



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

**CO-ORDINATED SCIENCES**

**0654/22**

Paper 2 Multiple Choice (Extended)

**May/June 2018**

**45 minutes**

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

\* 5 2 1 0 9 6 7 2 4 9 \*



**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 **19** printed pages and **1** blank page.

1 Which rows correctly match characteristics of living things with their descriptions?

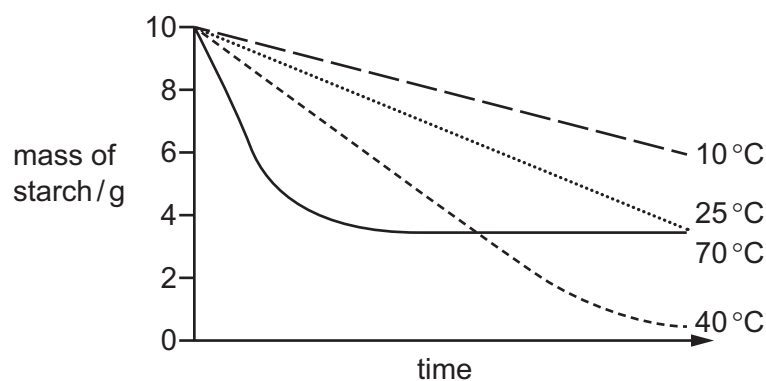
	characteristic	description
1	excretion	removing the waste products of metabolism
2	growth	making more living things of the same type
3	nutrition	taking in or producing food
4	respiration	releasing energy from food

**A** 1, 2 and 4      **B** 1, 3 and 4      **C** 1 and 3 only      **D** 2 and 4 only

2 Which statement about cells is correct?

- A** Cell membranes are found only in animal cells.
- B** Cell membranes are found only in plant cells.
- C** Cell walls are found only in animal cells.
- D** Cell walls are found only in plant cells.

3 The graph shows the rate at which 10g of starch is broken down by amylase at four temperatures.

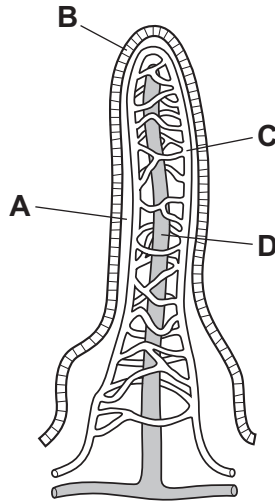


Which is the optimum temperature?

**A** 10°C      **B** 25°C      **C** 40°C      **D** 70°C

4 The diagram shows a section through a villus.

Which structure is the lacteal?



5 Which row shows the pressure of blood within vessels in the correct order?

	highest pressure	—————>	lowest pressure
<b>A</b>	aorta	pulmonary artery	pulmonary vein
<b>B</b>	aorta	pulmonary vein	pulmonary artery
<b>C</b>	pulmonary artery	pulmonary vein	aorta
<b>D</b>	pulmonary vein	aorta	pulmonary artery

6 How are alveoli protected from pathogens in inhaled air?

- A** Pathogens are destroyed by cilia.
- B** Pathogens are destroyed by mucus.
- C** Pathogens are trapped by cilia.
- D** Pathogens are trapped by mucus.

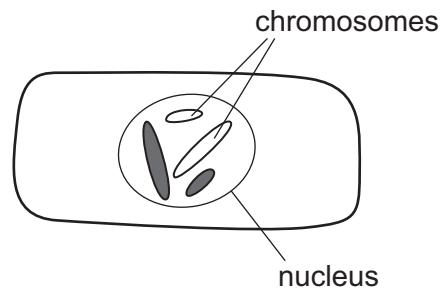
7 What happens when the human body temperature drops below normal?

	arterioles near skin surface	sweat secreted
<b>A</b>	constrict	no
<b>B</b>	constrict	yes
<b>C</b>	dilate	no
<b>D</b>	dilate	yes

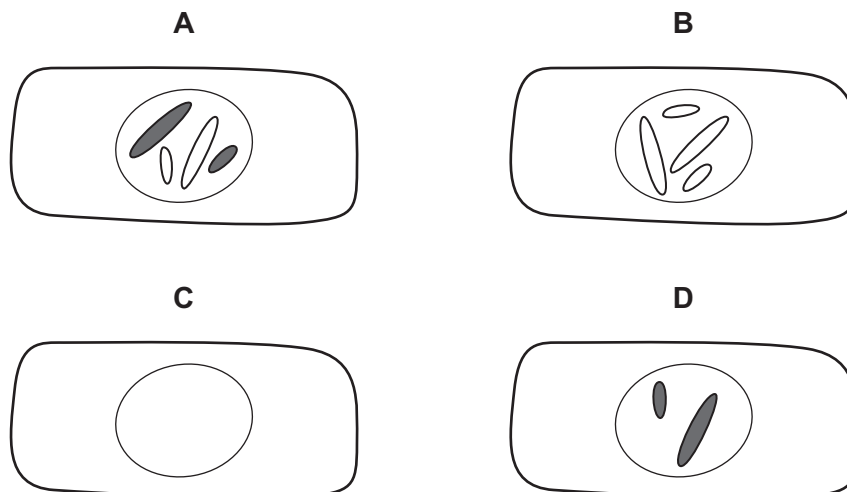
8 What is a function of the stigma of a flower?

- A to make female gametes
- B to make male gametes
- C to produce nectar to attract insects
- D to secrete a sugary solution to aid the germination of pollen grains

9 The diagram shows a cell that is about to divide by meiosis.



Which cell could be the result of this division?



10 Which row about types of cell division is correct?

	type of cell division	cells produced	genetic variation
<b>A</b>	meiosis	diploid	genetically different
<b>B</b>	meiosis	haploid	genetically identical
<b>C</b>	mitosis	diploid	genetically identical
<b>D</b>	mitosis	haploid	genetically different

11 What may cause continuous variation in a species and what may cause discontinuous variation?

	continuous variation		discontinuous variation	
	caused by genes	caused by environment	caused by genes	caused by environment
<b>A</b>	✓	✓	x	✓
<b>B</b>	✓	✓	✓	x
<b>C</b>	✓	x	✓	x
<b>D</b>	x	✓	x	✓

12 Which processes change the amount of carbon dioxide in the air?

	process causing increase in carbon dioxide	process causing decrease in carbon dioxide
<b>A</b>	burning fossil fuels	photosynthesis in plants
<b>B</b>	photosynthesis in plants	respiration in animals
<b>C</b>	respiration in animals	respiration in plants
<b>D</b>	respiration in plants	burning fossil fuels

13 What is a harmful effect of an increase in carbon dioxide in the atmosphere?

- A** It allows more heat from the Sun to enter the Earth's atmosphere.
- B** It decreases the rate at which organisms respire.
- C** It increases the rate at which plants photosynthesise.
- D** It prevents reflected heat from leaving the Earth's atmosphere.

- 14 Pure copper chloride can be obtained from a mixture of powdered copper and solid copper chloride.

Three stages in the method are listed.

P add water and stir

Q crystallise

R filter

In which order are these stages carried out in order to obtain pure copper chloride from the mixture?

A P → Q → R

B P → R → Q

C R → P → Q

D R → Q → P

- 15 Which statement about noble gases is correct?

A All noble gases have eight electrons in their outer shell.

B Argon is used to fill weather balloons.

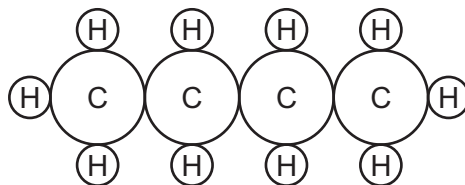
C Neon atoms have the same electronic structure as sodium ions.

D The element with atomic number 4 is a noble gas.

- 16 Which dot-and-cross diagrams represent the outer-shell electrons in molecules of nitrogen and of ethene?

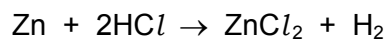
	nitrogen	ethene
<b>A</b>		
<b>B</b>		
<b>C</b>		
<b>D</b>		

- 17 The diagram represents a molecule of butane.



What is the formula of butane?

- A** C<sub>2</sub>H<sub>5</sub>      **B** C<sub>4</sub>H<sub>8</sub>      **C** C<sub>4</sub>H<sub>10</sub>      **D** C<sub>10</sub>H<sub>4</sub>
- 18 The equation for the reaction between zinc and dilute hydrochloric acid is



What is the volume of hydrogen gas produced by 3.25 g of zinc?

- A** 1.2 dm<sup>3</sup>      **B** 2.4 dm<sup>3</sup>      **C** 4.8 dm<sup>3</sup>      **D** 24.0 dm<sup>3</sup>

19 Which statement about electroplating iron with chromium is correct?

- A A catalyst is used.
- B The anode is chromium.
- C The electrolyte contains aqueous iron ions.
- D The electrolyte contains solid chromium ions.

20 Which row describes an endothermic reaction?

	energy transfer	temperature change /°C
<b>A</b>	chemical to heat	20 to 15
<b>B</b>	chemical to heat	20 to 25
<b>C</b>	heat to chemical	20 to 15
<b>D</b>	heat to chemical	20 to 25

21 Calcium carbonate reacts with dilute hydrochloric acid.

Equal masses of different-sized pieces of calcium carbonate are placed in four test-tubes, as shown.

test-tube	1	2	3	4
size of calcium carbonate	medium pieces	powder	small pieces	large pieces

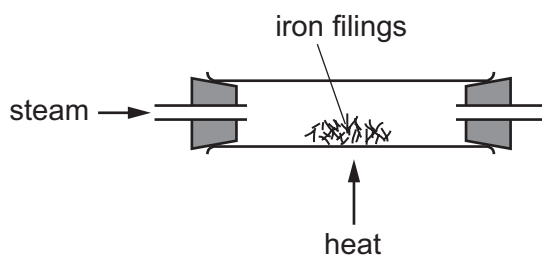
Equal volumes of the same concentration of dilute hydrochloric acid are added to each test-tube.

Which test-tube shows the lowest rate of reaction?

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



22 When iron is heated with steam, a black solid is formed.



The equation for the reaction is shown.



Which statement about this reaction is correct?

- A Iron has been oxidised because it has gained oxygen.
- B Iron has been reduced because it removed oxygen from water.
- C Iron oxide has been reduced because it contains oxygen.
- D Water has been oxidised because it contains oxygen.

23 Some properties of the Group VII elements are shown.

	melting point /°C	boiling point /°C	colour
F	-220	-188	pale green
Cl	-101	-35	
Br	-7	59	
I	114	184	
At	302	380	

Which statement about halogens at room temperature and pressure is correct?

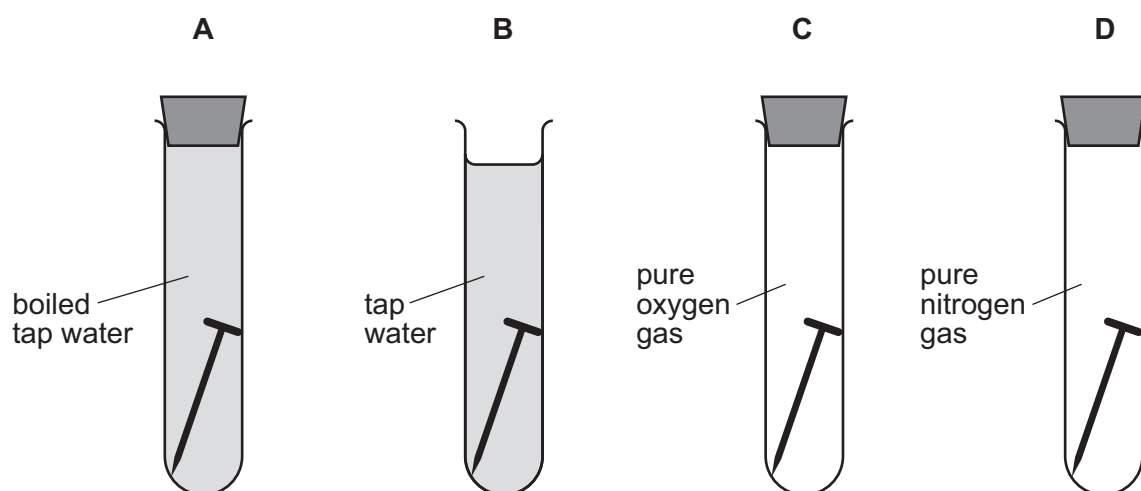
- A Astatine is a colourless solid.
- B Bromine is an orange-red solid.
- C Fluorine is a pale yellow gas.
- D Iodine is a brown liquid.

24 Which metal can **only** be extracted by electrolysis of a molten compound?

- A copper
- B iron
- C sodium
- D zinc

25 Four iron nails are placed in four test-tubes as shown.

In which test-tube does the iron nail rust most quickly?



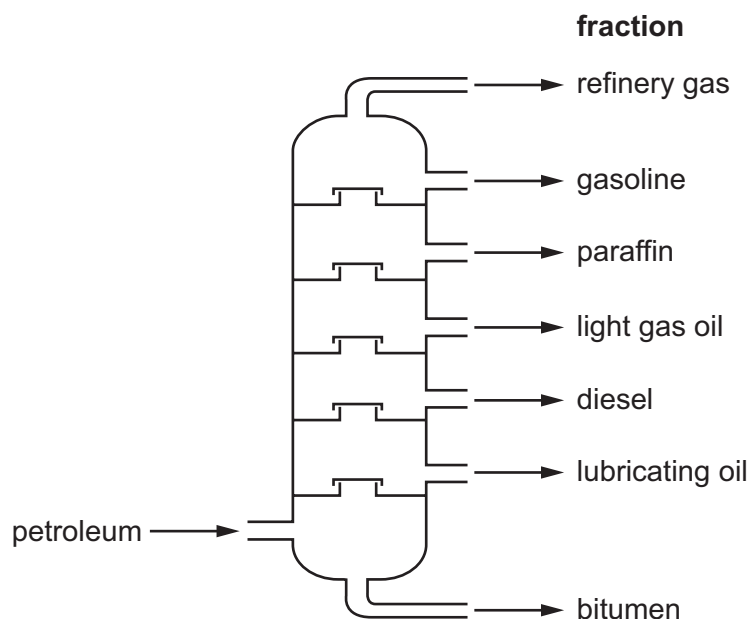
26 During the manufacture of sulfuric acid by the Contact process, sulfur trioxide is produced.

The sulfur trioxide is dissolved in concentrated sulfuric acid.

Which statement explains why sulfur trioxide is **not** dissolved in water?

- A The reaction is too endothermic.
- B The reaction is too exothermic.
- C The reaction is too slow.
- D The reaction needs a high pressure.

27 Petroleum is separated into fractions by fractional distillation.

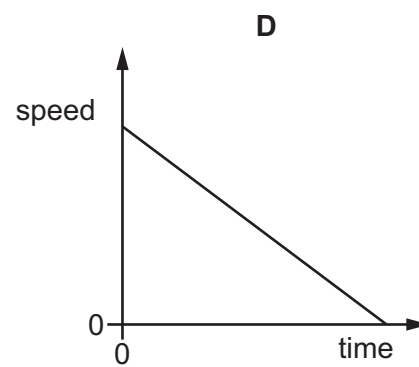
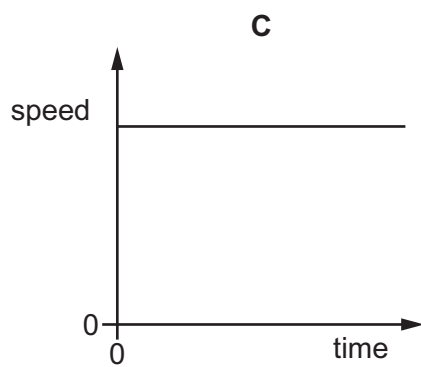
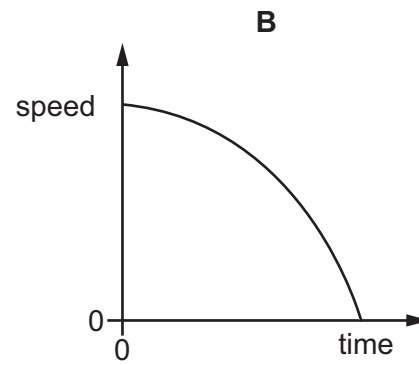
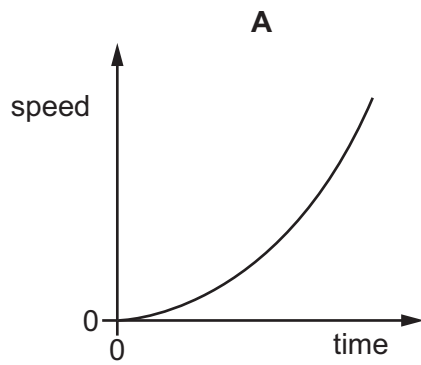


Which statement about the fractions is correct?

- A** The fraction at the bottom contains the molecules with the lowest boiling points.
- B** The fraction at the bottom contains the smallest molecules.
- C** The fraction at the top contains the molecules used for cracking.
- D** The fraction at the top contains the molecules with the weakest intermolecular attractive forces.

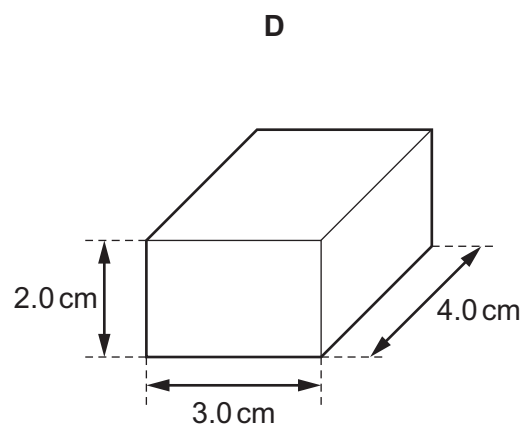
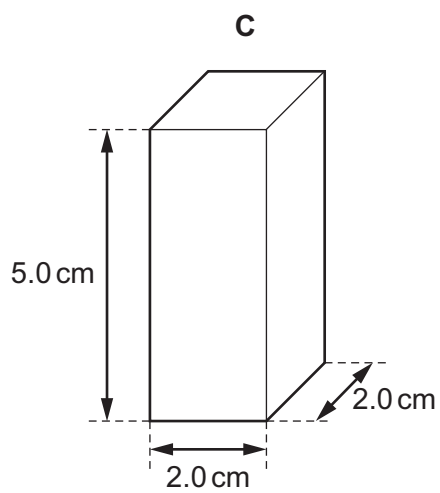
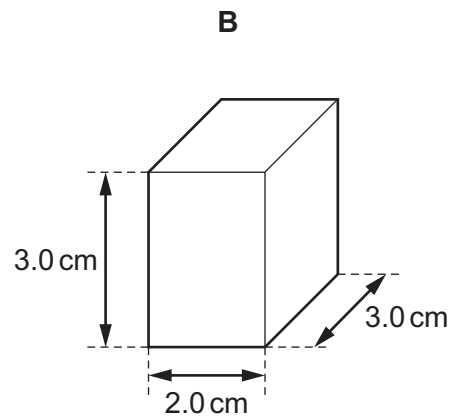
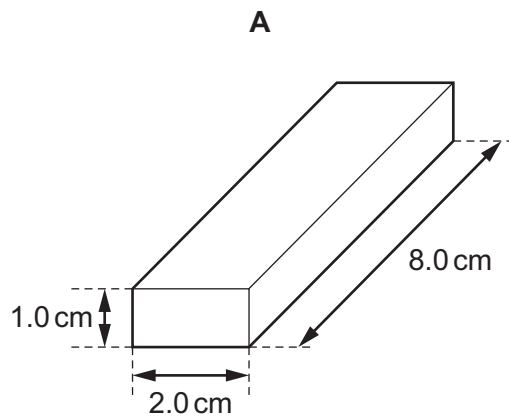
28 The diagrams show four speed-time graphs.

Which graph represents the motion of an object that has constant, non-zero, acceleration?

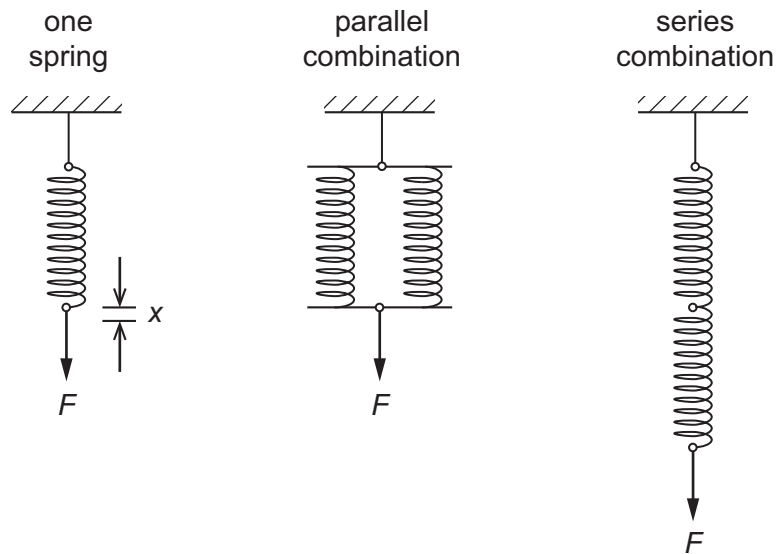


29 The diagrams show four solid blocks with the same mass.

Which block is made from the **least** dense material?



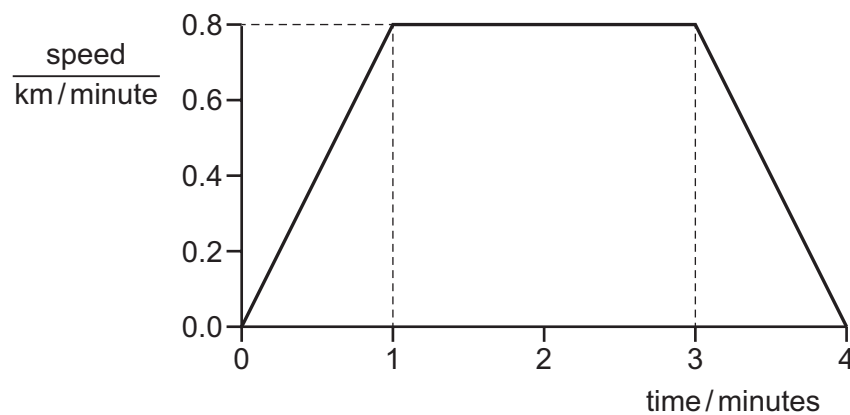
- 30 Each of the springs shown in the diagram has the same spring constant  $k$ . One spring extends by a distance  $x$  when a force  $F$  is applied to it.



What are the total extensions of the parallel and series combinations when a force  $F$  is applied to them?

	parallel	series
<b>A</b>	$\frac{x}{2}$	$x$
<b>B</b>	$\frac{x}{2}$	$2x$
<b>C</b>	$x$	$x$
<b>D</b>	$x$	$2x$

- 31 The speed-time graph represents the journey of a bicycle.

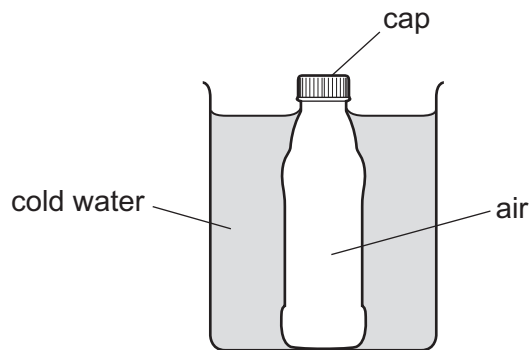


What is the total distance travelled by the bicycle?

- A** 1.6 km      **B** 2.0 km      **C** 2.4 km      **D** 3.2 km

- 32 Which energy resource does **not** use a turbine and generator to produce electricity?
- A geothermal
  - B nuclear fission
  - C solar cells
  - D wind

- 33 A glass bottle containing warm air is sealed with a screw cap and then cooled in cold water.



The contraction of the glass bottle can be ignored.

What remains the same during the cooling?

- A the air pressure inside the bottle
  - B the energy of the air molecules in the bottle
  - C the force on the cap made by the air molecules in the bottle
  - D the volume of air in the bottle
- 34 Which statement about boiling or evaporation of a liquid is correct?
- A Boiling occurs at any temperature.
  - B Boiling occurs only at the surface of the liquid.
  - C Evaporation occurs only at a specific temperature.
  - D Evaporation occurs only at the surface of the liquid.

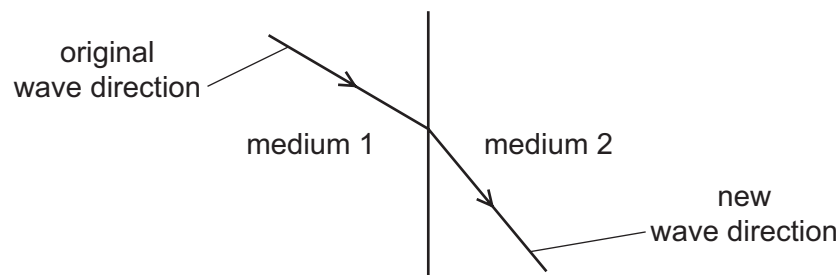
- 35 Four beakers contain the same amount of water. They are each wrapped tightly with aluminium foil of the same thickness, and placed in bright sunshine.

Each piece of foil is dull black, shiny black, dull white or shiny white.

After five minutes the temperature rise of the water in each beaker is measured.

The water in which beaker shows the greatest temperature rise?

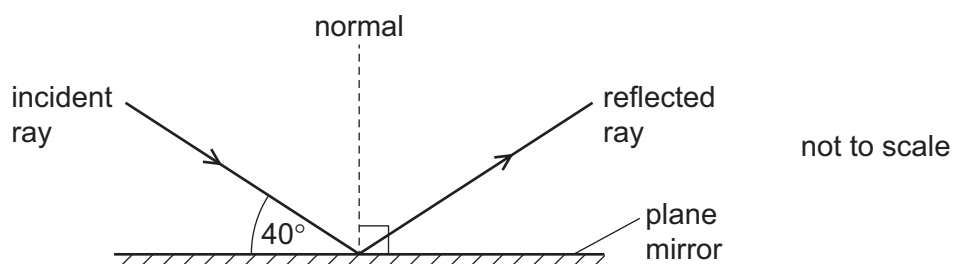
- A** the one wrapped with dull black foil  
**B** the one wrapped with shiny black foil  
**C** the one wrapped with dull white foil  
**D** the one wrapped with shiny white foil
- 36 A wave passes from medium 1 into medium 2. The diagram shows the change in direction of the wave.



How do the frequency and the wavelength of the wave change, if at all, as it passes from medium 1 into medium 2?

	frequency	wavelength
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	no change	decreases
<b>D</b>	no change	increases

- 37 The diagram shows light hitting a plane mirror.

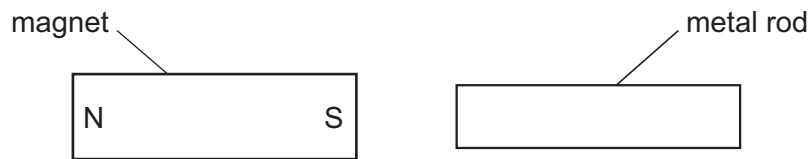


What is the angle of reflection?

- A**  $40^\circ$       **B**  $50^\circ$       **C**  $80^\circ$       **D**  $100^\circ$



- 38 A bar magnet is brought near to a metal rod.



The magnet is now turned around so that the N-pole is on the right. The magnet is again brought near to the metal rod.

In both cases the metal rod is attracted to the magnet.

What could the metal rod be?

- A another bar magnet
  - B a piece of aluminium
  - C a piece of copper
  - D a piece of iron
- 39 A circuit contains a battery, metal wires and a lamp. There is an electric current in the circuit. Electrons move from one battery terminal to the other battery terminal.

In which direction do electrons move around the circuit, and what is the equation relating charge  $Q$ , current  $I$  and time  $t$ ?

	direction of electrons	equation
<b>A</b>	from negative terminal to positive terminal	$Q = I \times t$
<b>B</b>	from negative terminal to positive terminal	$Q = \frac{I}{t}$
<b>C</b>	from positive terminal to negative terminal	$Q = I \times t$
<b>D</b>	from positive terminal to negative terminal	$Q = \frac{I}{t}$

- 40 The diagram shows  $\gamma$ -rays travelling in the direction shown. They enter a magnetic field that is directed into the page.



In which direction are the  $\gamma$ -rays deflected by the magnetic field, if at all?

- A They are deflected out of the page.
- B They are deflected towards the bottom of the page.
- C They are deflected towards the top of the page.
- D They are not deflected.

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## The Periodic Table of Elements

		Group																																																																																							
I	II	III	IV	V	VI	VII	VIII																																																																																		
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84																																																																				
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —	87 Fr francium —	88 Ra radium —	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Og oganeson —	117 Ts tennessine —	118 Og oganeson —																																																					
55 Cs caesium 133	56 Ba barium 137	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —	87 Fr francium —	88 Ra radium —	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Og oganeson —	117 Ts tennessine —	118 Og oganeson —																																																						
87 Fr francium —	88 Ra radium —	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Og oganeson —	117 Ts tennessine —	118 Og oganeson —																																																										
1 H hydrogen 1	2 He helium 4	3 Li lithium 7	4 Be beryllium 9	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	55 Cs caesium 133	56 Ba barium 137	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —	87 Fr francium —	88 Ra radium —	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Og oganeson —	117 Ts tennessine —	118 Og oganeson —

## Key

atomic number  
atomic symbol  
name  
relative atomic mass

lanthanoids

actinoids

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