EDEXCEL INTERNATIONAL GCSE (9–1)

SCIENCE DOUBLE AWARD

Student Book

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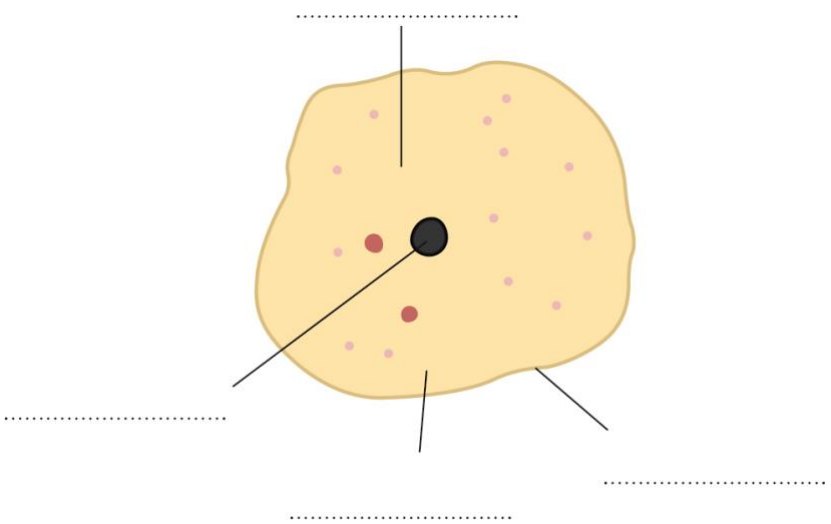
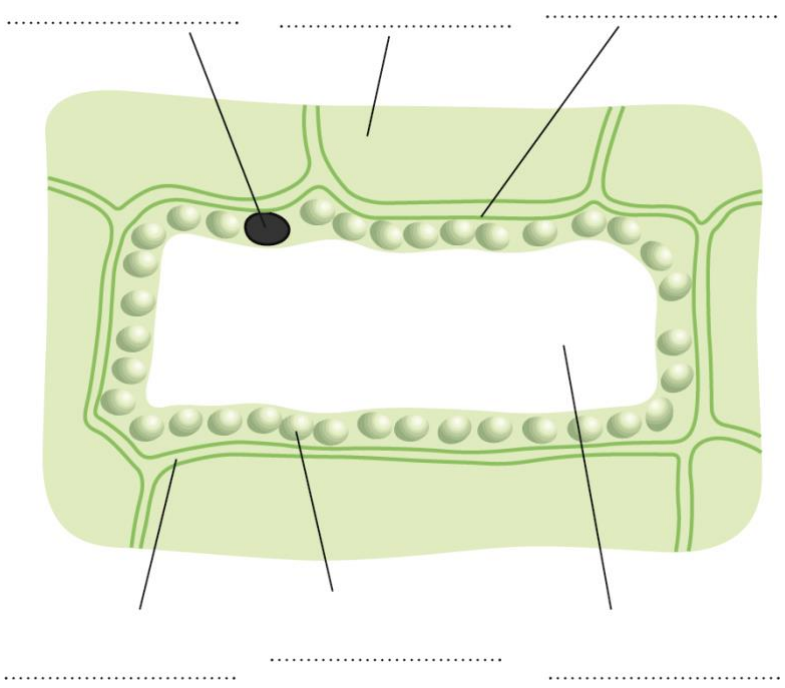
Pearson

TEACHER RESOURCE PACK

Chapter 1: Life Processes

1. The diagrams show an animal and a plant cell.





(a) Label the structures shown on the diagrams.

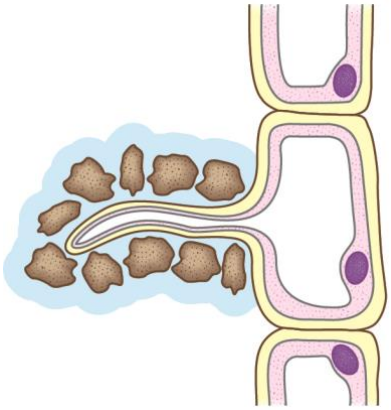
(b) Complete the table below to indicate whether the structures are present or absent.

Structure	Animal cell	Plant cell
cell membrane		
cellulose cell wall		
mitochondria		
cytoplasm		
vacuole		
nucleus		
chloroplast		
ribosome		

(c) Complete the table listing the functions of different organelles.

Organelle	Function
cell wall	
cell membrane	
cytoplasm	
	contains genetic material
	protein synthesis
	aerobic respiration
chloroplast	
large vacuole	

2. Identify each of these specialised cell types and suggest how they are adapted for their function.



Name of cell: .....

Adaptations .....
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Name of cell: .....

Adaptations .....
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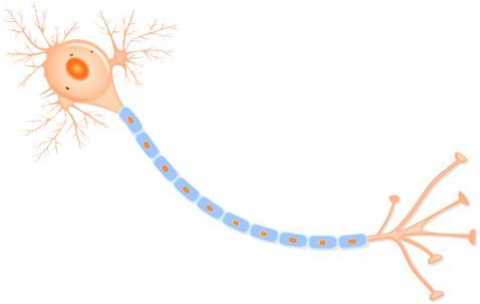

Name of cell: .....

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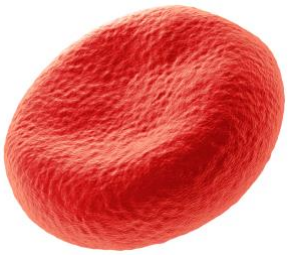

Name of cell: .....

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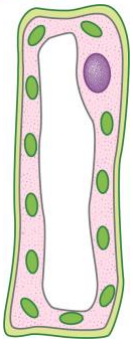

Name of cell: .....

Adaptations .....
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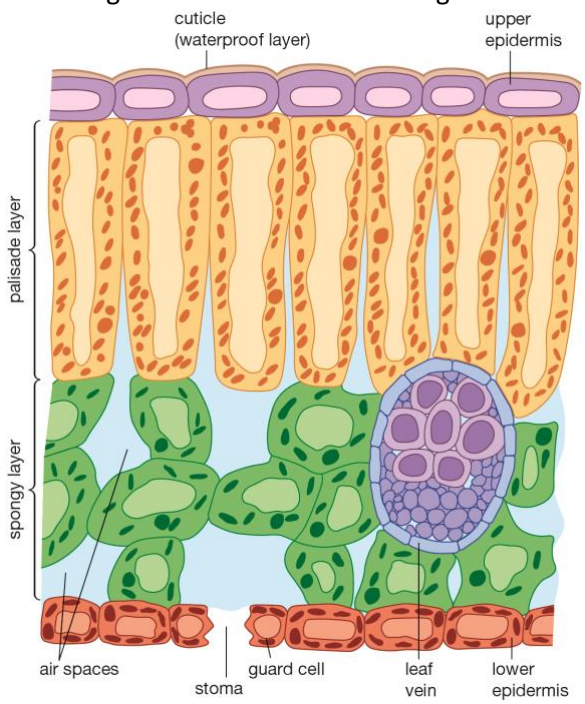
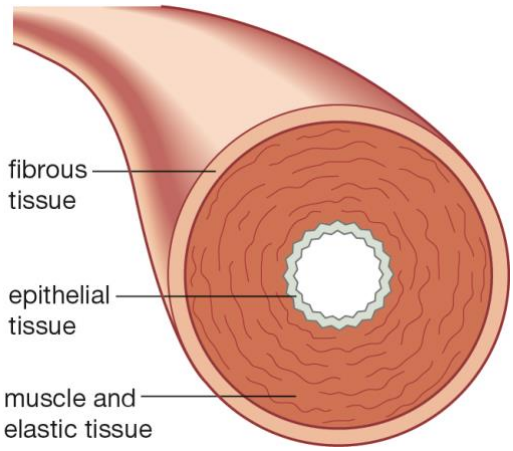
3. The diagram shows a section through a leaf and an artery.



Leaf cross section



Artery cross section

(a) Define the terms tissue, organ and system.

tissue ……

organ ……

system ……

(b) Explain whether a leaf is a tissue, organ or system.

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4. Read the passage below:

In 2014, at the age of 14, Hannah had a horse riding accident resulting in a broken spine and damaged spinal cord. She has been left unable to walk and has lost all the feeling in her legs. Her mobility is now very restricted and she must rely on a wheelchair, needing support and care from her family. There is currently no cure for people with severe spinal cord damage.

Most body tissues can heal themselves when damaged, but nervous tissue cannot as nerve cells lose the ability to divide soon after birth. Scientists are trying to develop a technique that could offer hope to many people like Hannah. They think that embryonic stem cells taken from very early human embryos could be turned into nerve cells and used to heal damaged spinal cords and enable people to walk again. The embryos used are spare ones from fertility treatments that would otherwise be allowed to perish.

It is difficult to make sure that these cells only make nerve cells and there is a danger that they could turn into cancer cells. The research is expensive and, so far, has had limited success in animal trials.

(a) Explain what stem cells are:

……

……

(b) Use the information in the passage and your own knowledge to evaluate the use of embryonic stem cells by completing the table.

Benefits	Drawbacks
My Conclusion:	

(c) Some types of stem cells, such as heart stem cells, can be taken from adults. These stem cells can still divide but are already specialised.

Explain why these cells may be better to use than embryonic stem cells.

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……

5. Complete the sentences about the properties of enzymes using the words in the box.

denatured	catalysts	two	chemical reactions	pH
active site	optimum	seven	shape	specific

Enzymes are biological _____. They speed up _____ without being changed themselves. A substrate binds to a region of the enzyme called the _____ _____. Usually only one substrate will fit so enzymes are highly _____. All enzymes have a temperature at which they work fastest, this is called the _____ temperature. If the temperature becomes too hot, they stop working because they have _____. This means that the _____ of the enzyme has changed and the substrate no longer fits. Enzymes also work best at a particular _____. An enzyme such as pepsin that works in the stomach works best at a pH of approximately _____. An enzyme such as salivary amylase that is found in the mouth works best at a pH of approximately _____.

6. A student carried out an experiment into the effect of temperature on the time taken to digest starch. The results are shown in the table.

Temperature / °C	Time taken for starch to be completely digested / s			
	1	2	3	mean
0	200	220	180	
10	140	140	120	
20	100	120	120	
30	60	80	80	
40	40	60	40	
50	100	120	100	
60	280	260	60	

The student thought that one of the results was an anomaly.

(a) State what is meant by an anomalous result and identify the anomalous result in the table.

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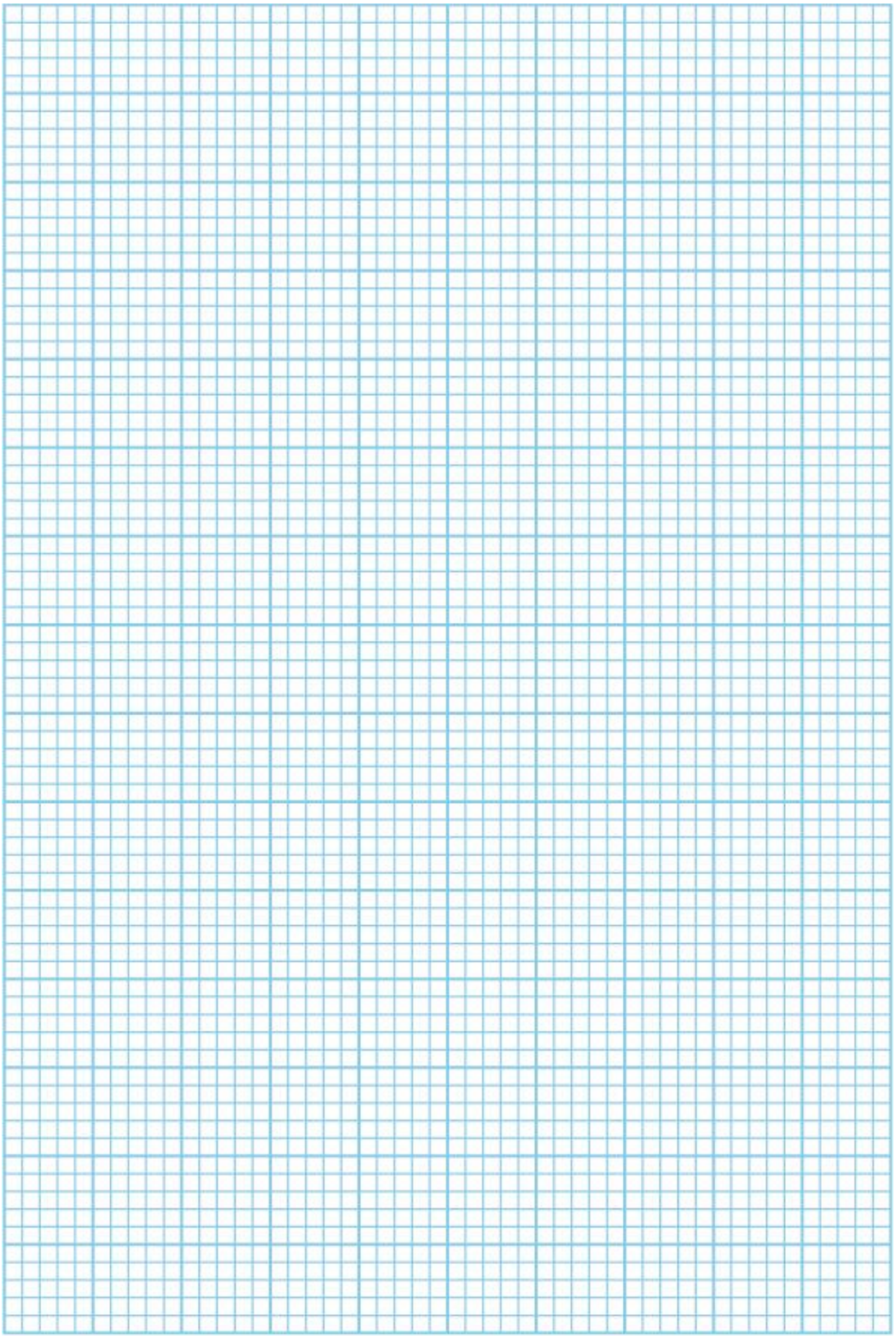
(b) Calculate the mean times taken for the starch to be completely digested and write them in the table. Do not include the anomalous result.

(c) Plot a graph to show the effect of temperature on the mean time taken to completely digest the starch.



(d) Describe the effect of temperature on the mean time taken to digest the starch.

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(e) Explain the effect of temperature on the mean time taken to digest the starch.

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The student tested samples of the starch and amylase mixture for the presence of starch every 20 s until no more starch was present.

Suggest how the student could have tested for the presence or absence of starch.

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(f) Suggest why the times calculated by the student may not be accurate.

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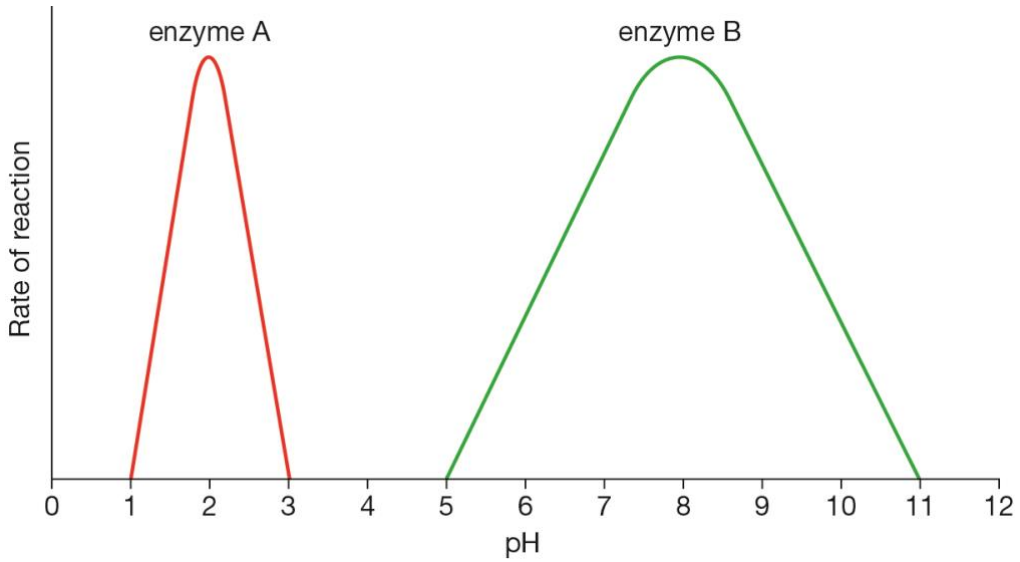
7. The graph shows the effect of pH on two protease enzymes, pepsin that is made by the stomach and trypsin that is made by the pancreas.



(a) State the optimal pH for enzyme A and enzyme B.

Enzyme A .....
Enzyme B .....

(b) Identify each of the enzymes:

Enzyme A: .....
Enzyme B: .....

(c) Biological washing powders often contain protease enzymes.
Devise an experiment to test the effect of pH on the activity of biological washing powder.

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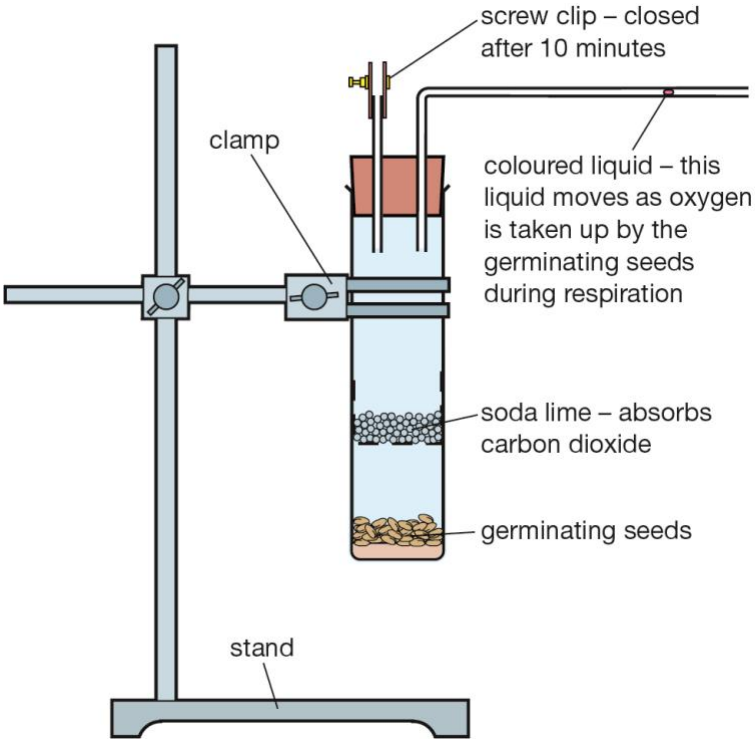
8. An experiment was carried out into the effect of temperature on the respiration rate of germinating seeds. The apparatus used is showed in the diagram.



(a) Write down the balanced chemical equation for aerobic respiration below:

_____ + _____ → _____+ _____

(b)(i) Explain why the coloured liquid moves towards the seeds as oxygen is taken up.

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(ii) Suggest the function of the screw clip.

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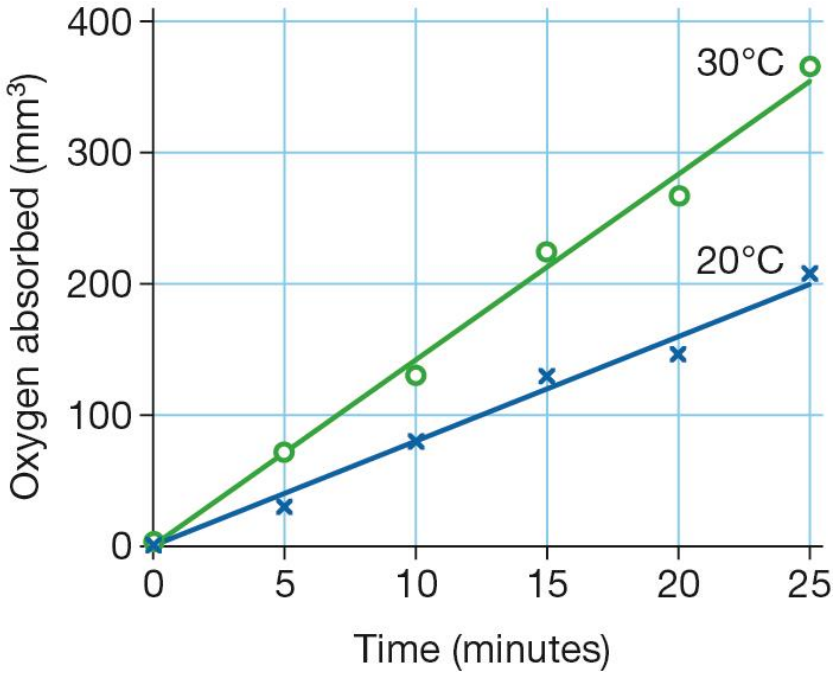
The volume of oxygen absorbed was measured every 5 minutes for 25 minutes at a temperature of 20°C. This was then repeated at 30°C.

The results are shown on the graph.



(c)(i) Calculate the slope of the lines of best fit at 20°C and 30°C to determine the mean rates of respiration. Show your working.

Mean rate of respiration at 20°C = …… mm^3 oxygen / min

Mean rate of respiration at 30°C = …… mm3 oxygen / min

(ii) Explain the effect of temperature on the mean rate of respiration.

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(iii) Suggest how the reliability of the experiment could be improved.

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(iv) Suggest a suitable control experiment.

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(v) Explain whether the graphs suggest if the seeds were beginning to respire anaerobically at the end of the experiment.

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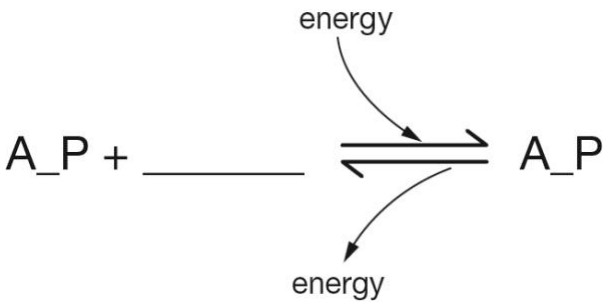
9.(a) Complete the following equation for ATP synthesis and breakdown.



(b) The ATP concentration in muscles and the respiration rate of an athlete were measured before and during exercise.

The results are shown in the table below.

Exercise	ATP concentration / mg per dm^3	respiration rate / cm^3 oxygen per hour
before exercise	0.4	0.6
during exercise	0.38	1.8

Comment on the results explaining the effect of exercise on ATP concentration.

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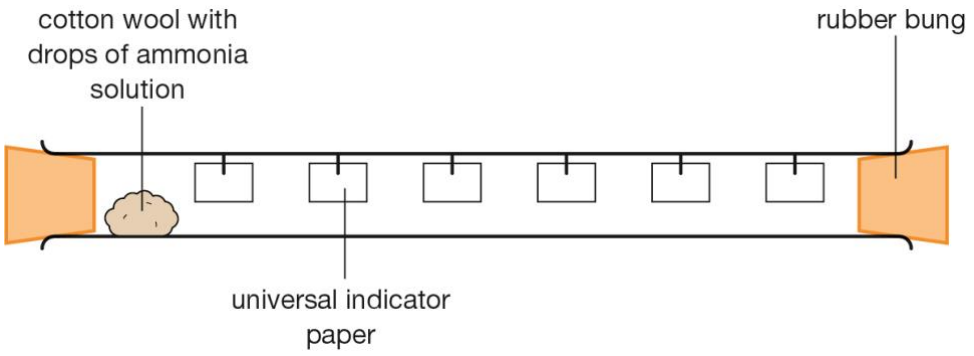
10. An experiment was carried out into the effect of temperature on the rate of diffusion of ammonia along a glass tube.

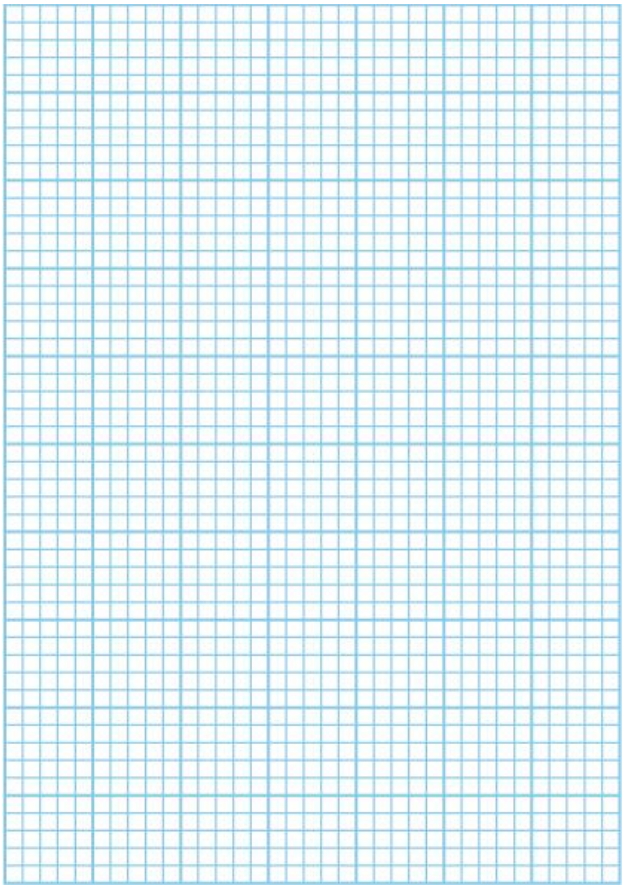
Pieces of universal indicator paper were placed at 5 cm intervals along the tube.
A piece of cotton wool with drops of ammonia was placed in one end of the tube and the times taken for each piece to change colour recorded.
The experiment was carried out at 15°C and 25°C.
The apparatus is shown in the diagram.



The results are shown in the table below.

temperature / °C	Time taken for universal indicator paper to change colour / s					
	5 cm	10 cm	15 cm	20 cm	25 cm	30 cm
15	12	25	36	47	60	71
25	7	13	21	29	36	43

(a) Plot a line graph to show the effect of temperature on the time taken for the ammonia to diffuse along the glass tubes. Join the points with straight lines.



(b) Explain the effect of temperature on the time taken for the universal indicator paper to change colour.

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(c) Explain one factor that would need to be controlled.

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11.(a)(i) Define the terms diffusion and active transport.

diffusion ……

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active transport ……

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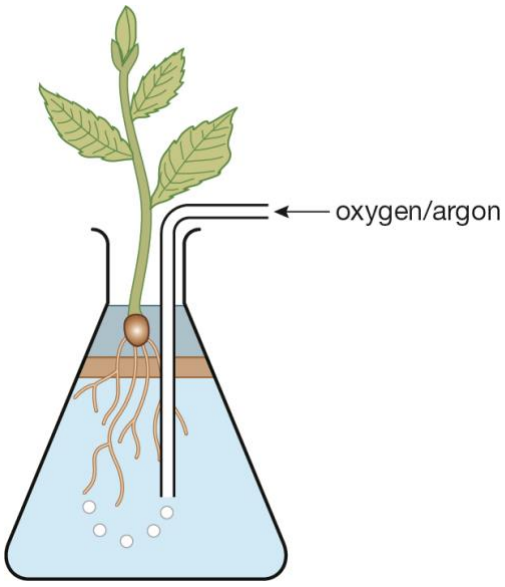
(ii) Complete the table, by writing yes or no, to make a comparison of diffusion and active transport.

Feature	diffusion	active transport
particles move down a concentration gradient		
particles move against a concentration gradient		
always requires living cells		
always requires membrane proteins		
requires ATP		

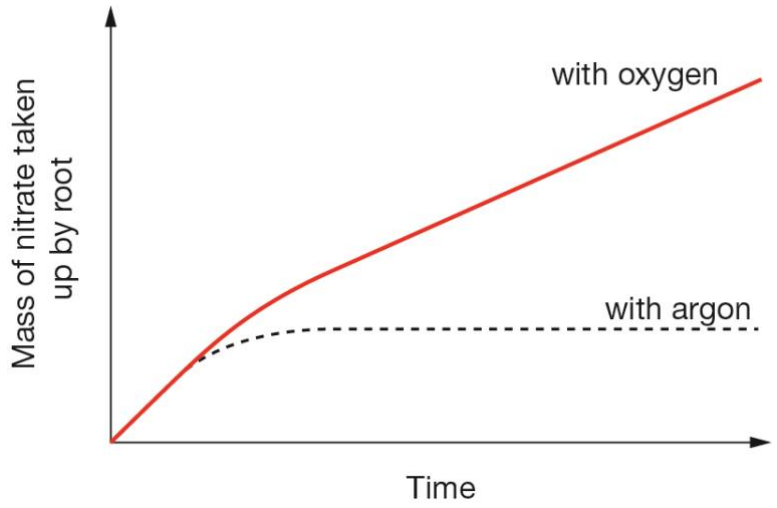
(b) The effect of oxygen on the uptake of radioactive nitrate ions by a plant root was investigated. Two barley seedlings were each placed into solutions of radioactively labelled nitrate ions as shown in the diagram.



Oxygen was bubbled through the solution of one plant. Argon was bubbled through the solution of the second plant (this ensures that the oxygen levels in the water are very low).

The mass of radioactive nitrate taken up by the root was measured over time for both plants.

The results are shown in the diagram.



(i) Compare and contrast the changes in mass of nitrate taken up by the root over time with oxygen with the changes in mass of nitrate taken up the root over time with argon.

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(ii) Explain whether the nitrate ions are taken up by the root by diffusion, active transport or both processes. Justify your answer.

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(c) Use your knowledge of active transport to explain the following:

(i) Why waterlogged soils cause poor crop growth.

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(ii) Why ploughing and aerating fields improves crop growth.

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Chapter 7: Ionic compounds

Ions and ionic bonding

1. Use the words in the box to complete the gaps below. Use each word only once.

Missing words: anion, cation, charge, decreases, electrons, ion, ionic, metal, negative, non-metals, oppositely, outer, positive

Ionic compounds usually contain a _____ and a non-metal. An _____is an element or compound that has lost or gained _____. Metals lose electrons to form _____ ions. Non-metals form negative ions by _____ electrons. The charge of the metals and non-metals change because electrons have a _____ charge. If electrons are gained the overall negative _____increases. If electrons are lost the negative overall charge_____. A positively ion is known as a _____ and a negative ion is known as an _____. To form an _____ bond, electrons move from a metal atom to the non-metal atom. This produces a positive and a negative ion. The _____ charged ions then attract each other. Electrons are transferred from the metals to the _____ to complete the non-metals atom's _____ electron shell.

The structure of ionic compounds

2. Draw dot and cross diagrams for the following compounds:
   a. Aluminium oxide (Al_2O_3)

   b. Iron chloride ($FeCl_2$)

   c. Potassium nitrate (KNO_3)

3. Add the symbols for the ions formed by the following elements and compounds.

Element/compound	Ion formed	Element/compound	Ion formed
Calcium		Iodine	
Barium		Silver	
Aluminium		Ammonium	
Beryllium		Sulfate	
Phosphorous		Nitrate	

Ionic compounds

4. Give the formula for the following ionic compounds.
   a. Aluminium hydroxide
   b. Barium sulfate
   c. Ammonium chloride
   d. Calcium carbonate
   e. Copper(II) chloride
   f. Lead(II) nitrate

Properties of ionic compounds

5. Look at the table below. Use the data to decide which of the compounds are ionic and which are not.

Compound	Melting point /^{0}C	Boiling point /^{0}C	Electrical conductivity when molten	Electrical conductivity when in aqueous solution
P	2015	2980	Good	Good
Q	-87	-67	Poor	Poor
R	300	500	Good	Insoluble
S	558	1506	Good	Good

The ionic compound(s) are: _____

Chapter 16: Work and Power

1 **a** State the equation that links work, energy and power.

b A student pulls a box of mass 5 kg with a force of 20 N through a horizontal distance of 2.5 m. Calculate the work done by the student.

c Another student transfers 60 J of energy to another box by pushing it with a force of 15 N. Calculate how far the box travels.

2 **a** A lorry is driving at a speed of 20 m/s. The engine of the lorry provides a driving force of 500 N. Calculate the work done by the lorry in 1 second.

b The driver of the lorry increases the driving force to 700 N. The engine transfer 35 kJ of energy to the lorry. How far does the lorry travel?

3 Calculate the kinetic energy of the following:

a a cyclist on his bike with a combined mass of 85 kg travelling at a speed of 4 m/s

b a runner of mass 65 kg running at a speed of 5.5 m/s

c a bullet of mass 250 g travelling at a speed of 65 m/s

4 Calculate the gravitational potential energy of the following:

a a 3 kg robot dog jumps up 0.5 m

b a lift of mass of 500 kg rises 15 m

c the Mars Rover, 15 m above the surface of Mars (gravitational field strength is 4 N/kg)

5 A ball of mass 2.5 kg rolls from the top of a hill to the bottom and falls through a height of 5 m. Calculate the ball's speed at the bottom of the hill. (g = 10 N/kg)

6 At a weightlifting competition, a weightlifter lifts a 30 kg barbell through a distance of 1.5 m.

a Calculate the weight of the barbell.

b Calculate the GPE of the barbell at the top of its motion.

c The weightlifter takes 30 seconds to lift the barbell 10 times. Calculate the total power output of the weightlifter.

Chapter 19: Natural Selection and Evolution

Textbook pages

261–267

Chapter overview

This topic covers the work of Charles Darwin, evolution, natural selection and the reasons for the increase in bacterial resistance to antibiotics.

What to expect

Specification areas covered:

3.38 explain Darwin's theory of evolution by natural selection
3.39 understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control.

Although this seems a short chapter and does not have a great deal of factual learning, the concepts are very important. Students need to have a secure knowledge and understanding of the process of natural selection in order to be able to explain exam questions that may use unfamiliar situations. Homework tasks can include research on Charles Darwin and his work, answering worksheet questions and explaining examples of the adaptations of organisms in terms of natural selection.

Teaching notes

- Students should have studied chapters 16, 17 and 18 and have a good understanding of the nature of genetic variation.
- A good starting point is to introduce Charles Darwin and his work. Darwin's observations (page 262 of textbook) could be given to students and they could then deduce the theory of natural selection.
- Evidence for evolution could be considered by students including: bringing in fossils or showing pictures of fossils (*Archaeopteryx* is a good example for students to identify both reptile and bird features) and demonstrating pictures of the peppered moth and Galapagos finches (or tortoises).
- Students could be given a range of different scenarios and asked to apply the stages of natural selection (mutation, variation, adaptations, survival, reproduction, repeat over generations, increased allele frequency).
- A range of animals and plants with different adaptations could be presented to students who then identify how they survive. This could be done by placing photographs (or plants such as cacti) around the room and students then rotate around the room explaining the adaptations of each. The value of camouflage can be tested practically (see practicals). A trip to a zoo or botanical garden would be a good experience for students.
- Antibiotic resistance can be introduced by looking through newspaper articles that describe its increase. It is possible to purchase non-pathogenic bacteria that have resistance to different antibiotics. Students could carry out research into the spread of antibiotic resistance and methods that could reduce it. A practical can be carried out by placing antibiotic discs on plates of these bacteria to identify resistance.

Possible misunderstandings

- Some students confuse alleles and genes – this should be reinforced when considering the process of natural selection.

- Some students think that organisms are mutated deliberately or change deliberately to survive better. This is best illustrated by having many different coloured blocks to start with and 'killing off' certain colours.

Differentiation

- For extension, students could research the work of Lamarck and explain how it compares to Darwin's findings. They could also research epigenetics and how it affects Darwin's work.
- Less-able students could produce posters or leaflets to describe Darwin's work and / or bacterial resistance to antibiotics. A sentence sorting exercise on the stages of natural selection would help them appreciate the order of events. Less-able students often benefit from seeing real-life examples and, if possible, trips to zoos and safari parks would be very useful – or even carrying out an Internet project on the adaptations of particular species.

Practicals

Practicals listed in the textbook

There are no practicals in this chapter.

Additional practicals

- Camouflage. Pieces of drinking straw of different colours (or dyed pasta) can be placed into a tank or box of sawdust. The same number of pieces of each colour should be used (about 20 or 30, depending on the size of the tank or box). Students should try to remove as many straws as possible in 10 seconds. This is repeated until no more straws are left. A graph can be plotted of the remaining number of straws of each colour against time. This can then be considered in terms of allele frequency.
- Bacterial resistance. Some non-pathogenic strains of bacteria can be purchased that have different antibiotic resistances. They can be grown on plates with antibiotic discs and the results demonstrated to students.

Chapter 5: Chemical formulae, equations and calculations Part 1

Alignment with Student Book: Pages 38-63

Chapter overview

This chapter introduces quantitative chemistry. Students will explore chemical formulae, including balancing equations. There will be a focus on the use of calculations including relative molecular mass and relative atomic mass. The use of experimental data will feature prominently and students will use a variety of techniques including reacting masses and the determination of formula by combustion. The different types of formula will be introduced for the first time.

What to expect

1.25 write word equations and balanced chemical equations (including state symbols):
• for reactions studied in this specification
• for unfamiliar reactions where suitable information is provided

1.26 calculate relative formula masses (including relative molecular masses) (Mr) from relative atomic masses (Ar)

1.27 know that the mole (mol) is the unit for the amount of a substance

1.28 understand how to carry out calculations involving amount of substance, relative atomic mass (Ar) and relative formula mass (Mr)

1.29 calculate reacting masses using experimental data and chemical equations

1.30 calculate percentage yield

1.31 understand how the formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water of crystallisation

1.32 know what is meant by the terms empirical formula and molecular formula

1.33 calculate empirical and molecular formulae from experimental data

1.36 practical: know how to determine the formula of a metal oxide by combustion (e.g. magnesium oxide) or by reduction (e.g. copper(II) oxide)

This chapter contains material that is much more complex. Due to the quantitative nature of much of the content students will need to have relatively strong mathematical skills.

Balancing equations should not be new to students and so will not need much time. However, teaching how to calculate relative atomic mass and relative formula mass will need ample time set aside. The mole has been a regularly identified topic which students either do not fully understand or find very boring. Though the use of the mole in this chapter is limited, it cannot be emphasised strongly enough how important it is for students to fully comprehend what the mole is and how it is used. As much practice should be given as possible, either in class or for homework, using the different equations and calculations.

As there is so much practical work, lesson time must be considered so as not to rush the calculation aspect of the investigation.

Teaching notes

Starter Activities

Elements and compounds states game - Students must write three lists. One for each of the three states of matter and list as many elements or compounds they can name that occur in each state at room temperature.

The mole demonstration - Weigh out 1 mole of a variety of different elements to reinforce that although the substances have different masses they have the same number of particles inside (Carbon 12g, water 16g, Magnesium 24g, copper(II) carbonate 124g). Ask students if they recognise the numbers for the elements from anywhere? Are they on the periodic table? The mass of 1 mole is equal to the relative atomic mass.

Main activities/practical work

Balancing equations practice - Give students a variety of unbalanced equations. This can be differentiated very easily with some students given more complex examples.

The change in mass when magnesium burns demonstration or practical - Students weigh some magnesium ribbon then burn it in air. They reweigh the new compound formed and use the result to determine the formula of magnesium oxide. See activity three on page 48 of the textbook.

Determining relative atomic mass practical - Students measure the volume of hydrogen gas produced when magnesium ribbon reacts with hydrochloric acid to determine the relative atomic mass of magnesium.

Finding the formula of hydrated copper(II) sulfate practical - Students weigh some hydrated copper(II) sulfate and then heat it to remove the water. They reweigh the copper(II) sulfate to find the water of crystallisation. Mole calculations are then used to find the formula. See page 53 of the textbook.

Finding the formula of copper oxide using methane practical or demonstration - Copper(II) oxide is reduced using methane gas which is passed over the oxide as it is heated. This is a complicated practical and so may be better as a demonstration with some students. By weighing the Copper(II) oxide and then the copper produced the formula of copper(II) oxide can be calculated. See activity 4 on page 49 of the textbook.

Determining the formula of water demonstration- See page 51 of the textbook.

Homework

The questions in the book on page 60-63 provide enough challenge to be set for a number of homework sessions. The homework sheet in the TRP offers additional questions.

Possible misunderstandings

As students may struggle with the concept of the mole, try to use the analogy of a dozen. A dozen apples and a dozen bananas do not have the same mass but there is the same number of each fruit. Students may confuse the different formulae they need to use so care must be taken to ensure they know when to use each.

When completing practical work remind students to weigh their reactants and their products as they often forget to weigh the reactants which then prevents any kind of analysis.

Highlight anything that students might find difficult to understand in the chapter in more detail. Provide clarity on the issues. Suggest ways in which teachers can explain or demonstrate the content so that it is most clear.

Differentiation

Students may be given a fourth list for the start game to include substances in solution (aq).

There is extension work on page 46 of the textbook on the Avogadro constant.

The use of formula triangles can be used to help support students. It is very easy for students to get lost as they progress through worked examples. Frequent learning checks are necessary.

Practicals

The change in mass when magnesium burns demonstration or practical. Details may be found here:

http://www.rsc.org/learn-chemistry/resource/res00000718/the-change-in-mass-when-magnesium-burns

Determining relative atomic mass practical - Details may be found here:

http://www.rsc.org/learn-chemistry/resource/res00000401/determination-of-relative-atomic-mass?cmpid=CMP00006706

Finding the formula of hydrated copper(II) sulfate practical- Details may be found here:

http://www.rsc.org/learn-chemistry/resource/res00000436/finding-the-formula-of-hydrated-copper-ii-sulfate

Finding the formula of copper oxide using methane practical or demonstration- Details may be found here:

http://www.rsc.org/learn-chemistry/resource/res00000727/finding-the-formula-of-copper-ii-oxide

Chapter 13: Sound

Alignment with Student Book: pages 123-129

Chapter overview

This chapter focuses on sound.

This chapter follows on from Chapter 12 and contains two required practicals for those students studying physics only.

What to expect:

3.24P know that the frequency range for human hearing is 20–20 000 Hz

3.25P practical: investigate the speed of sound in air

3.26P understand how an oscilloscope and microphone can be used to display a sound wave

3.27P practical: investigate the frequency of a sound wave using an oscilloscope

3.28P understand how the pitch of a sound relates to the frequency of vibration of the source

3.29P understand how the loudness of a sound relates to the amplitude of vibration of the source

Students will cope well with the contents of this chapter. They will be required to use basic maths skills to calculate the speed of sound and will learn a variety of practical skills in relation to taking accurate measurements and reducing errors. Students will need to understand the scales on the CRO display and this will need to be detailed clearly as they may not have encountered this before.

Calculations are mathematically basic and students should find these relatively straightforward. Practise with recognising that echoes are double the distance would be of benefit.

Teaching notes

Start activities

Hearing test: Ask all students to stand up. Using a signal generator, start at the lowest range of human hearing, approximately 20 Hz. Increase the frequency of sound until it reaches the top range of hearing. Ask students to sit down as they can no longer hear the noise. Students enjoy learning their range. This can lead to a discussion about security systems designed to deter young people, and how and why hearing deteriorates over time.

Animal sounds: Give students a grid with different animals on. Play sound bites of different animals and students have to match the sound to the animals.

Guess that sound: Find sound clips of a variety of everyday noises that have either been distorted or magnified. Students must try to guess the noise.

Main activities

Speed of sound practical: Students calculate the speed of sound by listening to the echo created by either clapping their hands or clapping two wooden blocks together. Students will stand 50 m away from a wall and clap their hands or the blocks twenty times. A second student starts the stopwatch on the sound of the first echo and then stops the stopwatch on the twentieth echo. Students then use speed = distance/time to calculate the speed of sound in air.

CRO and signal generator demonstration: Show students the scaling on the CRO, giving them an empty CRO grid to label. Ask a student to speak or sing into a microphone attached to the CRO. Ask students what they notice about the CRO display (transverse wave form), why might this be confusing? Using the signal generator, demonstrate the changes in amplitude and frequency and the impact this has on the sound.

CRO calculations: Supply students with a sheet of CRO display screens. Give students the timebase and Y gain settings. List example time periods on the board. Ask students to sketch these on the CRO screens. Students can then calculate the frequency of the waves. Students should then research which musical notes these frequencies correlate to.

Differentiation

Extension: Students can investigate the range of hearing in animals. Which species has the largest range of hearing? Why is it more important in some species than others? How do dolphins and whales use sound to navigate?

Homework

Questions on page 129 are suitable for homework, or the worksheet.

Research task: Research how sound can be used to detect damage to structures in industry or how sound can be used in imaging.

Possible misunderstandings

Students often get confused that sound waves are longitudinal. This is because the CRO displays a transverse wave. It needs to be explained clearly to students that the microphone converts the longitudinal wave into an electrical signal that is then displayed by the CRO as a transverse signal in order to be able to read information about the wave.

MCQs UNIT 2

1. In which one of the following structures does gas exchange occur?

A alveolus
B bronchiole
C bronchus
D trachea

2. Which of the following occurs in the thorax during inhalation?

A volume decreases and pressure decreases

B volume decreases and pressure increases

C volume increases and pressure decreases

D volume increases and pressure increases

3. Which of the following will occur when blowing exhaled air through hydrogen carbonate indicator?

A indicator turns red due to increased carbon dioxide gas
B indicator turns red due to decreased oxygen gas
C indicator turns yellow due to increased carbon dioxide gas
D indicator turns yellow due to decreased oxygen gas

4. Some consequences of cigarette smoking are listed below.

1. reduced oxygen transport in the blood

2. babies with smaller birth mass

3. lung cancer

Which of these consequences could be caused by carbon monoxide gas?

A 1 and 2

B 1 and 3

C 2 and 3

D 3 alone

5. A student carried out food tests on a meal. The results are shown in the table.

test solution	final colour
iodine solution	black
Benedict's solution	blue
biuret solution	lilac

Which substances were present in the food?

A glucose and protein

B glucose and starch

C protein and starch

D protein and glucose

6. Which of these conditions is caused by a deficiency of vitamin C in the diet?

A night blindness
B obesity
C rickets
D scurvy

7. Below are some statements about digestion.

1. protein is digested in the duodenum

2. protein is digested in the stomach

3. protein is digested in the mouth

Which of the statements are correct?

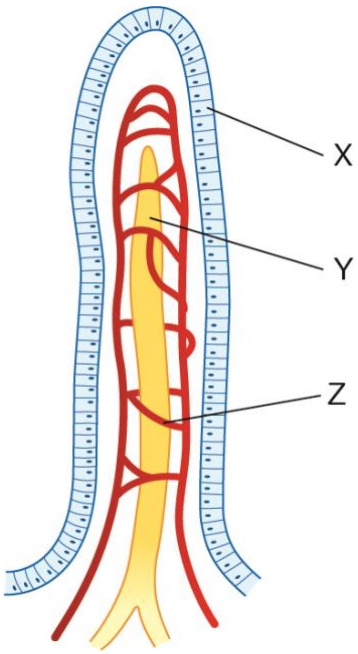
A 1 and 2

B 1 and 3

C 2 and 3

D 1, 2 and 3

8. The diagram shows a villus.



Which line gives the correct names of the structures X, Y and Z?

	X	Y	Z
A	capillary	microvilli	lacteal
B	lacteal	capillary	microvilli
C	microvilli	lacteal	capillary
D	microvilli	capillary	lacteal

9. Which of the following states the correct order of structures that food passes through?

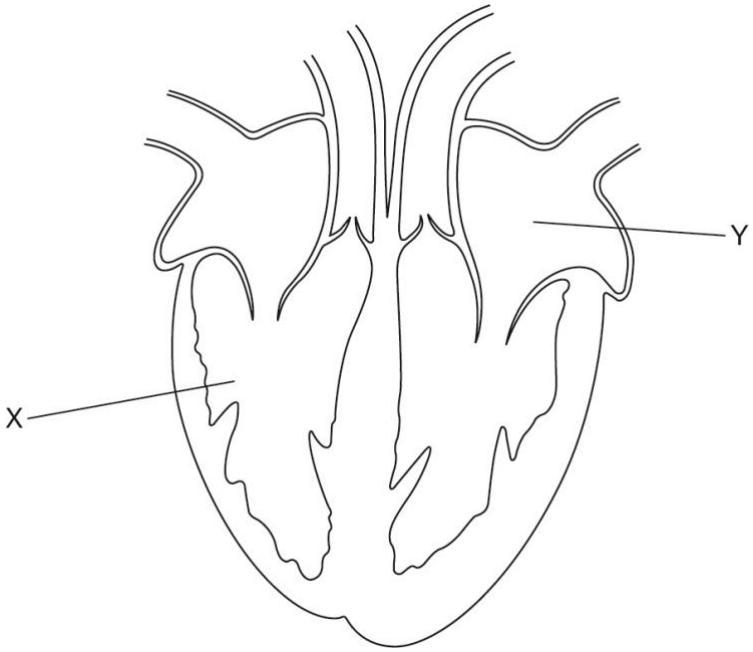
A duodenum, ileum, colon, rectum

B duodenum, colon, ileum, rectum

C ileum, colon, rectum, duodenum

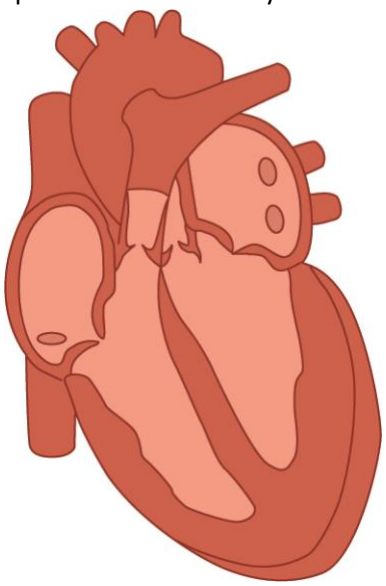
D ileum, duodenum, rectum, colon

10. Which line states the correct names for structures X and Y?



	X	Y
A	left atrium	right ventricle
B	left ventricle	right atrium
C	right atrium	left ventricle
D	right ventricle	left atrium

11. The diagram shows a heart at a point in the cardiac cycle.



Which of the following is correct?

A the atria are contracting and blood is flowing into the ventricles

B the atria are contracting and blood is flowing into the veins

C the ventricles are contracting and blood is flowing into the arteries

D the ventricles are contracting and blood is flowing into the atria

12. A student suggested the following risk factors for coronary heart disease.

1. high fat diet

2. smoking

3. lack of vitamin A

Which of the suggested risk factors for heart disease are correct?

A 1 and 2

B 1 and 3

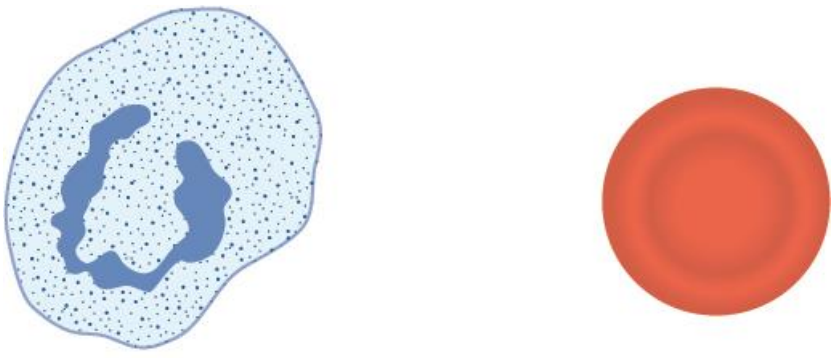
C 2 and 3

D 1, 2 and 3

13. Which line correctly states some of the properties of arteries?

	blood pressure	valves
A	high	absent
B	high	present
C	low	absent
D	low	present

14. The diagram shows two blood cells.



X Y

What are the correct names of the cells?

	X	Y
A	lymphocyte	red blood cell
B	lymphocyte	platelet
C	phagocyte	red blood cell
D	phagocyte	platelet

15. Which of the following correctly states the response of white blood cells to infection?

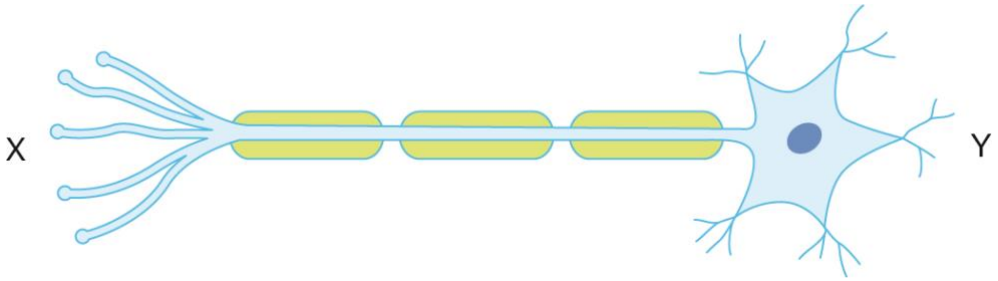
A lymphocytes release antibodies

B lymphocytes release antigens

C phagocytes release antibodies

D phagocytes release antigens

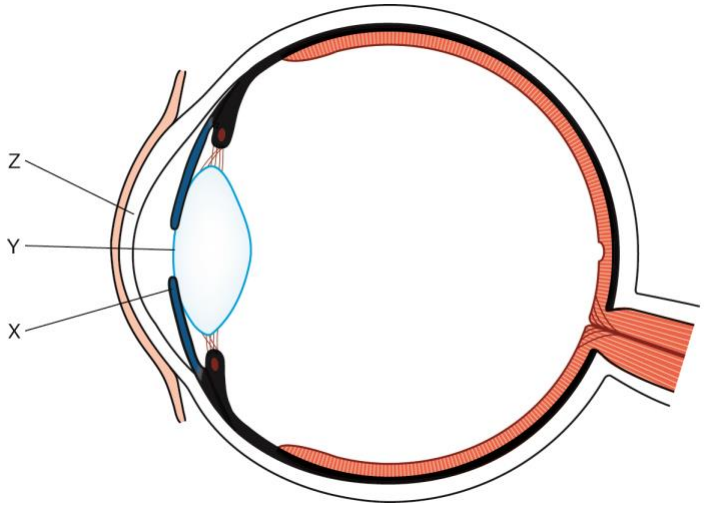
16. The diagram shows a neuron.



Which of the following gives the correct name of the neurone and direction of the impulse?

	name	direction
A	motor neurone	X → Y
B	motor neurone	Y → X
C	sensory neurone	X → Y
D	sensory neurone	y → X

17. The diagram shows the structure of a human eye.



Which of the following gives the correct names for X, Y and Z?

	X	Y	Z
A	cornea	lens	iris
B	iris	cornea	lens
C	iris	lens	cornea

D	lens	cornea	iris

18. Which of the following correctly gives the state of the ciliary muscle and suspensory ligaments when looking at a close object?

	ciliary muscles	suspensory ligaments
A	contracted	slack
B	contracted	tense
C	relaxed	slack
D	relaxed	tense

19. Below are some statements about synapses.

1. information crosses a synapse by neurotransmitter chemicals and electrical impulses
2. transmission across a synapse involves diffusion
3. synapses only transmit information in one direction

Which of the statements are correct?

A 1 and 2

B 1 and 3

C 2 and 3

D 1, 2 and 3

20. Which of the following statements about insulin is correct?

A it is made in the pancreas

B it is released when blood glucose falls

C it is released into the duodenum

D it raises blood glucose concentration

21. Which of the following statements about the endocrine system is correct?

A most hormones act faster than nerve impulses

B hormones work only on a few body cells

C hormones have shorter lasting effects than nerve impulses

D hormones are transported in the blood

22. A students made the following statements about homeostasis

- it is the maintenance of a constant internal environment
- all organisms maintain a constant body temperature
- in mammals, homeostasis maintains body water balance

How many of the statements are correct?

A 0

B 1

C 2

D 3

23. Which of the following rows about the body's response to lack of water is correct?

	ADH release	collecting duct permeability
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

24. Which of the following regions of nephron is where glucose is reabsorbed?

A Bowman's (renal) capsule

B collecting duct

C distal convoluted tubule

D proximal convoluted tubule

25. If the blood becomes too hot, which of the following correctly states the response of the skin?

A vasoconstriction increasing blood flow to the surface

B vasoconstriction reducing blood flow to the surface

C vasodilation increasing blood flow to the surface

D vasodilation reducing blood flow to the surface

26. By which of the following processes does sweating release heat from the skin?

A radiation

B evaporation

C conduction

D convection

27. Below are some statements about methods of reproduction.

1. involves two parents

2. involves fusion of gametes

3. results in genetically identical offspring

Which of the statements are correct for sexual reproduction?

A 1 and 2

B 1 and 3

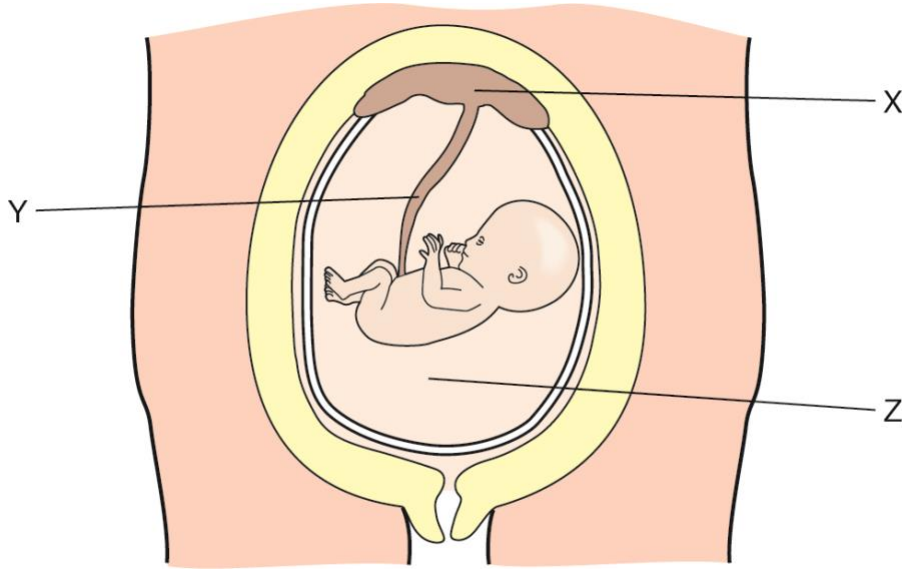
C 2 and 3

D 1, 2 and 3

28. Which of the following rows about oestrogen and progesterone is correct?

	oestrogen	**progesterone**
A	repairs endometrium	breaks down endometrium
B	blood concentrations peak before ovulation	blood concentrations peak before ovulation
C	blood concentrations are low during menstruation	blood concentrations are high during menstruation
D	stops the menstruation when concentrations rise	falling concentrations lead to menstruation

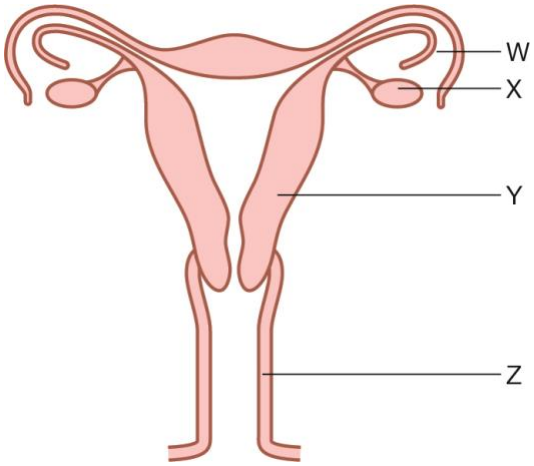
29. The diagram shows a developing fetus in a uterus.



Which row gives the correct names of structures X, Y and Z?

	X	Y	Z
A	amniotic sac	umbilical cord	placenta
B	placenta	umbilical cord	amniotic sac
C	placenta	amniotic sac	umbilical cord
D	umbilical cord	placenta	amniotic sac

30. The following diagram relates to questions 30 and 31. It shows the female reproductive system.



In which of the structures does ovulation occur?

A W

B X

C Y

D Z

31. In which of the structures does an embryo implant?

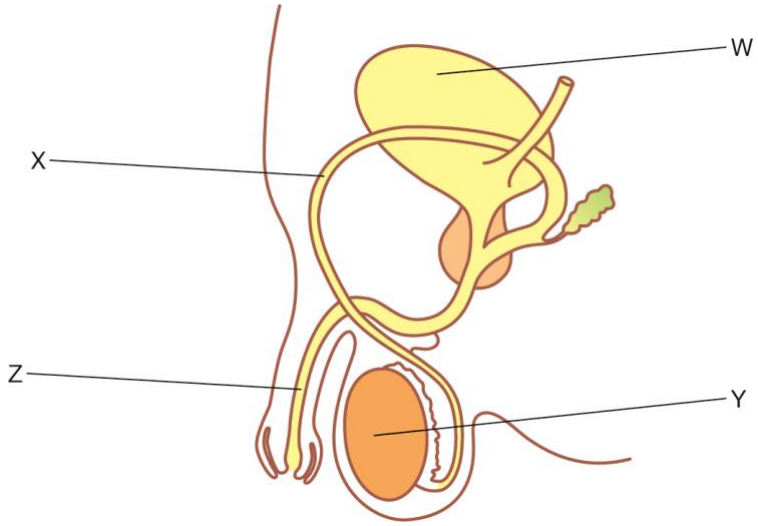
A W

B X

C Y

D Z

32. The following diagram relates to questions 32 and 33. It shows the male reproductive system.



In which of the structures is testosterone produced?

A W

B X

C Y

D Z

33. In which of the structures is sperm produced?

A W

B X

C Y

D Z

34. Which of the following statements about FSH is correct?

A FSH stimulates egg maturation

B FSH stimulates ovulation

C FSH levels rise after ovulation

D FSH is produced by the ovary

35. Which of the following statements about puberty in girls is correct?

A the shoulders broaden

B the voice deepens

C pubic hair growth occurs

D puberty is stimulated by testosterone

36. Which of the following substances will pass across the placenta from the mother to the baby?

A amino acids

B carbon dioxide

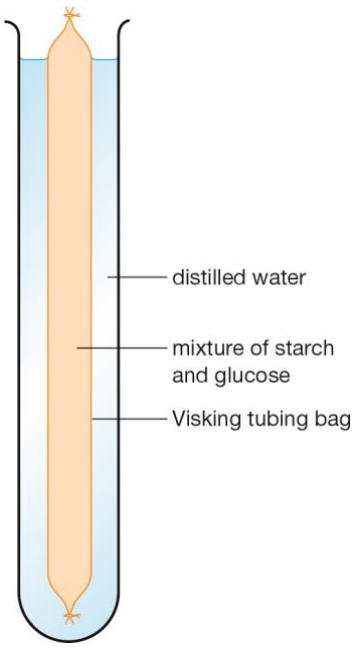
C protein

D urea

37. When looking at a bright light, which of the following gives the correct states of the circular and radial muscles of the iris?

	circular muscles	**radial muscles**
A	contracted	contracted
B	contracted	relaxed
C	relaxed	contracted
D	relaxed	relaxed

38. The effect of lipase on fat digestion was investigated using the equipment shown in the diagram.



After one hour of incubation, the pH of the distilled water was tested.

Which of the following is correct about the distilled water?

A the pH will fall due to the presence of amino acids

B the pH will fall due to the presence of fatty acids

C the pH will rise due to the presence of amino acids

D the pH will rise due to the presence of fatty acids

39. The composition of the blood of a healthy person and a patient admitted to hospital are shown in the table.

	red blood cell count	**white blood cell count**	**platelet count**
healthy person	4.32×10^9 per cm^3	3.7×10^6 per cm^3	1.5×10^8 per cm^3
patient	4.52×10^9 per cm^3	9.8×10^6 per cm^3	0.1×10^8 per cm^3

What conditions does the patient have?

A anaemia

B poor blood clotting

C anaemia and poor blood clotting

D infection and poor blood clotting

40. Below are the names of some enzymes.

1. amylase

2. lipase

3. protease

Which of the enzymes are made by the pancreas?

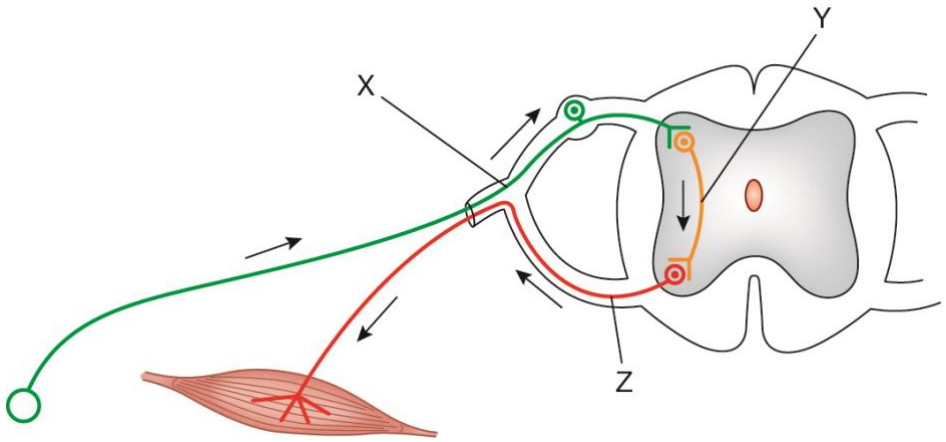
A 1 and 2

B 1 and 3

C 2 and 3

D 1, 2 and 3

41. The diagram shows a reflex arc.



Which of the rows correctly labels cells X, Y and Z?

	X	Y	Z
A	motor neurone	sensory neurone	relay neurone
B	motor neurone	relay neurone	sensory neurone
C	sensory neurone	motor neurone	relay neurone
D	sensory neurone	relay neurone	motor neurone

Answers

1. A - alveolus
2. C - volume increases and pressure decreases
3. C - indicator turns yellow due to increased carbon dioxide gas
4. A - 1 and 2
5. C -protein and starch
6. D - scurvy
7. A - 1 and 2
8. C
9. A - duodenum, ileum, colon, rectum
10. D
11. C - the ventricles are contracting and blood is flowing into the arteries
12. A - 1 and 2
13. A
14. A
15. A - lymphocytes release antibodies
16. B
17. C
18. A
19. C - 2 and 3
20. A - it is made in the pancreas
21. D - hormones are transported in the blood
22. C – 2
23. D
24. D - proximal convoluted tubule
25. C - vasodilation increasing blood flow to the surface
26. B - evaporation
27. A - 1 and 2
28. D
29. B
30. A – W
31. C – Y
32. C – Y
33. C - Y
34. A - FSH stimulates egg maturation
35. C - FSH stimulates egg maturation
36. A - amino acids
37. B
38. B - the pH will fall due to the presence of fatty acids
39. D - infection and poor blood clotting
40. D - 1, 2 and 3
41. D

Unit 2 Multiple-choice questions

1. Look at the table below. Which one of the unknown elements is most likely to be potassium?

Substance	Reaction with air	Reaction with water
A	No reaction	No reaction
B	Tarnishes slowly	Slow effervescence
C	Tarnishes quickly	Effervescence
D	Tarnishes immediately	Violent effervescence

2. Which of the following statements best explains why group 1 metals become more reactive down the group?

   A. Going down the group the distance between the nucleus and the outer shell electron decreases. This means that the force of attraction is weaker and therefore the electron is more easily lost.
   B. Going down the group the distance between the nucleus and the outer shell electron increases. This means that the force of attraction is stronger and therefore the electron is more easily lost.
   C. Going down the group the distance between the nucleus and the outer shell electron increases. This means that the force of attraction is weaker and therefore the electron is more easily lost.
   D. Going down the group the distance between the nucleus and the outer shell electron increases. This means that the force of attraction is stronger and therefore the electron is less easily lost.

3. Where in the Periodic Table would the halogens be found?

   A. Group 2
   B. Group 5
   C. Group 7
   D. Group 8

4. Halogens vary in their reactivity. Based on your knowledge which of the following reactions would not take place?

   A. Potassium bromide + Chlorine -> Potassium chloride + Bromine
   B. Sodium chloride + Iodine -> Sodium iodide + Chlorine
   C. Magnesium Iodide + Bromine -> Magnesium bromide + Iodine
   D. Zinc Bromide + Chlorine -> Zinc chloride + Bromine

5. Chlorine is one of the halogens. Look at the descriptions below and select the one the best describes chlorine at room temperature.

   A. Yellow gas

B. Grey solid
C. Red/brown liquid
D. Green gas

6. Astatine is a halogen and can be found in the Periodic Table, underneath Iodine. Using your knowledge of the trends of the halogens choose the most suitable description of astatine's properties.

A. Very reactive gas.
B. Very reactive liquid.
C. Unreactive solid.
D. Unreactive liquid.

7. Why is chlorine more reactive than iodine?

A. Chlorine has a stronger tendency for form a 1- ion as its nucleus is closer to its outer electron shell.
B. Iodine has a stronger tendency for form a 1- ion as its nucleus is further from its outer electron shell.
C. Chlorine has a weaker tendency for form a 1- ion as its nucleus is closer to its outer electron shell.
D. Iodine has a stronger tendency for form a 1- ion as its nucleus is closer to its outer electron shell.

8. The percentage by volume of oxygen in the atmosphere is?

A. 78%
B. 0.4%
C. 21%
D. 0.9%

9. Which of the following would be a suitable test for oxygen?

A. Turns limewater cloudy.
B. Relights a glowing splint.
C. Makes a squeaky pop when ignited.
D. Turns damp litmus paper blue.

10. Burning fossil fuels can release oxides into the atmosphere. Which one of the following oxides is not acidic?

A. Carbon dioxide.
B. Nitrogen dioxide.
C. Sulfur dioxide.
D. Potassium oxide.

11. When heated, copper (II) carbonate thermally decomposes. Which of the following reactions shows the correct products?

    A. Copper (II) carbonate -> Copper hydroxide + Carbon
    B. Copper (II) carbonate -> Copper oxide + Carbon dioxide
    C. Copper (II) carbonate -> Copper oxide + Hydrogen
    D. Copper (II) carbonate -> Copper hydroxide + Carbon dioxide

12. Magnesium burns in oxygen to form magnesium oxide. Choose the correct symbol equation for this reaction.

    A. $2Mg + O_2 \rightarrow 2MgO$
    B. $Mg + O_2 \rightarrow MgO$
    C. $Mg + O \rightarrow MgO$
    D. $2Mg + O_2 \rightarrow MgO_2$

13. Which of the following techniques could not be used to determine the percentage of oxygen in air?

    A. By reacting wet iron filings inside a conical flask and measuring the volume decrease using a gas syringe.
    B. By burning wire wool on a balance to show the mass increase.
    C. By passing a known volume of air back and forth across heated copper turnings inside a silica tube.
    D. By reacting phosphorus inside a bell jar set in water and measuring the change in water level.

14. Which of the following statements about reduction is true?

    A. Reduction is the gain of electrons or the loss of hydrogen.
    B. Reduction is the gain of electrons or the loss of oxygen.
    C. Reduction is the loss of electrons or the loss of oxygen.
    D. Reduction is the gain of electrons or the gain of oxygen.

15. A piece of magnesium is added to copper sulfate solution. Which of the following does not happen?

    A. The magnesium becomes covered in a thin layer of orange copper.
    B. The colour of the solution becomes less blue.
    C. Magnesium sulfate is formed.
    D. There is a drop in the temperature of the solution.

16. Choose the conditions under which iron will rust at the fastest rate.

    A. Dry, warm and in the presence of salt.
    B. Dry, cold and in the presence of salt.

C. Wet, warm and in the presence of salt.
D. Wet, warm and in the absence of salt.

17. The reactivity series is used to show the difference in the reactivity of elements. Choose the answer showing elements in the correct order of reactive from most reactive to least reactive.

Most reactive Least reactive

A. Gold – sodium – magnesium- copper – zinc - iron
B. Potassium – zinc – sodium- calcium – aluminium - copper
C. Sodium - magnesium- aluminium - iron – copper – gold
D. Lithium – aluminium- zinc- iron – copper – silver

18. Bocks of magnesium can be added to the hull of ships made from iron to reduce the amount of rusting that takes place. Which type of protection is this?

A. Sacrificial protection.
B. Barrier protection.
C. Galvanising.
D. Vulcanising.

19. Choose the correct statement about reducing agents.

A. Reducing agents gain electrons and are therefore oxidised during reactions.
B. Reducing agents gain electrons and are therefore oxidised during reactions.
C. Reducing agents give away electrons and are therefore reduced during reactions.
D. Reducing agents give away electrons and are therefore oxidised during reactions.

20. When added to dilute acids metals react in a general way. Which of the following shows the correct products of this type of reaction?

A. Metal + Acid -> Salt + Water
B. Metal + Acid -> Salt + Hydrogen
C. Metal + Acid -> Metal oxide + Water
D. Metal + Acid -> Salt + Water + Carbon dioxide

21. Metals are usually found combined with other elements in rocks called ores. A few unreactive metals are found in their pure form. Choose the metal that is most likely to be found in its pure form.

A. Aluminium.
B. Iron.
C. Silver.
D. Lead.

22. Why is carbon used in the extraction of iron form iron oxide?

    A. Because it is cheap.
    B. Because it is more reactive than iron.
    C. Because it is less reactive than iron.
    D. Because it is more reactive than oxygen.

23. Copper and its alloys are widely used metals. The use of copper often depends on a specific property it has. Pick the correct use of copper with the property that makes it suitable.

    A. Wires- Copper is a good conductor of heat.
    B. Water pipes- Copper is a very reactive metal.
    C. Surfaces in hospitals- Copper has antimicrobial properties.
    D. Pots and pans- Copper is a good conductor of electricity.

24. Steel is an example of an alloy. Select the best definition of an alloy.

    A. A mixture of a metal with, usually, other metals or carbon.
    B. A compound of a metal with a non-metal.
    C. A metal produced by electrolysis.
    D. A mixture of a metal with carbon.

25. Which of the following metals could not be extracted from its oxide by reduction with carbon?

    A. Copper.
    B. Iron.
    C. Zinc.
    D. Aluminium.

26. Mild steel is an alloy of iron which contains about 0.25% carbon. Which of the following is not a common use of mild steel?

    A. Cutlery.
    B. Car bodies.
    C. Nails.
    D. Bridges.

27. Alloys are often used because they are harder than pure metals. Why are alloys harder?

    A. In alloys, the different sized atoms in the lattice make it harder for the layers of ions to slide over one another.
    B. In alloys, the different sized atoms in the lattice make it easier for the layers of ions to slide over one another.
    C. In alloys, the different sized electrons in the lattice make it harder for the layers of ions to slide over one another.

D. In alloys, the atoms are the same size which makes it harder for the layers of ions to slide over one another.

28. An indicator is a substance that can be used to determine the pH of an acid or alkali. A number of indicators were added to a sample of acid. Choose the row from the table that shows the results you would expect to see for each indicator if it was added to an acid.

Sample	Phenolphthalein	Methyl orange	Universal indicator	Litmus
A	Colourless	Red	Red	Red
B	Red	Red	Red	Red
C	Pink	Red	Blue	Blue
D	Pink	Orange	Red	Blue

29. Ethanoic acid is a weak acid. What pH value would you expect it to have?

A. 12
B. 4
C. 2
D. 7

30. A wasp sting is alkaline and can be neutralised using a weak acid like vinegar. Which of the following description about acids and alkalis is correct?

A. In an aqueous solution, alkalis are sources of hydrogen ions and acids are sources of hydroxide ions.
B. In an aqueous solution, acids are sources of hydrogen ions and alkalis are sources of hydroxide ions.
C. In an aqueous solution, acids are sources of hydroxide ions and alkalis are sources of hydrogen ions.
D. In an aqueous solution, acids are sources of hydrogen ions and alkalis are sources of hydrogen ions.

31. Two students were testing the solubility in water of different nitrates. Which row shows the results that you would expect to obtain?

	Potassium nitrate	Sodium nitrate	Calcium nitrate
A	Soluble	Insoluble	Soluble
B	Insoluble	Insoluble	Soluble
C	Insoluble	Soluble	Insoluble
D	Soluble	Soluble	Soluble

32. Which of the following chlorides are insoluble in water?

A. Silver chloride.
B. Calcium chloride.

C. Sodium chloride.
D. Copper chloride.

33. Calcium carbonate is a base that is often used in medication to reduce stomach acidity. The acid present in your stomach is hydrochloric acid. Choose the correct balanced equation for the reaction between calcium carbonate and hydrochloric acid.

A. $CaCO_3 + HCl \rightarrow CaCl_2 + CO + H_2O$
B. $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2$
C. $CaCO_3 + HCl \rightarrow CaCl_3 + CO_2 + H_2O$
D. $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

34. Copper (II) sulfate crystals can be made from copper oxide. Choose the best method from the answers below.

A. Add copper oxide to hot hydrochloric acid until no more will dissolve, filter off the undissolved copper oxide, heat the filtrate in an evaporating basin until blue crystal begin to form.
B. Add copper oxide to hot sulfuric acid until no more will dissolve, filter off the undissolved copper oxide, distil the filtrate into a condensing tube.
C. Add copper oxide to hot sulfuric acid until no more will dissolve, filter off the undissolved copper oxide, heat the filtrate in an evaporating basin until blue crystal begin to form.
D. Heat the copper oxide with powdered carbon, dissolve both in water and then filter off any undissolved copper oxide, leave the filtrate to cool in an evaporating basin.

35. Which of the following is the correct colour for a lithium flame test?

A. Blue.
B. Pink.
C. Red.
D. Lilac.

36. Ammonia is a strong-smelling gas which can be harmful if inhaled in high concentrations. What is the chemical test for ammonia?

A. Heat the liquid and hold a piece of damp litmus paper at the end of the test tube, it will turn blue.
B. By bubbling it through lime water, it will turn cloudy.
C. By adding a glowing splint, it will reignite.
D. Heat the liquid and hold a piece of litmus paper at the end of the test tube, it will be bleached.

37. What would you expect to see if copper (II) sulfate was added to sodium hydroxide solution?

A. A yellow precipitate forms.
B. Effervescence.

C. A blue precipitate.
D. A white precipitate.

38. Look at the table below. Which row shows the correct results when iron (II) and iron (III) ions are added to sodium hydroxide?

Sample	Iron (II) ions	Iron (III) ions
A	Orange/ brown precipitate	Orange/ brown precipitate
B	Green precipitate	Orange/ brown precipitate
C	Green precipitate	Green precipitate
D	Orange/ brown precipitate	Green precipitate

39. Flame tests are a useful way to identify unknown substances. A sample of an unknown powder was added to a damp splint. The split was then held in a flame. A yellow flame was observed. Which ion was present?

A. Lithium
B. Calcium
C. Copper (II)
D. Sodium

40. Describe the colour change observed when water is added to anhydrous copper (II) sulfate.

A. Blue to white.
B. Blue to red.
C. White to blue.
D. White to orange.

Answers

1. D
2. C - Going down the group the distance between the nucleus and the outer shell electron increases. This means that the force of attraction is weaker and therefore the electron is more easily lost.
3. C - Group 7
4. B - Sodium chloride + Iodine -> Sodium iodide + Chlorine
5. D - Green gas
6. C - Unreactive solid.
7. A - Chlorine has a stronger tendency for form a 1- ion as its nucleus is closer to its outer electron shell.
8. C - 21%
9. B - Relights a glowing splint.
10. C - Potassium oxide.
11. B - Copper (II) carbonate -> Copper oxide + Carbon dioxide
12. A - $2Mg + O_2 \rightarrow 2MgO$
13. B - By burning wire wool on a balance to show the mass increase.
14. B - Reduction is the gain of electrons or the loss of oxygen.
15. D - There is a drop in the temperature of the solution.
16. C - Wet, warm and in the presence of salt.
17. C - Sodium - magnesium- aluminium - iron – copper – gold
18. A - Sacrificial protection
19. D - Reducing agents give away electrons and are therefore oxidised during reactions.
20. B - Metal + Acid -> Salt + Hydrogen
21. C - Silver
22. B - Because it is more reactive than iron.
23. C - Surfaces in hospitals- Copper has antimicrobial properties.
24. A - A mixture of a metal with, usually, other metals or carbon.
25. D - Aluminium
26. A - Cutlery
27. A - In alloys, the different sized atoms in the lattice make it harder for the layers of ions to slide over one another.
28. A
29. B - 4
30. B - In an aqueous solution, acids are sources of hydrogen ions and alkalis are sources of hydroxide ions.
31. D
32. A - Silver chloride.
33. D - $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$
34. A - Add copper oxide to hot hydrochloric acid until no more will dissolve, filter off the undissolved copper oxide, heat the filtrate in an evaporating basin until blue crystal begin to form.
35. C - Red
36. A - Heat the liquid and hold a piece of damp litmus paper at the end of the test tube, it will turn blue.
37. C - A blue precipitate.
38. B
39. D - Sodium
40. C - White to blue.

Chapter 15

1 Any object that has a temperature above a key value is said to have thermal energy. What is this key value?

A 0° C

B 0 K

C 273 K

D 293 K

2 What is the method of heat transfer through a solid known as?

A conduction

B convection

C radiation

D all of the above

3 What is the method of heat transfer in a fluid known as?

A conduction

B convection

C radiation

D all of the above

4 A chef is cooking a kebab using a metal skewer. The heat is conducted along the metal. Which of the following statements best describes what is happening inside the metal skewer?

A The heat is flowing up and down the metal.

B The atoms at the heated end gain energy and pass this on through vibrations.

C The skewer melts.

D The cold energy is transferred out of the metal due to the heat energy at one end.

5 Which of the following materials is a good conductor of heat?

A wood

B plastic

C copper

D glass

6 Why does a piece of aluminium feel cooler to the touch than a piece of plastic at the same temperature?

A The aluminium conducts heat away from the hand, leaving it feeling cool.

B Plastic is a better conductor of heat so conducts it back to the hand.

C They are not really the same temperature.

D The aluminium keeps the cold for longer because it is a bad conductor of heat.

7 Complete the sentence:

Convection is the transfer of heat energy

A in solids, by the particles passing on kinetic energy to neighbouring particles.

B in gases, by passing on kinetic energy through collisions.

C in fluids, by the upwards movement of warm less dense water.

D in all substances, by transferring the heat particles along.

8 A convection current is established in a heated beaker of water when?

A cooler more dense water displaces warmer less dense water

B warmer water rises to the top

C warm more dense water falls to the bottom of the beaker of water

D all the water in the beaker mixes

9 Firemen direct people to crawl along the floor when there is a fire in a building. Why is this?

A The warmer less dense air is higher in the room and carries the smoke with it.

B The cooler more dense air rises to the top of the room.

C They can see the floor more easily for tripping hazards.

D The floor cannot catch fire.

10 Complete the following sentence:

Radiation is a method of heat transfer that

A occurs in solids.

B occurs in liquids.

C does not require particles.

D occurs in all substances.

11 Complete the following sentence:

The hotter an object is

A the greater the amount of heat radiated.

B the redder the object will be.

C the smaller the object will be.

D the smaller the kinetic energy of the particles.

12 Which of the following is a property of infrared waves?

A They travel at 3.0×10^8 m/s.

B They travel in straight lines.

C They can travel through space.

D All of the above.

13 Which of the following surfaces is the best absorber and emitter of heat?

A silver shiny surface

B white matt surface

C black shiny surface

D black matt surface

14 How do double glazed windows prevent heat loss by conduction?

A They use thin sheets of glass.

B They fill the space between the panes of glass with a small amount of gas.

C Some countries use triple glazed windows.

D All of the above.

15 From which part of a house is the most heat lost?

A floor and walls

B windows and front door

C windows and roof

D walls and the back door

Answers

1 B
2 A
3 B
4 B
5 C
6 A
7 C
8 A – This drives the convection current.
9 A – This leaves the floor cooler and clear of smoke.
10 C – Radiation does not require a medium as it is an electromagnetic wave.
11 A
12 D
13 D – Black is the best absorber and emitter and matt surfaces are the poorest reflectors so black matt surfaces are the best for absorbing and emitting heat.
14 D
15 C – The walls conduct the most heat away from the home. This can be reduced by filling the wall cavity with fibreglass insulation.

Biology Paper 2 Exam Question

(c) (i) Describe how a mutation in the DNA of a cell can affect the functioning of an enzyme.

(3)

The Mark Scheme

Question number	Answer	Mark
5(c)(i)	A description that makes reference to three of the following points: • change in the order of bases/equivalent (1) • leads to different codon (1) • different amino acid in protein (1) • different-shaped enzyme/change to active site/enzyme not made/equivalent (1)	**3**

Student Response 1

Mutations can be very harmful, sometimes lethal. They are caused by changes to the amino acid sequence of the DNA. This means that different proteins are made and so do not work properly, for example, some enzymes may not be made. Blue eyes may be a mutation of brown eyes genes.

Is this a good answer?

Student Response 1: Verdict

Mutations can be very harmful, sometimes lethal. They are caused by changes to the amino acid sequence of the DNA. This means that different proteins are made and so do not work properly, for example, some enzymes may not be made. Blue eyes may be a mutation of brown eyes genes.

Good

- The candidate correctly states that enzymes may not be made (1 mark).

Could be improved

- This is a very vague answer with significant confusion.
- The candidate has made a common mistake – confusing bases in DNA with amino acids.
- They have tried to give an example of a mutation (eye colour) but the question does not ask for one and there is no explanation.
- They state that different proteins are made but do not link this to active sites of enzymes.

Student Response 1: Improvements

Mutations can be very harmful, sometimes lethal. They are caused by changes to the amino acid sequence of the DNA.

This is not the same as base sequence – a common error.

This means that different proteins are made

This is correct and is an alternative to the fourth point in the mark scheme.

and so do not work properly, for example, some enzymes may not be made.

This lacks detail. It hints at enzymes not functioning but is not precise. No mention of active sites.

Blue eyes may be a mutation of brown eyes genes.

Student Response 2

A mutation is a change in the order of bases of a gene (in the DNA). This leads to transcription of different mRNA which is translated into a protein with a different sequence of amino acids. The active site of the enzyme will have a different shape and so no longer bind the substrate. Some mutations, however, have no effect.

Student Response 2: Commentary

A mutation is a change in the order of bases of a gene (in the DNA).

This is a correct statement about the base sequence change (1 mark).

This leads to transcription of different mRNA

This is a correct but does not mention codons.

which is translated into a protein with a different sequence of amino acids.

This is a correct statement about the change in amino acid sequence (1 mark).

The active site of the enzyme will have a different shape and so no longer bind the substrate.

This is a correct statement about the effect on enzymes (1 mark).

Some mutations, however, have no effect.

International GCSE

Chemistry

Sample Examination Paper 1

Q	Marks
1	10
2	7
3	10
4	15
5	10
6	8
7	15
8	12
9	6
10	11
11	6

Instructions

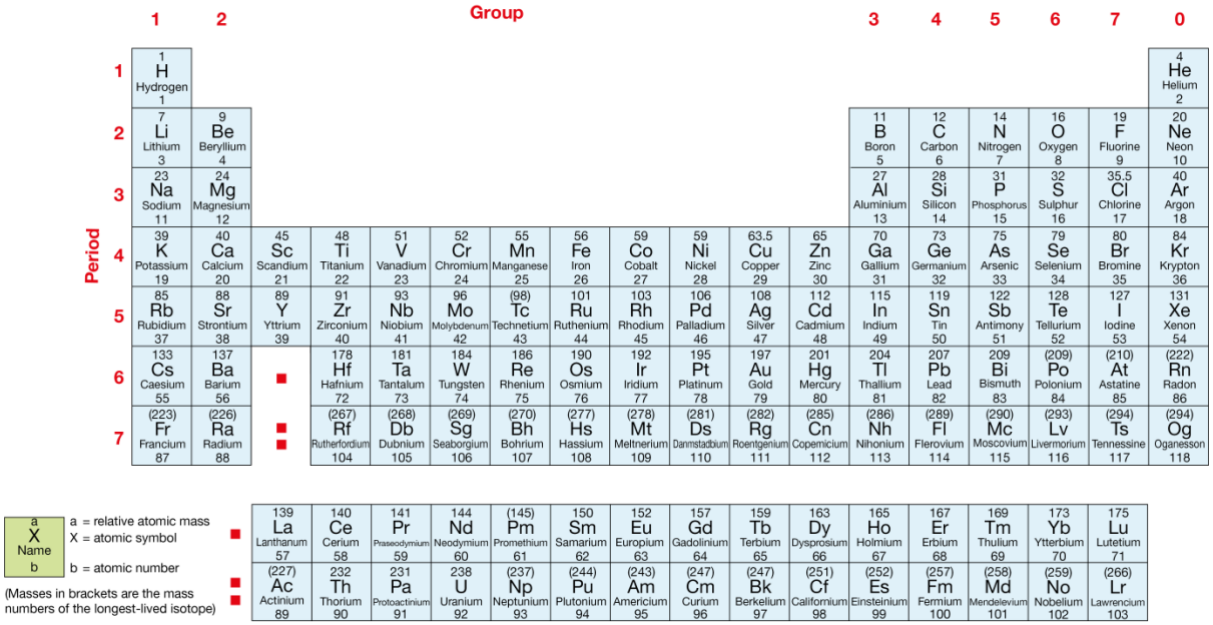
- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- Calculators may be used.
- Some questions must be answered with a cross in a box. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.



Answer all questions. Write your answers in the space provided.

1. Some students are investigating the effect of adding salt to the melting point of ice.

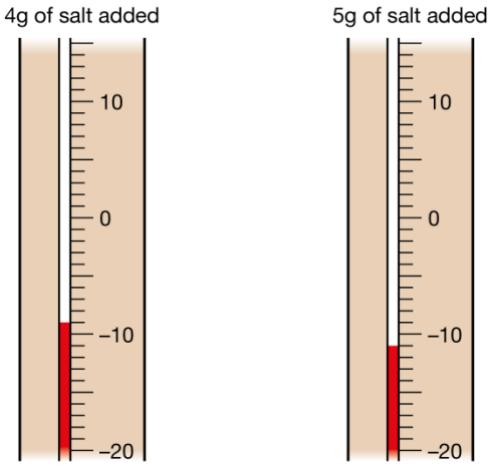
They added different masses of salt to some ice cubes in a beaker with some water. The students measure the temperature after one minute using a thermometer.

a) Describe the change of state that occurs during melting.

(1)

……..

b) The diagram shows the thermometer readings for the experiments they did for 4g and 5g of salt.



Complete the table below using these readings.

(2)

Mass of salt added /g	Temperature after one minute /^{0}C
0	0
1	-2
2	-5
3	-8
4	
5	

c) Which of the following describes the salt in this experiment?

(1)

[ ] A. It was the solvent.
[ ] B. It was the solution.

[ ] C. It was the filtrate.
[ ] D. It was the solute.

d) State two variables that must be controlled in this experiment to make the results valid.

(2)

……
……
……

e) At the end of the experiment the students discuss ways of separating the salt from the water in the beaker.

State the most suitable method of separating mixtures for each of the following:

(4)

i) Separating water from a sodium chloride solution.
……
……

ii) Separating copper (II) sulfate from a copper (II) sulfate solution.
……
……

iii) Separating water from a mixture of water and ethanol.
……
……

iv) Separating green food dye that has been mixed with pink and yellow food dye.
……
……

(Total for question 1 = 10 marks)

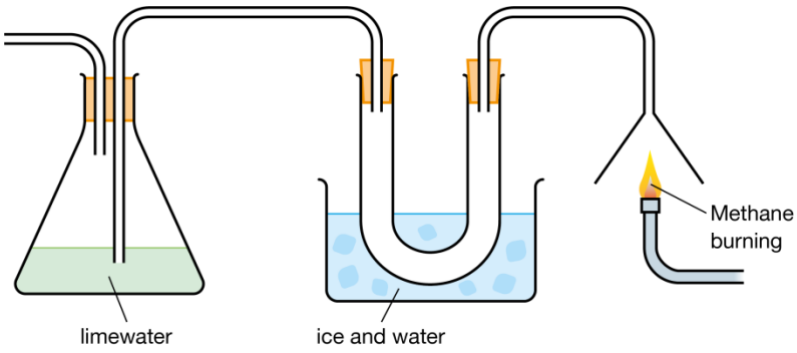
2. This question is about testing for compounds and elements.

a) Describe the test for chlorine gas.

(2)

……
……

b) The diagram shows methane gas burning in air and the gases produced being passed through some apparatus.



i. A liquid collects at the bottom of the U-shaped tube.
Suggest a **chemical** test to determine whether this liquid was water?

(2)

……

……

ii. What change would you expect to see in the lime water if the burning methane produced carbon dioxide?

(1)

……

c) Describe how you could test a solution to show that it was acidic?

(2)

Test

……

Result

……

(Total for question 2 =7 marks)

3. A student is investigating the effect of metal oxide catalysts on the decomposition of hydrogen peroxide.

a) Balance the equation below.

(1)

……H_2O_2 ⟶ ……H_2O + …… O_2

b) Describe how you could test for oxygen gas.

(2)

……

……

c) The student uses four different catalysts in the investigation.
Define the term **catalyst.**

(2)

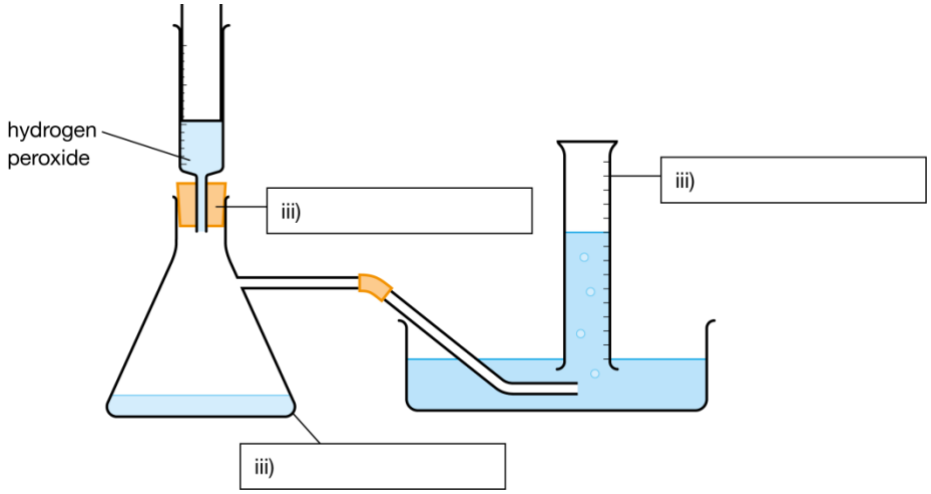
……

……

……

d) Look at the diagram below. Add labels to the apparatus.

(3)



e) Place an **X** on the diagram to show where the catalyst should be placed.

(1)

f) The student added 3g of catalyst during the investigation. After the investigation, the student filtered the catalyst out of the mixture using filter paper. The catalyst was allowed to dry and was then reweighed. What was the mass of catalyst at the end of the investigation?

(1)

(Total for question 3 = 10 marks)

4. Crude oil contains many different substances.

a) Which of the following best describes crude oil?

(1)

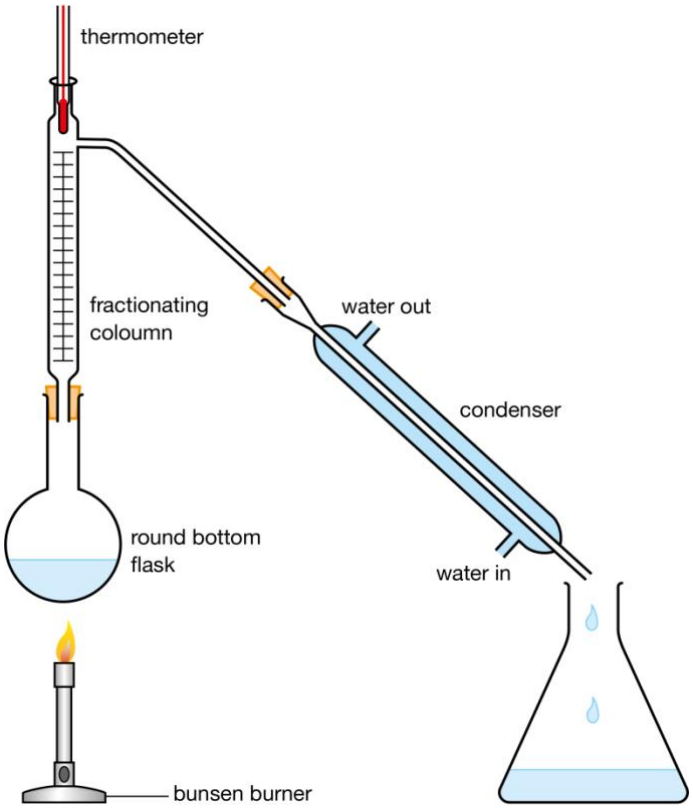
[ ] A mixture

[ ] An element

[ ] A compound

[ ] An ion

b) Crude oil can be separated into the fractions that it is made of using a technique called fraction distillation. This method can be used in the laboratory.



The steps below for fractional distillation of crude oil using the apparatus are in the wrong order.

(4)

1. Attach the fractionating column to the round bottom flask.
2. Fix the thermometer to the top of the fractionating column.
3. Collect the fractions in separate conical flasks.
4. Begin to heat the crude oil gently, then more strongly.
5. Add the crude oil to the round bottom flask.

Add the numbers for the steps in the correct order below.

..... → 1 → ..... → ..... → .....

c) The fractions produced from crude oil have different uses. Complete the table below to suggest a use for each of the fractions listed.

(6)

Fraction	Main uses
Refinery gases	
Gasoline	
Kerosene	

Diesel	
Fuel oil	
Bitumen	

d) One use of hydrocarbons is as fuels.

i. What are the products of the **complete** combustion of a hydrocarbon in oxygen?

(2)

……

……

ii. Which gas is produced when the **incomplete** combustion of a hydrocarbon takes place?

(1)

……

iii. State why the gas produced by the incomplete combustion of hydrocarbons is poisonous to humans.

(1)

……..

(Total for question 4 = 15 marks)

5 This question is about the halogens.

a) Explain why chlorine and bromine are in group 7 of the Periodic Table

(1)

……..

b) In the space below draw the electronic configuration of a chlorine atom. Show all electrons.

(3)

c) Fill in the missing data from the table below.

(3)

Element	Colour	Physical state
Fluorine	Yellow	Gas
Chlorine		Gas
Bromine	Dark red liquid	
Iodine		Solid

d) Some students were investigating the reaction of different halogens with halides.

Chlorine displaced potassium iodide.

Bromine displaced sodium iodide.

Iodine did not displace sodium chloride.

Chlorine displaced lead bromide.

Based on the results of these displacement reactions place the halogens used in order or reactivity from most react to least reactive.

(2)

Most reactive ……..

……

Least reactive ……

e) Astatine appears on the Periodic Table beneath iodine. Predict the physical state of astatine at room temperature.

(1)

……

f) Bromine water can be used to test whether hydrocarbons are saturated or unsaturated. Describe the colour change you would expect if propene was added to bromine water.

(1)

……

(Total for question 5 = 10 marks)

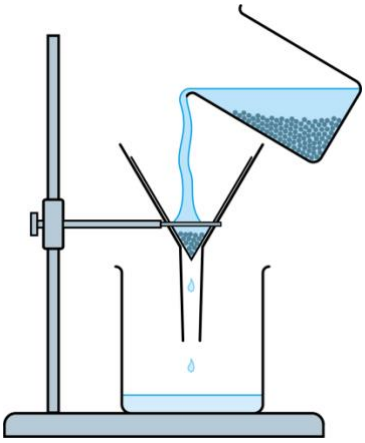
6 This question is about making salts.

a) A student is making magnesium sulfate. The first step in the process is reacting magnesium with sulfuric acid. Write a balanced symbol equation for this reaction below.

(2)

..... + ... -> ..... + ...

After the reaction has taken place the solution is filtered.



b) State the name of substance that will be collected in the filter paper.

(1)

……

c) State the technique that could be used to obtain the magnesium sulfate from the solution.

(1)

……

d) Salts vary in their solubility in water. Complete the table below to show which of the common salts are soluble and which are insoluble.

(4)

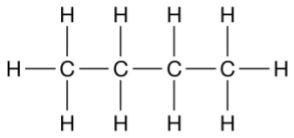
Name of salt	Soluble	Insoluble
Potassium nitrate		
Lead chloride		
Calcium carbonate		
Iron sulfate		

(Total for question 6 = 8 marks)

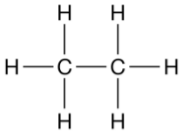
7 This question is about alkanes and alkenes.

a) Match each of the displayed diagrams to the correct hydrocarbon in the table.

(5)



A



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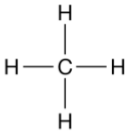

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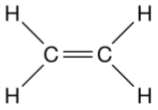
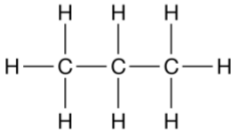


D



E

Hydrocarbon	Letter
Methane	
Ethane	
Ethene	
Propane	
Butane	

b) Identify which of the hydrocarbons named is question is the main component of natural gas.

(1)

……

c) Identify the letters showing the display formula of an alkene.

(1)

……

d) Give the molecular formula and the empirical formula of A.

(2)

Molecular formula ……

Structural formula ……

e) Pentane (C_5H_{12}) is an alkane which can be cracked to produce shorter chain hydrocarbons. Give the letters of the two hydrocarbons in the diagram that are produced when pentane is cracked.

(1)

……

f) Describe the conditions needed for the cracking of hydrocarbons to take place on an industrial scale.

(2)

……

……

g) The hydrocarbons A, B, C and E all form a homologous series - the alkanes. State what is meant by the term homologous series.

(2)

……
……

h) Give then general formula for an alkane.

(1)

……

(Total for question 7 = 15 marks)

8. This question is about reaction rates.

A student is using calcium carbonate to investigate the effect of changing the concentration of hydrochloric acid on the rate of reaction.

a) Name the type of reaction that takes place between calcium carbonate and hydrochloric acid.

(1)

……

The calcium carbonate the student will be using is in the form of marble chips.

b) Suggest two features of the chips the student must keep the same if they are going to conduct a valid investigation.

(2)

……
……
……

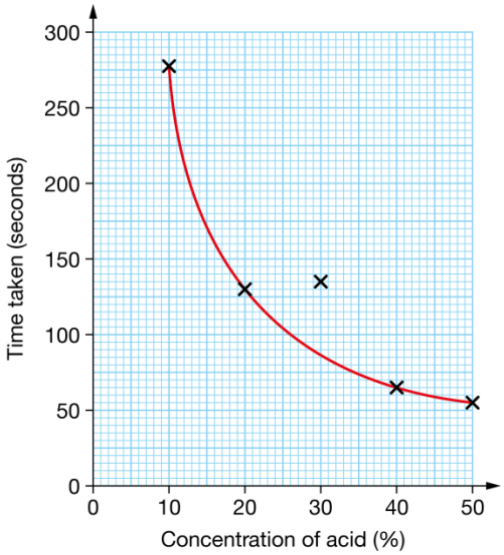
The student weighs the mass a conical flask with 100cm^3 of 50% hydrochloric acid.
They then weight the mass of the marble chips.
The conical flask is placed on a balance.
The student adds the marble chips to the conical flask and then records the time taken for the mass to decrease by 1g.

c) Suggest why the mass decreases.

(1)

……

d) The student repeated the experiment with hydrochloric acid at a number of different concentrations. Their results are shown on the graph below.



i) Using the graph estimate the time taken for 1g to be lost from the conical flask when the concentration of acid was 25%. You must show on the graph how you obtained your answer.

(2)

……

ii) One of the readings on the graph is anomalous. Put a circle around the anomalous reading.

(1)

e) Using the results of the experiment it is possible to calculate the rate of reaction using the formula:

$$\text{Rate of reaction in grams per second} = \frac{1}{\text{Time taken to lose 1g}}$$

Use the formula to calculate the rate of reaction for the 40% hydrochloric acid solution.

(2)

……grams per second

f) Explain, in terms of particles, why the reaction rate was faster when the concentration of acid was greater.

(3)

……
……
……
……

(Total for question 8 = 12 marks)

This question is about the element boron.

Use the words in the box to complete the sentences about boron.

(6)

The words may be used once, more than once or not used at all.

atom	neutral	neutrons	negative
protons	electrons	positive	ion

At the centre of a boron …… there is a nucleus. Inside the nucleus there are particles called …….. and…… . The type of particle in the nucleus that has a …….. charge is called a proton. Orbiting round the nucleus are another type of particle called electrons. The electrons orbit in shells and have a …….. charge. Boron does not have an overall charge because it has the same number of …… and electrons.

(Total for question 9 = 6 marks)

10 This question is about rusting.

a) Water must be present for iron to rust. State one other substance that must be present.

(1)

……

b) The chemical symbol for the product of rusting is Fe_2O_3.
Give the name of this compound.

(1)

……

c) A student conducted an experiment to see how rusting can be prevented. An iron nail was added to each test tube. The other contents of each tube were then added.

Tube	Contents of tube
X	Boiled water with a layer of oil on top
Y	Calcium chloride granules

Z	Sodium chloride solution

The tubes were then sealed with a rubber bung and left for 5 days.

i) State which tube you would expect to have rusted the most.

(1)

……

ii) State which tube did not have any water present.

(1)

……

iii) State which tube had very little oxygen present.

(1)

……

d) The student took a fourth nail. The nail did not rust at all after 5 days in a test tube with water. This iron nail was different to the others because it was coated in zinc. Name this type of rust protection and explain how it works.

(3)

……
……
……
……

e) Many methods of rust prevention work by creating a barrier between the metal and the oxygen in the atmosphere. For the examples below choose the most appropriate barrier from the box.

(3)

grease	paint	plastic	zinc	aluminium	oil

i) A radio mast ……..

ii) A motorcycle chain ……

iii) A garden chair ……

(Total for question 10 = 11 marks)

12. Zinc reacts with dilute hydrochloric acid. The equation for this reaction is:

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

a) 0.0850g of zinc was added to 50cm^3 of 0.500/ mol/dm^3 of hydrochloric acid.

Calculate the amount of zinc used, in moles.

(2)

Amount of zinc used= …… mol

b) Calculate the amount of HCl in the 50cm^3 of hydrochloric acid used, in moles.

(2)

Amount of HCl used= …… mol

c) One of the two reacts is in excess. Use your calculations from parts a & b to determine which reactant it is.

Show your reasoning.

(2)

(Total for question 9 = 6 marks)

Total for test = 110 marks

End of paper

Physics Paper 1 Exam Question – Forces

A car has a constant driving force of 30 000 N. It initially accelerates but eventually it reaches a constant speed. Explain why, if the driving force is constant, the car reaches a constant speed.

(4)

Student Response 1

The car drives off and accelerates. It then stops accelerating because of the air resistance becomes equal and the driver takes her foot off the pedal so it slows down to a constant speed.

Is this a good answer?

Student Response 1: Verdict

The car drives off and accelerates. It then stops accelerating because of the air resistance becomes equal and the driver takes her foot off the pedal so it slows down to a constant speed.

This answer is very basic and a little confused. The right idea is there but needs developing. This would be unlikely to score a mark.

Student Response 1: Improvements

The car drives off and accelerates**.**

The student needs to explain **why** the car accelerates as it states this in the question. What would this imply about the forces acting on the car?

It then stops accelerating because of the air resistance becomes equal…

This answer needs to be more detailed to score the marks available. The student needs to mention Newton's second law and what is happening to the resultant force.

…and the driver takes her foot off the pedal so it slows down to a constant speed.

This is not a valid point. The question states that the forward force from the engine remains constant.

Student Response 2

The forward force of the car initially causes an acceleration. As the car speeds up, the air resistance gets greater. This means the resultant force gets smaller.

Eventually, the forward force is equal and opposite to the resistive force so the resultant is zero. The car is at terminal velocity.

Is this a good answer?

Student Response 2: Commentary

The forward force of the car initially causes an acceleration.

The student could reference *F* = *ma* here to get the first mark.

As the car speeds up, the air resistance gets greater. [1]

This shows that the resistive forces are linked to speed.

This means the resultant force gets smaller.

A comment on the impact of the acceleration would be good here.

Eventually, the forward force is equal and opposite to the resistive force so the resultant is zero. [1]

Again, reference to *F* = *ma* would be relevant here.

The car is at terminal velocity. [1]