



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education (9–1)

**CO-ORDINATED SCIENCES**

**0973/22**

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 1 2 2 0 1 6 6 9 5 \*

**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 Which characteristic of living organisms is correctly matched to the description?

	characteristic	description
<b>A</b>	excretion	the removal from organisms of the waste products of metabolism
<b>B</b>	nutrition	the chemical reactions in cells that break down nutrient molecules and release energy for metabolism
<b>C</b>	respiration	the taking in of materials for energy, growth and development
<b>D</b>	sensitivity	the action by an organism or part of an organism causing a change of position or place

2 When a plant cell is put into a solution which has a lower water potential than the cell, the cytoplasm can pull away from the cell wall.

What is the term for this?

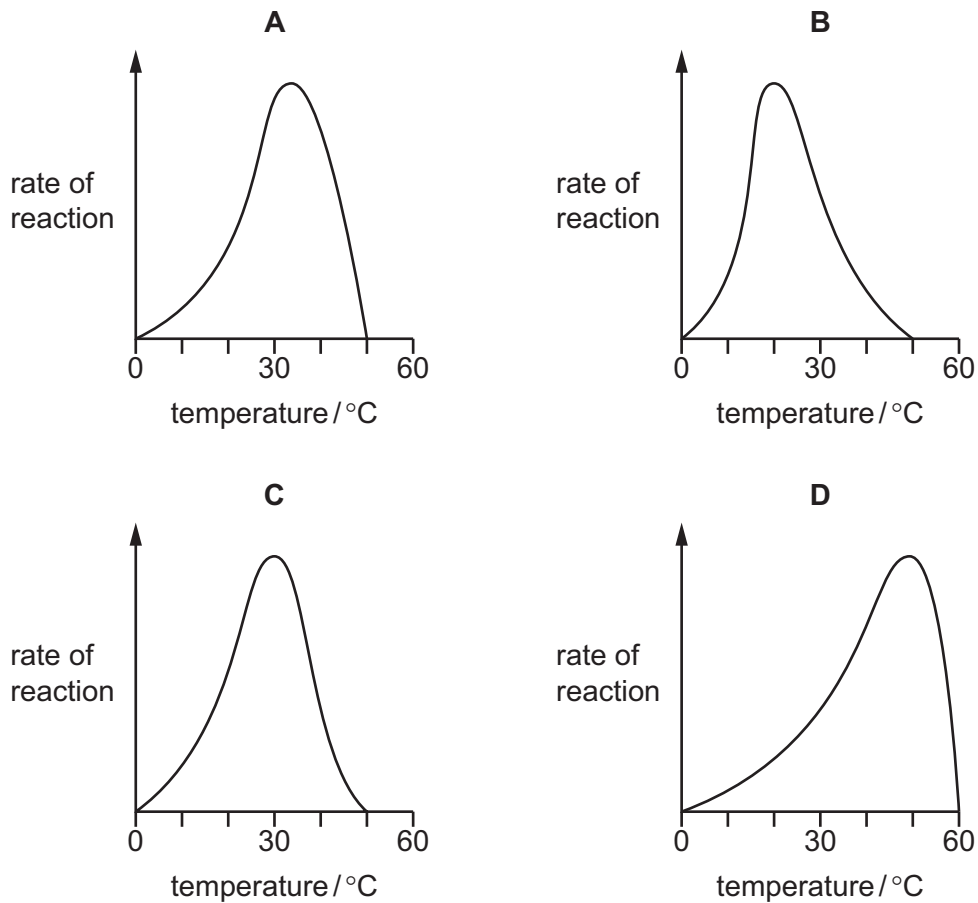
- A** flaccid
- B** plasmolysis
- C** turgid
- D** turgor pressure

3 Which chemical element is found in proteins, but **not** in carbohydrates or fats?

- A** carbon
- B** hydrogen
- C** oxygen
- D** nitrogen

4 The graphs show the possible effects of temperature on the rate of reaction of an enzyme.

Which graph is correct for a human enzyme?



5 What does chlorophyll enable plants to absorb?

- A carbon dioxide
- B energy from light
- C mineral salts
- D water

6 What is the correct definition of ingestion?

- A The breakdown of large, insoluble food molecules into small, water-soluble molecules.
- B The movement of digested food molecules through the wall of the small intestine into the blood.
- C The passing out of food that has not been digested, as faeces, through the anus.
- D The taking of substances into the body through the mouth.

7 Which row describes a part of the circulatory system in mammals?

	name of blood vessel	type of blood carried	coming from	going to
<b>A</b>	aorta	oxygenated	right ventricle	body
<b>B</b>	pulmonary artery	oxygenated	left ventricle	lungs
<b>C</b>	pulmonary vein	deoxygenated	lungs	left atrium
<b>D</b>	vena cava	deoxygenated	body	right atrium

8 After sprinting 200 metres as fast as possible, an athlete could not continue and was breathing deeply.

What had accumulated in her muscles?

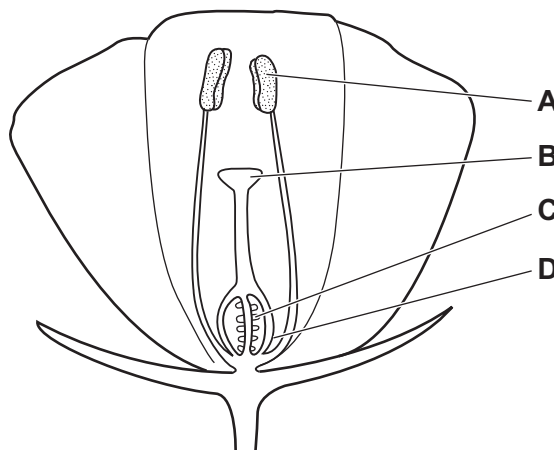
- A** alcohol
- B** carbon dioxide
- C** lactic acid
- D** water

9 What occurs when our eyes look from a near object in dim light to a distant object in bright light?

- A** Pupils constrict and lenses become thinner.
- B** Pupils constrict and lenses become fatter.
- C** Pupils dilate and lenses become thinner.
- D** Pupils dilate and lenses become fatter.

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

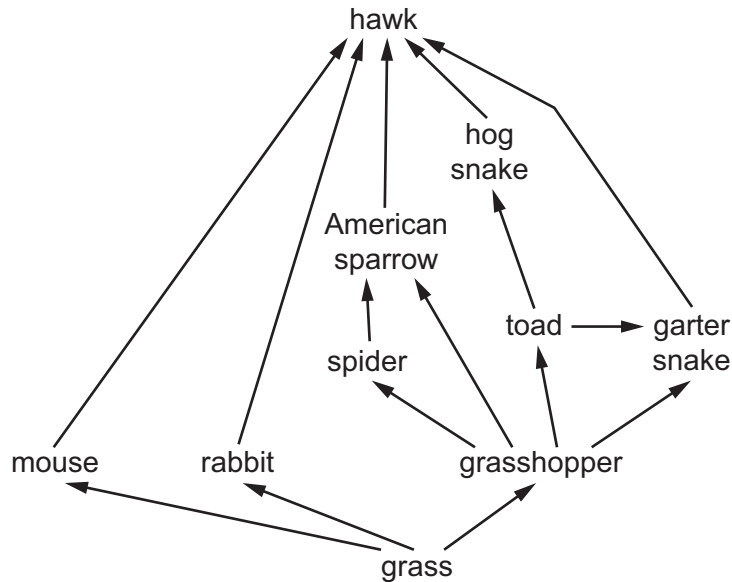
When pollination occurs, where must the pollen grains reach?



11 Which sex chromosomes need to be present in a sperm cell to produce a male zygote?

- A** X only      **B** Y only      **C** XX      **D** XY

12 The diagram shows a food web.



What is the maximum number of trophic levels shown?

- A** 3      **B** 4      **C** 5      **D** 10

13 One of the problems with the overuse of fertilisers is the eutrophication of lakes and rivers.

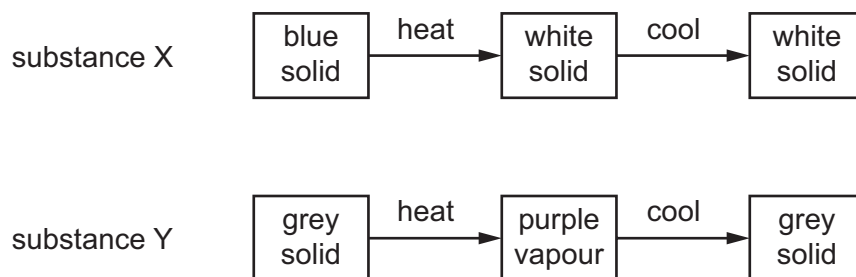
What effect does this have on the water?

	oxygen concentration	bacterial activity
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

14 Which process occurs when the arrangement of particles in a substance changes from regular to random?

- A** boiling  
**B** condensing  
**C** freezing  
**D** melting

- 15 Two substances, X and Y, are heated and then cooled. The observations are shown.



Which type of change occurs when X and Y are heated?

	X	Y
<b>A</b>	chemical	chemical
<b>B</b>	chemical	physical
<b>C</b>	physical	chemical
<b>D</b>	physical	physical

- 16 Diamond and graphite are different forms of the element carbon.

Graphite conducts electricity.

Which statement explains why diamond does **not** conduct electricity?

- A** All of the atoms in diamond are arranged tetrahedrally.
- B** All of the bond lengths in diamond are the same.
- C** All of the bonds in diamond are single bonds.
- D** All of the outer shell electrons in diamond are held in covalent bonds.
- 17 The concentration of a sample of dilute sulfuric acid,  $\text{H}_2\text{SO}_4$ , is  $0.01 \text{ mol/dm}^3$ .

What is the mass of sulfuric acid in  $1 \text{ dm}^3$  of the sample?

- A** 0.49 g      **B** 4.9 g      **C** 0.98 g      **D** 9.8 g

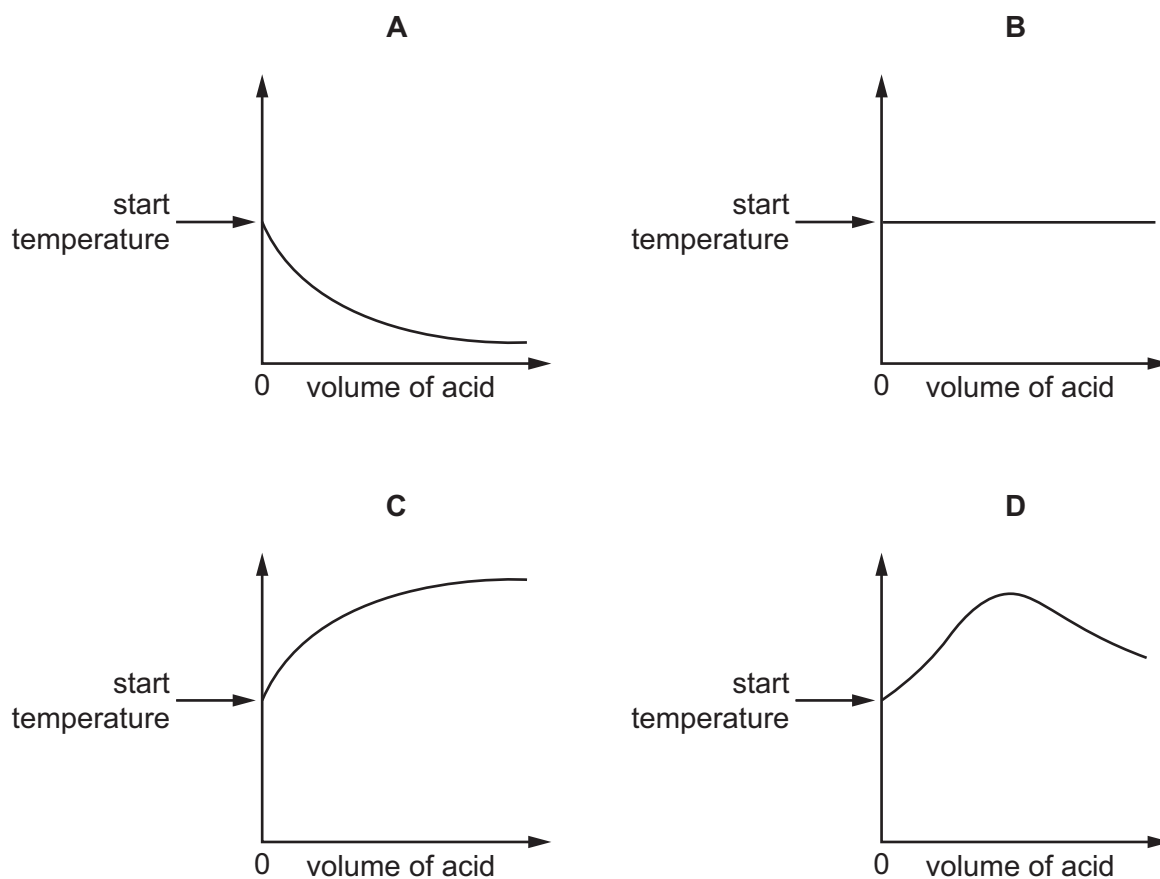
- 18 Which row identifies the products of the electrolysis of the named electrolyte using carbon electrodes?

	electrolyte	product at anode	product at cathode
<b>A</b>	aqueous copper(II) sulfate	oxygen	copper
<b>B</b>	concentrated aqueous sodium chloride	chlorine	sodium
<b>C</b>	dilute sulfuric acid	hydrogen	oxygen
<b>D</b>	molten potassium bromide	potassium	bromine

- 19 An acid is added to an alkali until the final solution is **just** neutral.

The reaction is exothermic.

Which graph shows how the temperature changes as the acid is being added to the alkali?



- 20** Which statement explains why increasing the concentration of a reactant increases the rate of reaction?
- A** A greater proportion of colliding particles possess activation energy.
  - B** The activation energy is lowered.
  - C** The reactant particles collide faster.
  - D** The reactant particles collide more frequently.
- 21** Hydrochloric acid and sodium hydroxide neutralise each other to form water and sodium chloride.
- Which method is used to make the solution crystallise?
- A** chromatography
  - B** evaporation
  - C** filtration
  - D** fractional distillation
- 22** What do elements in the same group in the Periodic Table have in common?
- A** number of electron shells
  - B** number of electrons in the outer shell
  - C** number of nucleons in the nucleus
  - D** proton number
- 23** Which statement describes the properties of solid metals?
- A** They are brittle and good thermal conductors.
  - B** They are brittle and poor thermal conductors.
  - C** They are malleable and good thermal conductors.
  - D** They are malleable and poor thermal conductors.

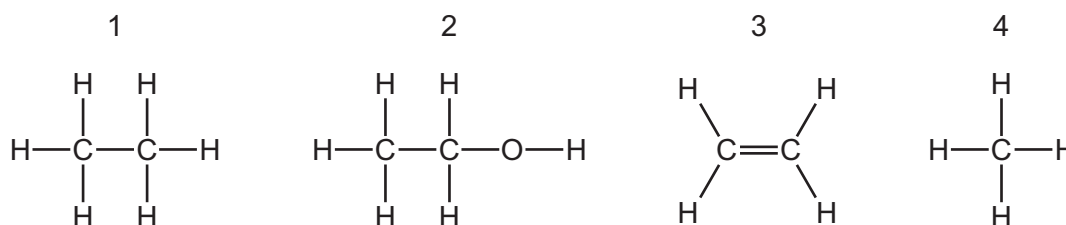


24 Sulfur dioxide, nitrogen monoxide and carbon monoxide are common pollutants in air.

Which row shows a method of reducing the emissions of these pollutants into the air?

	sulfur dioxide	nitrogen monoxide	carbon monoxide
<b>A</b>	using low sulfur petrol	using a catalytic converter	using a catalytic converter
<b>B</b>	using calcium oxide in a gas flue	using calcium oxide in a gas flue	using a catalytic converter
<b>C</b>	using calcium oxide in a gas flue	using a catalytic converter	using calcium oxide in a gas flue
<b>D</b>	using a catalytic converter	using calcium oxide in a gas flue	using calcium oxide in a gas flue

25 The structures of four compounds are shown.



What are the names of the compounds?

	1	2	3	4
<b>A</b>	ethane	ethanol	ethene	methane
<b>B</b>	ethene	methane	ethanol	ethane
<b>C</b>	ethene	methane	ethane	ethanol
<b>D</b>	methane	ethene	ethane	ethanol

- 26 Fractional distillation separates petroleum into useful fractions.

Fraction L has a lower boiling point than fraction H.

Which row describes the size of molecules and the attractive forces between molecules in fractions L and H?

	size of molecules	attractive forces between molecules
<b>A</b>	L larger than H	L greater than H
<b>B</b>	L larger than H	L less than H
<b>C</b>	L smaller than H	L less than H
<b>D</b>	L smaller than H	L greater than H

- 27 Compound X is the monomer in an addition polymerisation reaction.

Which statement describes a molecule of X?

- A** It has an acidic end and basic end.  
**B** It has two acidic ends.  
**C** It is a long chain molecule with a high molecular mass.  
**D** It is an alkene.
- 28 A spring that obeys Hooke's law has an unstretched length of 5.0 cm. A load of weight 0.50 N is hung from the spring and the length of the spring becomes 10.0 cm.

The load is replaced with a new load and the length of the spring becomes 15.0 cm.

The spring has not passed its limit of proportionality.

What is the weight of the new load?

- A** 0.50 N      **B** 0.75 N      **C** 1.0 N      **D** 1.5 N
- 29 An object X with mass 2.0 kg is moving with a speed of 4.0 m/s.

Which object has kinetic energy equal to that of object X?

	mass of object / kg	<u>speed of object</u> m/s
<b>A</b>	0.50	16
<b>B</b>	1.0	8.0
<b>C</b>	8.0	2.0
<b>D</b>	16	1.0

30 For which list is the Sun the original source of the energy for **all** of the energy resources?

- A coal, geothermal and wind
- B coal, hydroelectric and nuclear fission
- C hydroelectric, oil and wind
- D oil, geothermal and nuclear fission

31 When equal masses of solids, liquids and gases are heated equally, they expand by different amounts.

Which list shows the relative order of the magnitudes of the expansion, starting with the state of matter that expands the least?

- A gas, liquid, solid
- B liquid, gas, solid
- C liquid, solid, gas
- D solid, liquid, gas

32 Diagram 1 represents a wave.

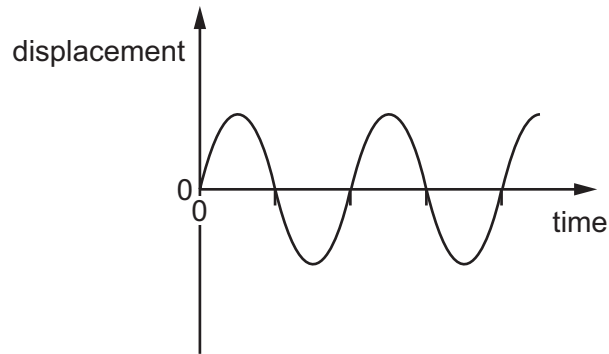
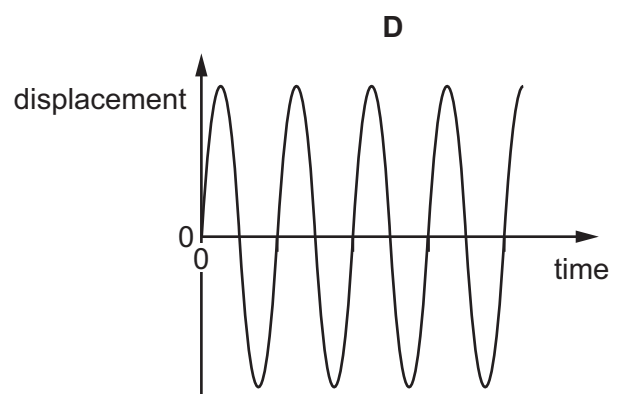
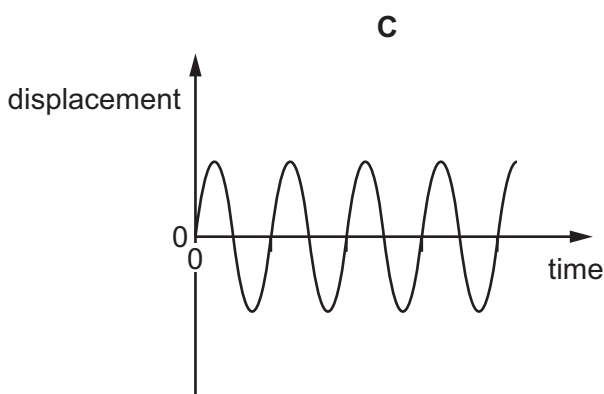
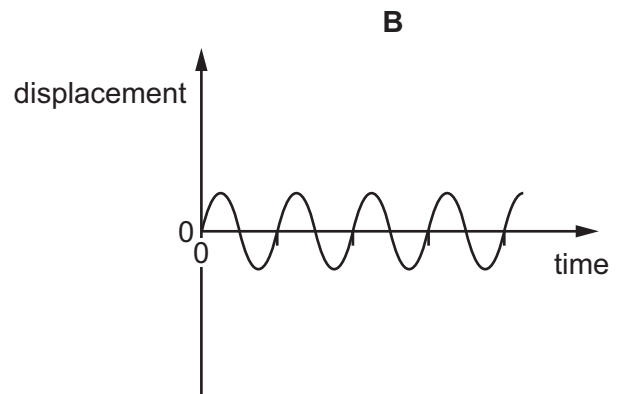
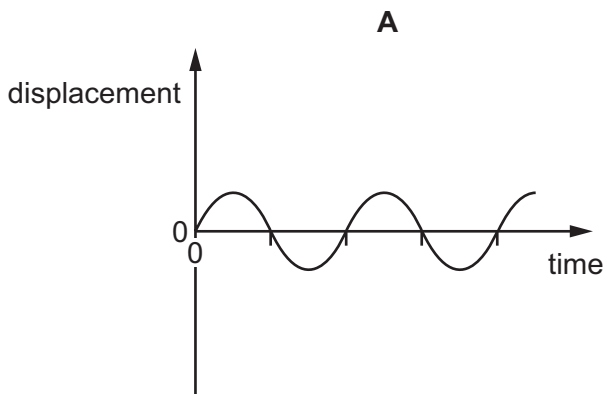


diagram 1

Which diagram represents a wave with twice the frequency and half the amplitude of the wave in diagram 1?

The scales are the same in all the diagrams.



33 A student stands in front of a plane mirror on a wall.

Which statement about the image of the student is **not** correct?

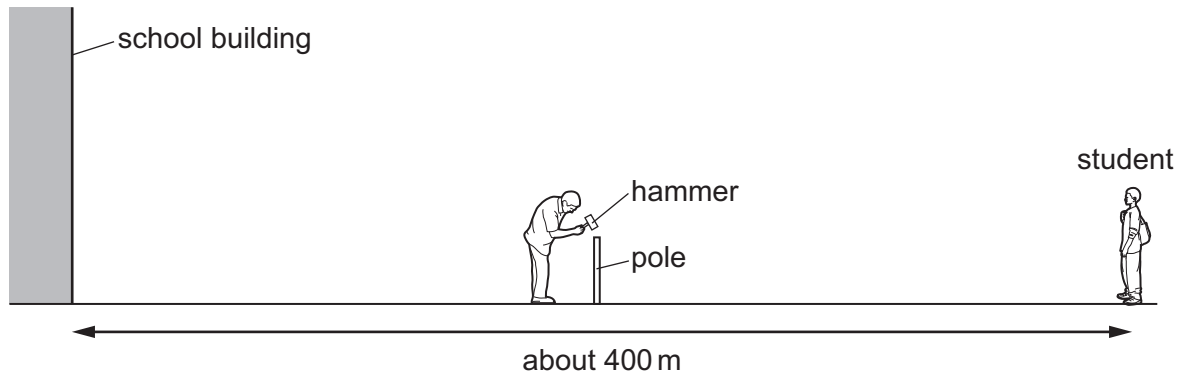
- A** The image is laterally inverted.
- B** The image is smaller than the student.
- C** The image is upright.
- D** The student and the image are equal distances from the mirror.

34 There is a current of 3.0 A in a resistor.

How much electric charge passes through the resistor in 2.0 minutes?

- A 0.025 C      B 1.5 C      C 6.0 C      D 360 C

35 A sports field is next to a large school building. A student at the far side of the sports field sees a groundsman hit a pole with a hammer.

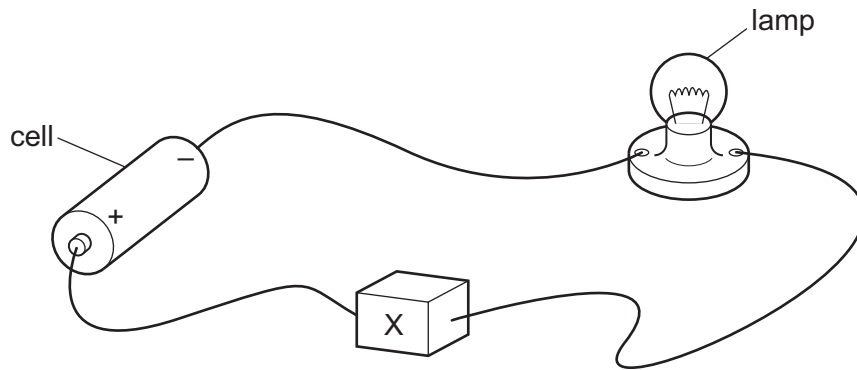


After the hammer hits the pole, the student hears two bangs.

Why does the student hear two bangs?

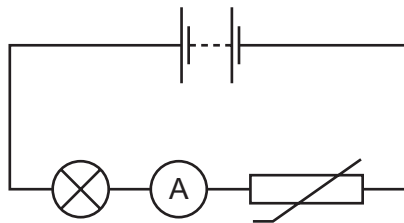
	first bang caused by	second bang caused by
<b>A</b>	sound of hammer hitting pole	sound of pole hitting hammer
<b>B</b>	sound reaching the student's left ear	sound reaching the student's right ear
<b>C</b>	sound reaching student directly	sound reflected back from school building
<b>D</b>	sound reflected back from school building	sound reaching student directly

- 36 In the circuit, component X is used to control the brightness of the lamp.



What is component X?

- A an ammeter
  - B a fixed resistor
  - C a fuse
  - D a variable resistor
- 37 A circuit contains a power supply, a lamp, an ammeter and a NTC thermistor, connected in series.

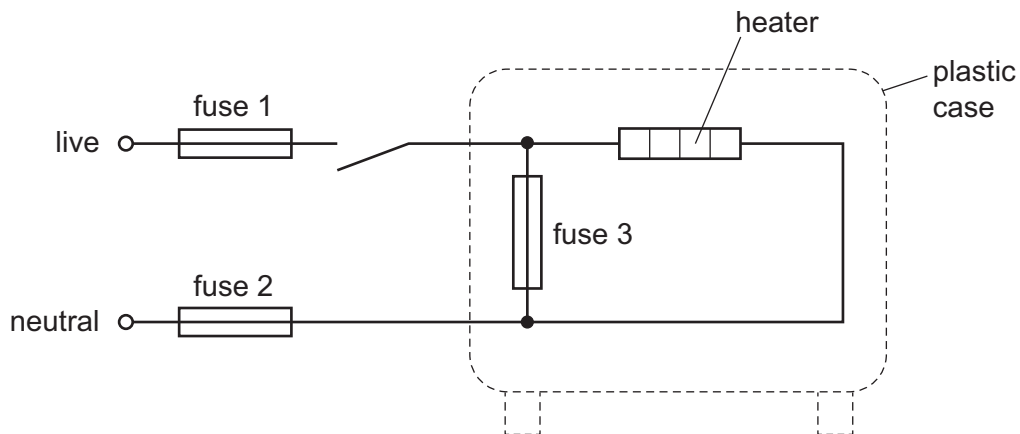


The NTC thermistor is now heated.

What happens to the brightness of the lamp and what happens to the ammeter reading?

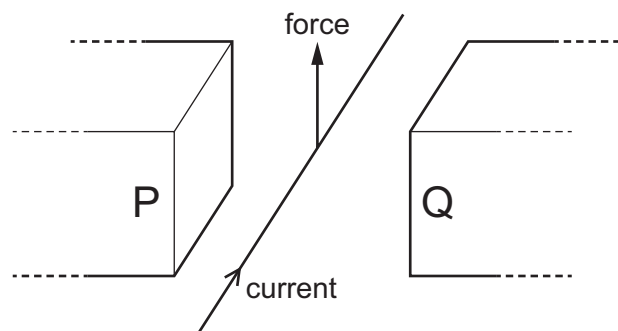
	brightness of lamp	ammeter reading
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

38 The diagram shows the connections to an electric heater. The circuit includes three fuses.



Which of the fuses are correctly placed?

- A fuse 1, fuse 2 and fuse 3
  - B fuse 1 and fuse 2 only
  - C fuse 1 only
  - D fuse 2 only
- 39 A current-carrying wire is placed between the poles P and Q of a magnet, as shown.



The direction of the current is shown.

A force acts on the wire in the upward direction as shown.

What is the direction of the magnetic field?

- A from P to Q
- B from Q to P
- C towards the bottom of the page
- D towards the top of the page

- 40** The output from the generator in a power station is connected to a transformer before electricity is sent along a transmission cable.

Why is a transformer used?

- A** to decrease the voltage and decrease the current
- B** to decrease the voltage and increase the current
- C** to increase the voltage and decrease the current
- D** to increase the voltage and increase the current



**BLANK PAGE**

**BLANK PAGE**

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

## 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	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	2 He helium 4					
19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	2 He helium 4	10 Ne neon 20	18 Ar argon 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
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
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 —
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 —	114 Fl flerovium —	116 Lv livermorium —				

## Key

atomic number  
atomic symbol  
name  
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	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 —

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