibration

review units 7–9

vocabulary

1 Circle the correct word.

2 Listen and check your answers.

3 Choose the correct word.

A	B	C
cut	expand	tripod	vibration	contract
conductor	insulator	scale	pitch
E	F	G	

a A scale is a piece of lab equipment that measures the mass of something.

b A test tube is a piece of equipment with three legs that holds things up.

c contract means to get smaller in size.

d expand means to get bigger in size.

e A conductor is something that is good at transferring energy.

f An insulator is something that is bad at transferring energy.

g pitch is how high or low a sound is.

h vibration is a continuous slight shaking movement.

i A cut is a division that separates something that was whole in two.

grammar

4 Circle the correct preposition of place.

a Pour the solution (into) / under the test tubes.

b She's sitting *behind* / *in front* of me, so I can't see her.

c You need to wear a mask. There are some over / on the table.

d Use the tongs to take the beakers through / out of the autoclave.

5 Complete the sentences with the words below.

A	B	C	D	E
much	either	any	less	a lot of

a How much time do we have to finish our experiment?

b Do you have any idea how to do this assignment? I am very confused!

c There are a lot of people here. I am not sure we'll find a seat.

d I'd love to study together. either Monday or Tuesday would work for me.

e The exam was less difficult than I thought it would be. It was actually pretty easy.

6 Combine the phrases using the zero conditional.

a You freeze water. Get ice.
If you freeze water, you get ice.

b Get thirsty. You don't drink enough water.

c You mix red and yellow. Get orange.

d Can't sleep. He drinks too much tea.

e It rains. The land floods.

reading

7 Read and choose the correct answer.

1 have to / don't have to / can't
2 have to / don't have to / can't
3 will be / going to be / has been
4 do / can / are going to
5 have finished / finished / will finish
6 don't have to / can't / don't

Guided visit to the Science Museum

There are short guided tours of parts of the Science Museum three times a week. People who want to join a tour have to book by telephone (004-458213) at least two days in advance, but you don't have to pay as the museum is free.

On the tour, our first stop is the physics department. This was renovated recently and now contains exhibitions about light and energy, which your children are going to love.

Once we have to there, we have got a surprise for you—a high-tech 3-D movie about volcanoes. However, you don't have to bring children under five as it can be frightening. If you are visiting with small children, you will be given drinks in our cafe during this part of our tour.

8 Read again and write T (true) or F (false).

a You have to book guided tours of the museum. T

b The museum costs ten dollars. F

c The chemistry department was renovated recently. T

d The tour features a movie about volcanoes. F

e Children aged five and over can watch the film. T

speaking

9 Work in pairs. Tell your partner about yourself using the phrases below.

a I never... Play on my Phone in English

b I often...

c I always forget to...

d This weekend I want to...

e I hope to... when I finish university.

writing

10 Write five sentences about your plans for the weekend. Use *going to*.

On Saturday, I'm going to work on my physics project.

11 Choose any experiment you know well. Write 2 short paragraphs describing the experiment.

Include:

- the chemicals you need
- the apparatus you need
- the steps you need to take
- the result of the experiment

11.3 biology 102

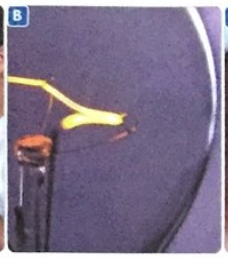
learning objective: can talk about extracting DNA

vocabulary

1 Discuss in pairs. Look at the pictures. Which pictures show a substance that contains human DNA?

2 Label the pictures.

saliva extract ~~mucus~~ filament disinfectant pineapple juice



mucus | Filament | disinfectant | Pineapple juice

extact

Salive

3 Listen and check your answers. Then listen and repeat.

grammar — uncountable nouns

Uncountable nouns don't have plurals. You can't count them, but you can measure many of them: *money, salt, bread, milk, sodium, rice, tea, sugar, water, air, juice, baking soda*

We ask *How much?* with these uncountable nouns, and we answer with measurements.

These measurements can be specific: ***a bag of** money, **20 ml of** juice, **one teaspoon of** baking soda, **a loaf of** bread, **a pinch of** salt, **a few drops of** juice, **a glass of** milk*

Or they can be more general: ***some** money, **a lot of** rice, **a little** water*

Listen and repeat.

Please may I have **a glass of milk** and **some** toast with cheese?

I'll have **some chicken curry** with **a bowl of rice**

Oh, I might have **a cup of tea** and **a slice of cake**

practice

Complete the sentences with the correct uncountable noun.

bread juice water ~~sugar~~ sodium milk food coloring

a I have one spoon of sugar in my tea, please.
b She doesn't have any milk in her coffee.
c The pot of Water on the stove is for boiling some rice.
d Please buy three loaves of bread at the supermarket.
e Would you like a glass of Juice to drink? I've got apple and orange
f In this experiment, we need 5 g of Sodium
g You only need a few drops of Food coloring to make the cake red.

listening

Listen to a conversation between two students. What are they extracting in this experiment?

a deoxyribonucleic acid ☐
b ribonucleic acid ☑
c adenosine triphosphate ☐

7 Listen again and complete the sentences.

a Saliva is a liquid formed in the mouth
b The white mucous filaments are DNA
c The basic liquid used to break open the cells is Soap
d The acidic liquid used to neutralize the proteins is Pineapple juice
e The Salt makes the DNA clump together
f The DNA floats on top of the

speaking

8 Listen again to the conversation.

9 Work in pairs. Prepare a short presentation on how to extract your own DNA. Remember to answer the questions below.

Where do you need to be? E.g. in a lab
What do you need?
What is the process?
How does it work?

10 Practice your presentation in pairs. Then present it to the class.

checkpoint

learning objective: can talk about extracting DNA

12.1 mathematics

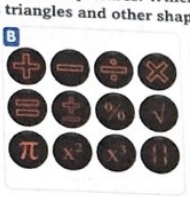
vocabulary	grammar	reading	writing	speaking	listening
fields of mathematics	direct & indirect speech; prepositions of time, & gerunds	an introduction to math	a biography	a conversation about geometry rules	a conversa about mat

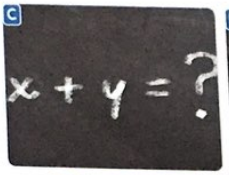
learning objective: can talk about fields of mathematics

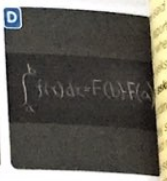
vocabulary

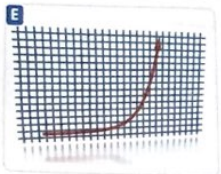
1 Discuss in pairs. Look at the pictures. Which show different fields of mathematics? Which field studies triangles and other shapes?

A 

B 

C 

D 

E 

F 

G 

H 

2 Match the pictures and the words.

1 trigonometry	F	2 calculator	A	3 arithmetic	B	4 prove	H
5 patterns	G	6 curve	E	7 algebra	C	8 calculus	D

3 Listen and check your answers. Then listen and repeat.

listening

4 Listen to a conversation between a math student and his father. What is the student's favorite field of math? Circle.

a algebra b geometry
c trigonometry d calculus

5 Listen again and write T (true) or F (false).

a Algebra is the study of slopes and curves. F
b The student uses his calculator to do arithmetic. T
c Trigonometry is part of calculus. F
d Conjecture is a field of math. F
e Math tries to prove theories.
f Galileo said that math is a language.

6 Listen again and check your answers.

grammar direct and indirect speech

...direct speech when we repeat ...y's words directly (exactly as they ...e put their words in quotation marks: ...said, "I love books."

...rect (also called reported speech) ...e report what someone has said ...porting words like *said* followed by ...don't use quotation marks:

...**that she** *loved books*

...rt a question, we use *asked* followed by ...ether:

...ks: "*Do they like math?*"

...**ked if/whether** *they liked math*

...irect speech, we usually change the pronouns. ...said, "*We like math.*" → *They said that* **they** ...math. (*we* usually changes to *they*)

...ked, "*I like geometry.*" → *He said that* **he** *liked* ...metry. (*I* often changes to *he/she*)

...also change the verb tense because reported ...ech is usually in the past:

direct speech	indirect speech
...esent simple	past simple
...esent continuous	past conitnuous

...said, "*I love math.*" → *She* **said that** *she* ...d math.

...said, "*I'm buying a new calculator.*" → *He* **said** ...t he **was buying** *a new calculator.*

...**Listen and repeat.**

...The professor said, "Math is a language."
...The professor **said that** math **was** a language.

...m said, "I see her over there."
...**said that** ...

practice

8 Rewrite the direct speech as indirect speech.

a She said, "We are buying more bread."
She said that they were buying more bread.
b They said, "We are going out tonight."
c She screamed, "There's a fly in my soup!"
d She said, "I am happy."
e He said, "I like helping my brother."
f The man said, "Arithmetic is easy!"
g The children asked, "May we have ice cream?"

9 Work in groups of three. Take turns to ask and answer questions, and to report your partners' answers. Use indirect speech and the questions below.

What are you doing?
How do you feel right now?
What do you see in the classroom?
What do you want to do when you finish your studies?
What is your favorite field of math?
What do you like to do on the weekend?

A: What are you doing, Saad?
B: *I am practicing my English.*
C: Saad said that he was practicing his English.

checkpoint

learning objective: can talk about fields of mathematics

led

12.2 mathematics

learning objective: can talk and write about the history of mathematics

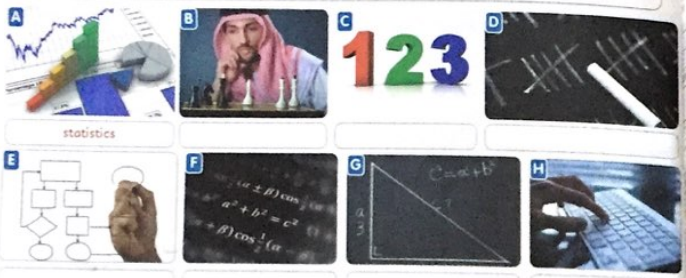
vocabulary

1 Discuss in pairs. Look at the pictures. Which show the Pythagorean theorem and its proof?

2 Listen and label the pictures.

B C F G H D A E

game theory | numeracy | theorem | proof | database | tally | ~~statistics~~ | axiomatic systems



3 Listen again and repeat the words.

reading

4 Before you read, look at the title. Who do you think is mentioned in the article? Tick.

a Shakespeare ☐ b Euclid ✓
c Galileo Galilei ✓ d David Hilbert ☐

5 Read the article. Did you tick the correct names?

The History of Mathematics

Numeracy pre-dates writing. This means that humans were counting things long before they were writing about them. For example, prehistoric people made tallies on bones.

Around 5,000 years ago, the Egyptians and Babylonians began using arithmetic, algebra, and geometry. Between 600 and 300 BCE, the Ancient Greeks began their own study of mathematics. Euclid's *Elements* is an important work from this period. During the 9th and 10th centuries, there were many more mathematical discoveries in the Arabic world.

Modern science began in the 17th century. Galileo Galilei (1564–1642) and Johannes Kepler (1571–1630) introduced new ideas about mathematics and how the world works. For example, they believed in heliocentrism: the idea that the Earth moves around the sun.

In the 1800s and early 1900s, Giuseppe Peano (1858–1932) and David Hilbert (1862–1943) did important work on axiomatic systems. And in the 20th century, the fields of game theory and modern statistics developed.

Mathematicians are still making mathematical discoveries today. More than 75,000 papers and books are added to the Mathematical Reviews database every year. Most of these works contain new mathematical theorems and their proofs.

6 Read again and complete the sentences.

a Arithmetic, algebra, and geometry were first used about 5,000 years ago.
b *Elements* was written by EUCLID'S
c Galileo Galilei was born in 1564
d Before the theory of _____, people believed that the sun moved around the Earth.
e David Hilbert and _____ worked on axiomatic systems.

grammar — prepositions of time

prepositions of time to say when something is happened or will happen.

	used for
	days of the week / the weekend
	months / seasons / year / centuries / time of day / period of time
	night / an exact time
	from a particular time in the past until a later time or now
	an amount of time
	back in the past
	a time earlier than another time or now
	until a particular time / before the hour when telling the time
	after the hour when telling the time
	used to show the time when something starts
	up to a particular time
	not later than

Listen and repeat.

was born **on** a Monday **at** ten **past** eleven **in** the month of May.
She doesn't sleep well **at** night **since** she started drinking coffee.
Three days **ago**, **on** the 14th June, they walked **for** five hours.

practice

Complete the sentences with the correct preposition of time.

1 I go swimming on Mondays and Fridays.
2 He is away from March 25th to April 2nd.
3 I haven't seen her since her birthday last year.
4 Water the plant until you see water coming out the bottom of the pot.
5 The lecture starts at 2 pm. It's ten from two already. You're late!
6 He got home before I did, so he made dinner.
7 Many years ago, when he was still a child, he lived in Jeddah.
8 She lived in Medina for 12 years: from 2000 to 2012.

writing

9 Read the paragraph about John Nash.

John Nash

means.
Nobel Prize /na
awarded each y
outstanding achi

John Nash was an American mathematician. He was born on June 13, 1928 in West Virginia. He graduated in 1948 with two degrees in mathematics. He studied and worked at Princeton University for many years and made important contributions to game theory. He shared the Nobel Memorial Prize in Economic Sciences with two other scientists in 1994. John Nash died on May 23rd, 2015.

10 Research a famous mathematician. Then write a paragraph about his/her life. Include the information below.

- When was he/she born?
- Where is he/she from?
- Where did he/she work?
- Why is he/she famous?
- Did he/she win any awards?
- Is he/she still alive? When did he/she die?

checkpoint

learning objective: can talk and write about the history of mathematics

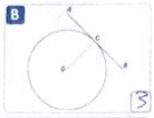
12.3 mathematics

learning objective: can talk about circle geometry

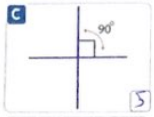
vocabulary

1 170 **Read the definitions below and number the pictures. Then listen and check your answers.**

compass



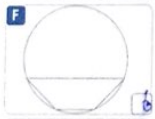
tangent



perpendicular bisector

protractor

set square



cyclic quadrilateral

1 used for measuring angles
2 used for drawing circles
3 a straight line that touches a curve without crossing it
4 used for drawing right angles
5 a line that meets another line at right angles, dividing it into two equal parts
6 a four-sided shape in a circle with each vertex touching the circumference

2 170 **Listen and repeat the words.**

3 **Work in pairs. What is a vertex? Read the sentences and write your own definition.**

a A square has four vertices.
b Every triangle has three vertices.

grammar gerunds

- Gerunds are formed by adding *-ing* to the end of a verb. They look like present participles, but they act like nouns. This means that they are often the subject or the object of a sentence.
  My family and I travel every year. We love ***traveling***
  I stopped ***talking*** *because the lecturer came into the classroom.*
- Note the difference between the gerund and the present participle:
  I ***am learning*** *about circle geometry.*
  (*Learning* is a present participle. It follows the verb *to be*.)
  I enjoy ***learning*** *about circle geometry.*
  (*Learning* is a gerund.)

4 170 **Listen and repeat.**

a I enjoy **reading**
b **Flying** is something I would love to do.
c **Climbing** a mountain takes a lot of energy.

practice

5 **Is the underlined word a gerund (G) or a present participle (PP)? Circle.**

a Thinking is something that plants can't do. G PP
b I really enjoy eating. G PP
c I am playing cricket this afternoon. G PP
d You have been working really hard recently. G PP
e Attending Professor Al-Qasabi's lectures is really interesting. G PP
f Watching TV isn't a good way to get fit. G PP

learning

Listen to a conversation between two students. What class are they going to?

b geometry
d calculus

7 170 **Listen again and write T (true) or F (false).**

a The students know exactly what they need for class.
b The one student is taking a compass, protractor, and calculator to class.
c The students don't enjoy circle geometry.
d If you remember the rules, circle geometry makes a lot of sense.
e If one angle of a cyclic quadrilateral equals 80 degrees, then the opposite angle equals 100 degrees.
f The angle between the tangent and the radius of a circle is 90 degrees.
g The one student forgets the definition of "perpendicular".
h A circle's diameter is a chord.

speaking

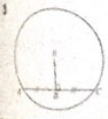
170 **Listen again to the conversation. Focus on the geometry rules.**

Look at the diagrams and complete the rules.

perpendicular ~~opposite~~ chord degrees tangent circle line

1 
The opposite angles of a cyclical quadrilateral add up to 180 degrees.

2 
The tangent to a circle is perpendicular to the radius at the point of contact.

3 
The perpendicular from the center of a circle to a chord, bisects the chord.

4 
A chord is any line that joins two points on a curve.

10 **Work in pairs. Compare your answers with a partner and make sure you understand the rules.**

checkpoint

learning objective: can talk about circle geometry

review units 10–12

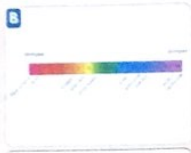
vocabulary

1 Label the pictures.

Algebra compass battery chromosome equation atom pH scale disinfectant

A 

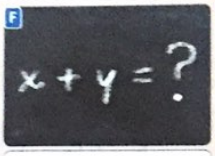
battery

B 

C 

D 

E 

F 

G 

H 

2 Listen and check your answers.

3 Circle the correct word.

a *Attract / Repel* means to make something move closer to another thing.

b A *cation / anion* is a negatively charged ion.

c A *product / reactant* is the result of a chemical reaction.

d The *cytoplasm / lipid layer* is all the contents of a cell except for its nucleus.

e *Carbohydrates / Proteins* are molecules made of carbon, hydrogen, oxygen, and nitrogen that are a basic nutrient.

f *Arithmetic / Calculus* is the branch of mathematics that studies changing values.

g A *proof / tally* is a set of logical steps that shows a mathematical statement is true.

h A *tangent / perpendicular bisector* is a straight line that touches a curve or circle at only one point.

grammar

4 Complete the sentences with the words below.

will don't might ~~want~~ needs take

a I ___want___ to go on holiday, but I need to work.

b She _____ be able to come tomorrow, but she has to check her schedule.

c He _____ definitely help us with our project. I asked him yesterday.

d We _____ want to eat anymore! We're full!

e She _____ to study tonight. She has an important exam tomorrow.

f They may _____ chemistry next semester, but they're still deciding on their courses.

...e sentences and decide if they are ...ve (P) or active (A) voice.

...s are used in the experiment. P

...ach chromosomes in biology.

...and bases are measured using pH.

...usually meet at 11 am.

...ecture is given on Thursdays.

...project is funded by the government.

...lete the chart with the comparatives ...perlatives.

...tive	comparative	superlative
...od	better	the best
...ad		
...ealthy		
...nteresting		

...e the correct answer.

...ould (a shorter thing) / *the shortest* me.

...class is *more interesting / the most interesting* at ...university.

...biology *easier than / the easiest* chemistry.

...is *bigger than / the biggest* city in Saudi Arabia?

...e *is better than / the best* student in our class.

...e the sentences in order.

...warm glass she a apple of juice

She wants a glass of apple juice.

...xperiment magnesium of need we 25 g the for

...ugar of take I spoon my one in coffee

...ould like you would some ?

...rcle and correct the mistakes. There is ...e mistake in each sentence.

...have study biology. I really want to learn about ...botany. *studying*

...We always compare notes in Thursdays at noon.

...There are many mitochondrion in this cell.

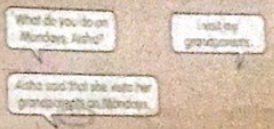
...learn about enzymes is very interesting. I can't wait ...to find out more.

...We worked since three hours before the library ...closed.

speaking

10 Work in groups of three. Take turns to ask and answer questions, and to report your partners' answers. Use indirect speech and the questions below.

- ...What do you do on Mondays?
- ...What is something you love doing?
- ...What do you like for breakfast?
- ...Who is the smartest student in our class?
- ...What is your favorite field of science?



writing

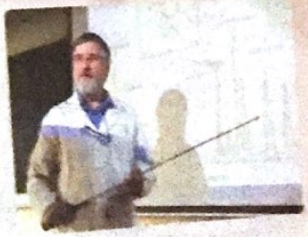
11 Think of a recent lecture you attended. Write a paragraph describing what you learned. Use the phrases below.

...had a ...ecture on ...

...we learned about ...

...The professor said, exclaimed that ...

...The most interesting / difficult thing we discussed ...was ...



- ياصديقي نحن أقوى من أن نستسلم
في منتصف طريق قطعناه لنيل
مرادنا

لاتنسين اذكارك وتوكلي على
الله واجتهدي وسوي كل شي
تقدرين عليه ولو النتيجه
ماترضيك ....الله مايضيع لك تعب

ودعواتكم لي ولكم بالمثل 💞