



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/21**

Paper 2 Multiple Choice (Extended)

**May/June 2019**

**45 minutes**

Additional Materials: Multiple Choice Answer Sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

\* 1 5 8 5 3 0 7 5 3 1 \*

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

**DO NOT WRITE IN ANY BARCODES.**

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 20.

Electronic calculators may be used.

This document consists of **17** printed pages and **3** blank pages.

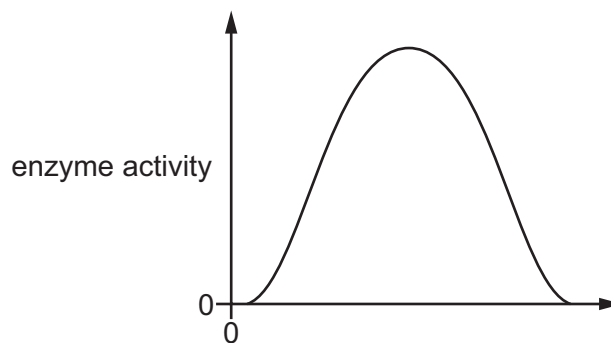
- 1 A student is reading a text book. He finds the following definition about how substances move in and out of cells.

The net movement of water molecules from a region of higher water potential to a region of lower water potential through a partially permeable membrane is called

The corner of the page has been torn.

What is the missing word at the end of the sentence?

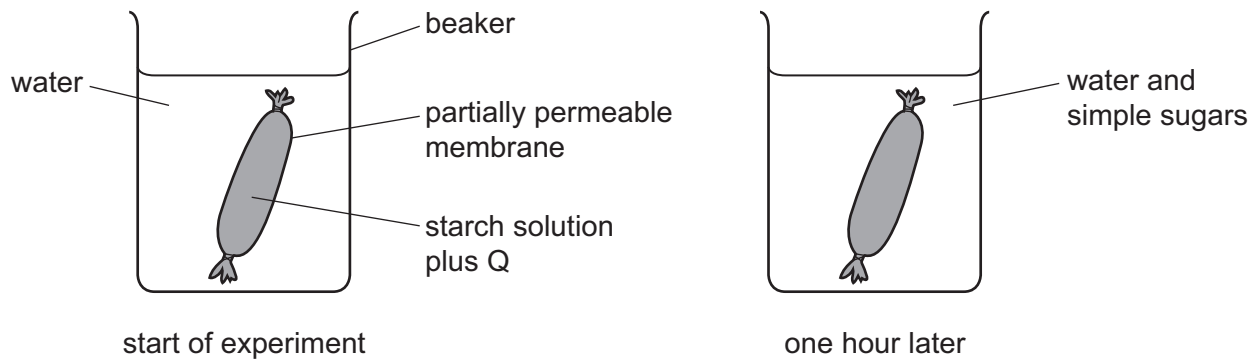
- A diffusion
  - B dissolving
  - C evaporation
  - D osmosis
- 2 The graph shows how the activity of an enzyme varies.



Which label for the x-axis of this graph is correct?

- A enzyme activity
  - B pH
  - C temperature
  - D time
- 3 What is defined as the breakdown of food into smaller pieces, without chemically changing the molecules?
- A absorption
  - B chemical digestion
  - C egestion
  - D mechanical digestion

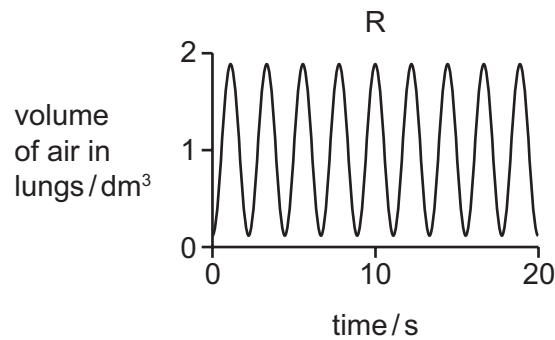
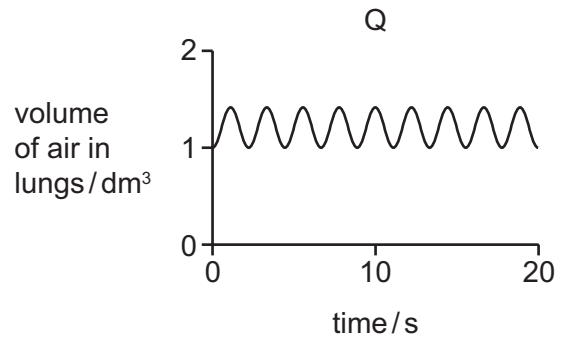
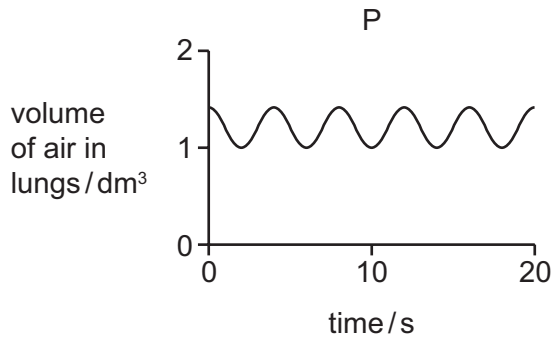
- 4 The diagram shows an experiment at the start and one hour later.



What is Q?

- A amylase
  - B lipase
  - C protease
  - D water
- 5 The rate of water absorption into a plant is increased by the large surface area of which type of cell?
- A mesophyll
  - B root cortex
  - C root hair
  - D xylem

- 6 The graphs P, Q and R show the changes in the volume of air in the lungs of the same person, measured after different levels of activities.



Which row shows the correct graph for each level of activity?

	at rest	immediately after 10 minutes of running	immediately after 10 minutes of walking
<b>A</b>	P	Q	R
<b>B</b>	P	R	Q
<b>C</b>	R	Q	P
<b>D</b>	R	P	Q

- 7 Which word equation represents aerobic respiration?

- A** carbon dioxide + glucose → oxygen + water
- B** glucose + oxygen → carbon dioxide + water
- C** oxygen + water → carbon dioxide + glucose
- D** water + carbon dioxide → glucose + oxygen

8 How does adrenaline affect blood glucose concentration and pulse rate?

	blood glucose concentration	pulse rate
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

9 Diagram 1 shows a germinating bean seed placed horizontally.

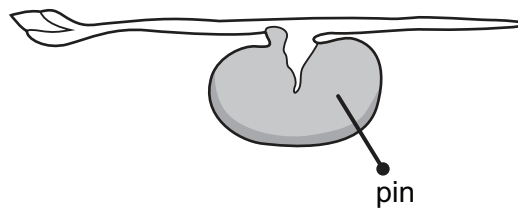


diagram 1

Diagram 2 shows the same seed after three days. The shoot has grown upwards because of the action of an auxin.

Where is the auxin produced?

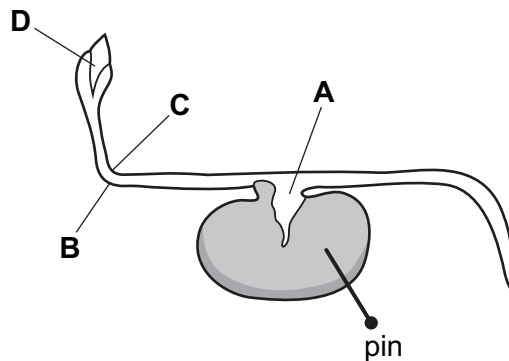
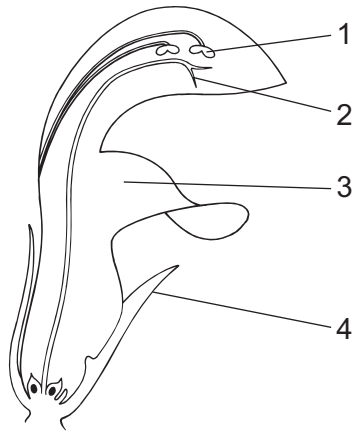


diagram 2

10 What are the features of sexual reproduction?

	fusion of nuclei	nature of offspring
<b>A</b>	no	genetically dissimilar
<b>B</b>	yes	genetically identical
<b>C</b>	no	genetically identical
<b>D</b>	yes	genetically dissimilar

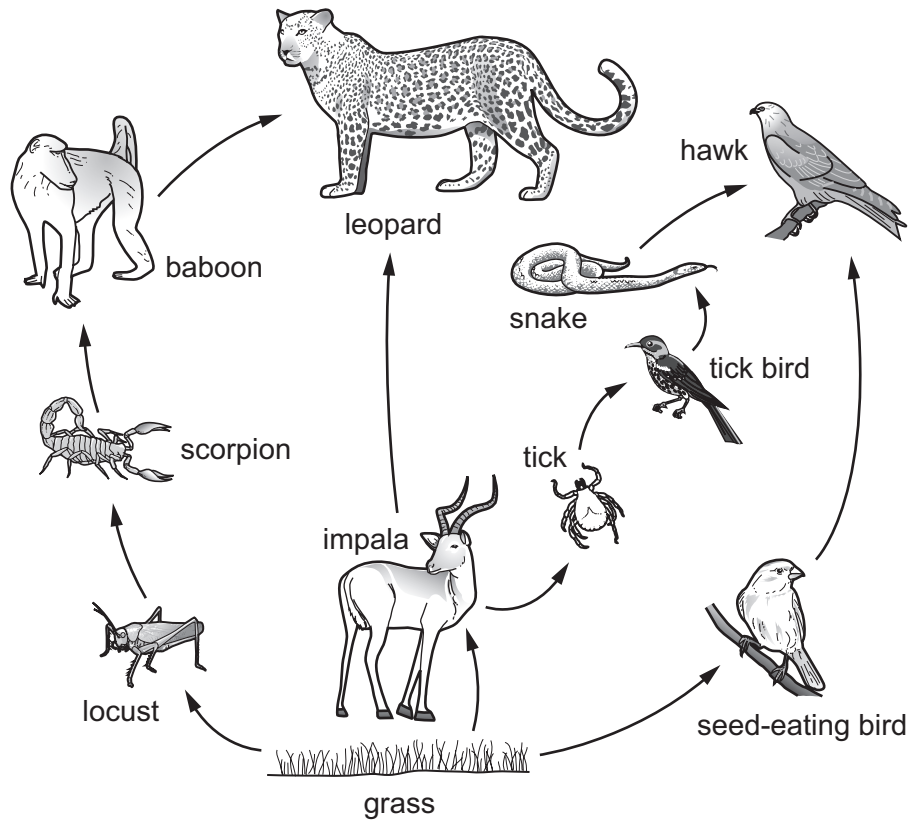
11 The diagram shows a section through an insect-pollinated flower.



Which labels are correct?

	anther	petal	sepal	stigma
<b>A</b>	1	3	4	2
<b>B</b>	1	4	3	2
<b>C</b>	2	3	4	1
<b>D</b>	2	4	3	1

12 The diagram shows a food web from the African grasslands.



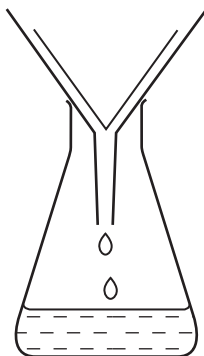
Which row correctly identifies the positions of the organisms in the food web?

	primary consumer	secondary consumer	tertiary consumer
<b>A</b>	grass	seed-eating bird	locust
<b>B</b>	impala	tick	leopard
<b>C</b>	locust	scorpion	tick bird
<b>D</b>	seed-eating bird	tick bird	baboon

13 Which changes to the composition of the atmosphere are caused by cutting down forests?

	carbon dioxide gas	oxygen gas
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

14 The diagram shows apparatus used for filtration.



Why can sugar and salt **not** be separated by using this apparatus?

- A They are both compounds.
- B They are both white.
- C They both dissolve in water.
- D They both have the same size particles.

15 Copper sulfate crystals dissolve in water.

Which word describes the role of the water?

- A filtrate
- B solute
- C solution
- D solvent

16 Magnesium chloride is an ionic compound.

Which row describes the formation of magnesium chloride and the strength of the attraction between its ions?

	formation of magnesium chloride	strength of the attraction between ions
A	electrons are shared between magnesium and chlorine	strong
B	electrons are shared between magnesium and chlorine	weak
C	electrons are transferred from magnesium to chlorine	strong
D	electrons are transferred from magnesium to chlorine	weak



17 Which process occurs at the anode during the electrolysis of concentrated aqueous sodium chloride?

- A Chloride ions lose electrons to form chlorine.
- B Hydrogen ions gain electrons to form hydrogen.
- C Oxide ions lose electrons to form oxygen.
- D Sodium ions gain electrons to form sodium.

18 When an excess of zinc is added to dilute hydrochloric acid, a gas is released.

Which pieces of apparatus are needed to investigate the rate of this reaction?

- 1 balance
- 2 gas syringe
- 3 stop watch
- 4 thermometer

- A 1 and 2      B 1 and 4      C 2 and 3      D 3 and 4

19 Calcium chloride is a soluble salt.

It is made by adding calcium carbonate to substance X.

Solid calcium chloride is obtained from the reaction mixture by process Y.

What are substance X and process Y?

	substance X	process Y
A	hydrochloric acid	crystallisation
B	hydrochloric acid	filtration
C	sodium chloride	crystallisation
D	sodium chloride	filtration

20 Which aqueous ion gives a white precipitate with aqueous sodium hydroxide and with aqueous ammonia?

- A  $\text{Cu}^{2+}$       B  $\text{Fe}^{2+}$       C  $\text{Fe}^{3+}$       D  $\text{Zn}^{2+}$

21 Which pair of substances react together?

- A bromine and potassium chloride
- B bromine and potassium iodide
- C iodine and potassium bromide
- D iodine and potassium chloride

22 Iron obtained from the blast furnace contains small amounts of carbon and silicon.

Which statement describes this iron?

- A It is a covalent compound.
- B It is an alloy.
- C It is an ionic compound.
- D It is slag.

23 P, Q, R and S are four metallic elements.

An atom of S forms an ion by losing only one electron.

When Q is added to a solution of  $R^{2+}$  ions, metal R is produced.

P reacts with cold water to form hydrogen.

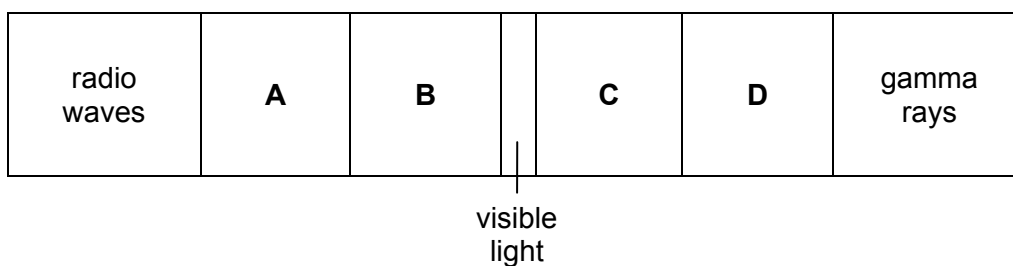
What are P, Q, R and S?

	P	Q	R	S
<b>A</b>	calcium	magnesium	copper	sodium
<b>B</b>	copper	magnesium	iron	potassium
<b>C</b>	potassium	copper	zinc	sodium
<b>D</b>	sodium	zinc	iron	magnesium

24 Which statement about water is **not** correct?

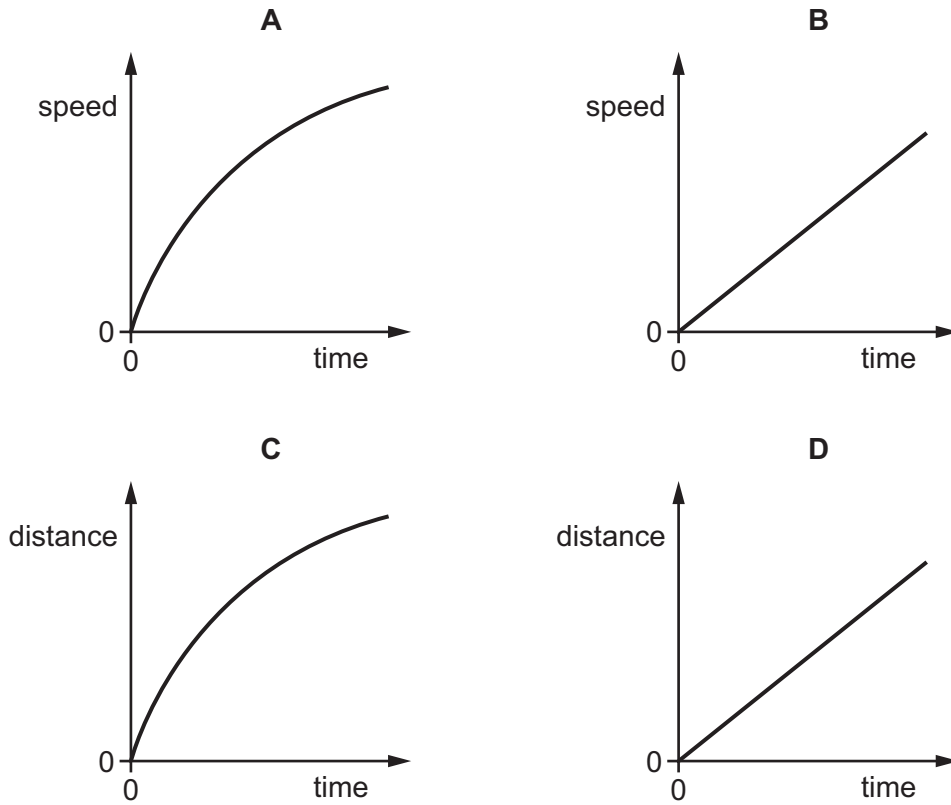
- A A water molecule consists of three atoms covalently bonded together.
- B The water supply is treated with chlorine to kill the bacteria in it.
- C Water changes the colour of cobalt chloride paper from blue to pink.
- D Water has a low melting point because covalent bonds are weak.

- 25 Which statement shows that petroleum is a mixture?
- A Petroleum can be burned as a fuel.
  - B Petroleum can be separated into fractions by distillation.
  - C Petroleum is a fossil fuel formed over millions of years.
  - D Petroleum is a thick, black liquid.
- 26 Which statement about alkanes is **not** correct?
- A Alkanes are unsaturated hydrocarbons.
  - B Alkanes burn to release heat energy.
  - C Alkanes form carbon dioxide and water when they burn.
  - D Alkane molecules contain only single bonds.
- 27 Which reaction equation represents cracking?
- A  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
  - B  $\text{C}_2\text{H}_4 + \text{Br}_2 \rightarrow \text{C}_2\text{H}_4\text{Br}_2$
  - C  $n\text{C}_2\text{H}_4 \rightarrow -(\text{C}_2\text{H}_2)_n$
  - D  $\text{C}_2\text{H}_6 \rightarrow \text{C}_2\text{H}_4 + \text{H}_2$
- 28 Which labelled part of the electromagnetic spectrum is often involved in thermal energy transfer by radiation?

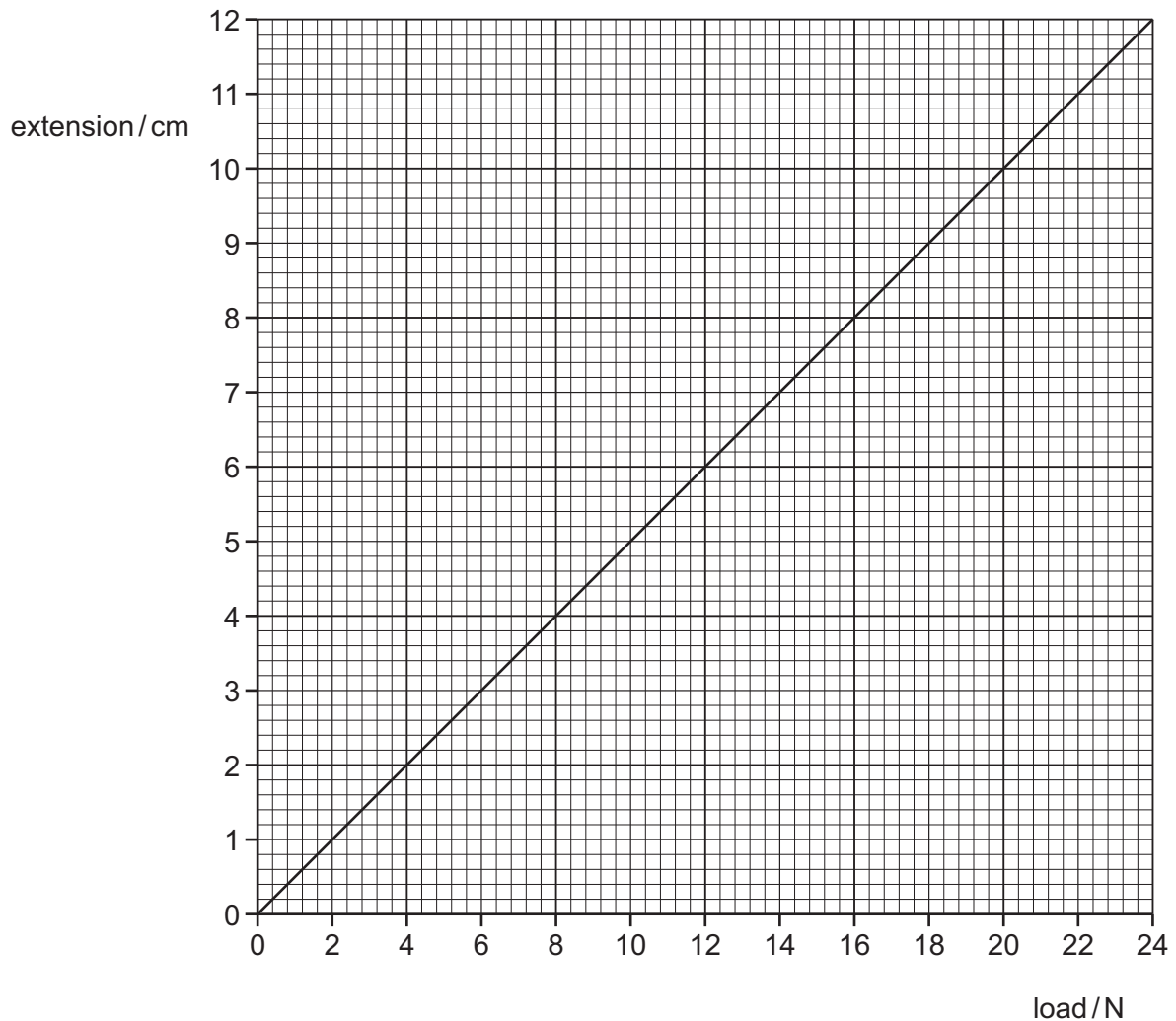


29 The diagrams show two speed–time graphs and two distance–time graphs.

Which graph represents the motion of a train with a positive acceleration that is **not** constant?



30 The diagram shows an extension-load graph for a spring.



The unstretched length of the spring is 10.0 cm.

What is the length of the spring when a load of 8.0 N is suspended from it?

- A** 4.0 cm      **B** 14.0 cm      **C** 16.0 cm      **D** 26.0 cm

31 Which statement describes the process of convection in a liquid?

- A** Heated liquid becomes less dense and falls.  
**B** Heated liquid becomes less dense and rises.  
**C** Heated liquid becomes more dense and falls.  
**D** Heated liquid becomes more dense and rises.

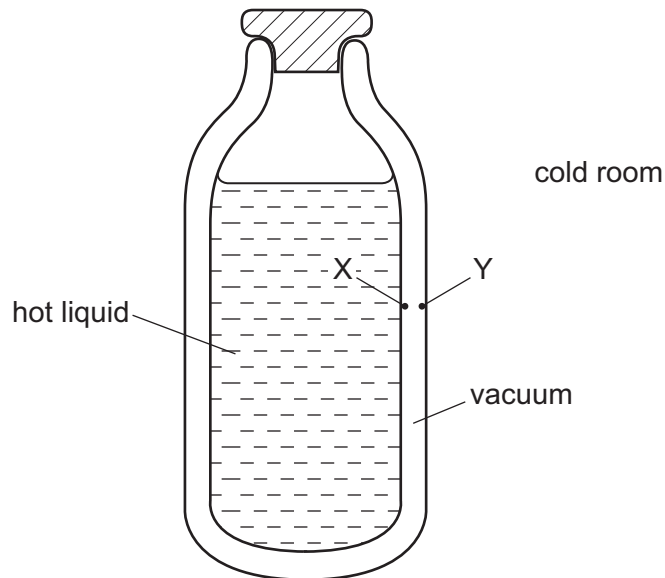
- 32** A balloon contains helium. The balloon is released and rises through the atmosphere. Its volume increases and the temperature of the helium inside it decreases.

What happens to the average distance between the helium molecules and what happens to their average speed?

	average distance between molecules	average speed of molecules
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

- 33** The diagram shows a vacuum flask containing a hot liquid in a cold room.

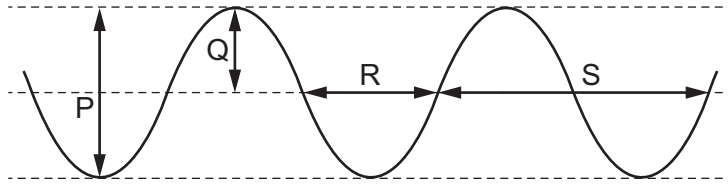
X and Y are points on the inside surfaces of the walls of the flask.



How is thermal energy transferred through the vacuum between X and Y?

- A** by conduction and convection
- B** by conduction only
- C** by radiation and convection
- D** by radiation only

34 The diagram represents a wave at one moment.



Which labelled arrows represent the amplitude and the wavelength of the wave?

	amplitude	wavelength
<b>A</b>	P	R
<b>B</b>	P	S
<b>C</b>	Q	R
<b>D</b>	Q	S

35 Which row describes what happens to sound waves as they travel from air into water, and from water into rock?

	sound travelling from air into water	sound travelling from water into rock
<b>A</b>	slows down	slows down
<b>B</b>	slows down	speeds up
<b>C</b>	speeds up	slows down
<b>D</b>	speeds up	speeds up

36 The amplitude of a sound wave decreases and its frequency increases.

What happens to the sound heard?

- A** It becomes louder and its pitch becomes higher.
- B** It becomes louder and its pitch becomes lower.
- C** It becomes quieter and its pitch becomes higher.
- D** It becomes quieter and its pitch becomes lower.

37 What is the unit of electric charge?

- A** ampere
- B** coulomb
- C** volt
- D** watt

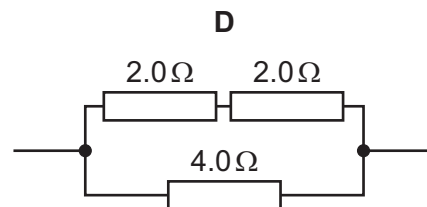
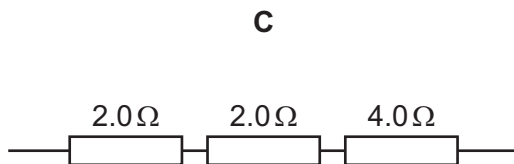
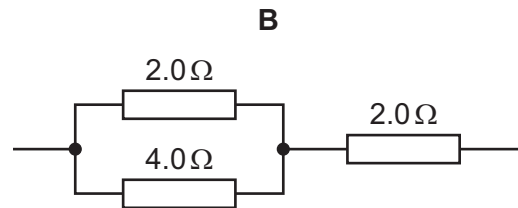
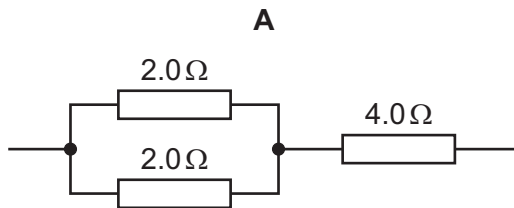
- 38 There is a current of 2.0 A in a resistor. The power produced in the resistor is 8.0 W.

What is the potential difference across the resistor?

- A 0.25 V      B 4.0 V      C 10 V      D 16 V

- 39 Three resistors, one of resistance  $4.0\ \Omega$  and two of resistance  $2.0\ \Omega$ , are connected in different arrangements.

Which arrangement has a total resistance of  $5.0\ \Omega$ ?



- 40 A mains circuit can safely supply a current of up to 40 A.

The current in a hairdryer is 2 A when it is operating normally. The hairdryer is connected to the mains by a lead which can safely carry up to 5 A.

What is the correct fuse to protect the hairdryer?

- A 1 A fuse  
 B 3 A fuse  
 C 10 A fuse  
 D 50 A fuse



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The Periodic Table of Elements

		Group																	
I	II	III	IV	V	VI	VII	VIII												
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20												
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40												
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84		
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131		
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —		
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —						

1  
**H**  
hydrogen  
1

**Key**  
atomic number  
atomic symbol  
name  
relative atomic mass

57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).