



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 |
|----------|----------------|--|
| A | excretion | the removal from organisms of the waste products of metabolism |
| B | nutrition | the chemical reactions in cells that break down nutrient molecules and release energy for metabolism |
| C | respiration | the taking in of materials for energy, growth and development |
| D | 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?

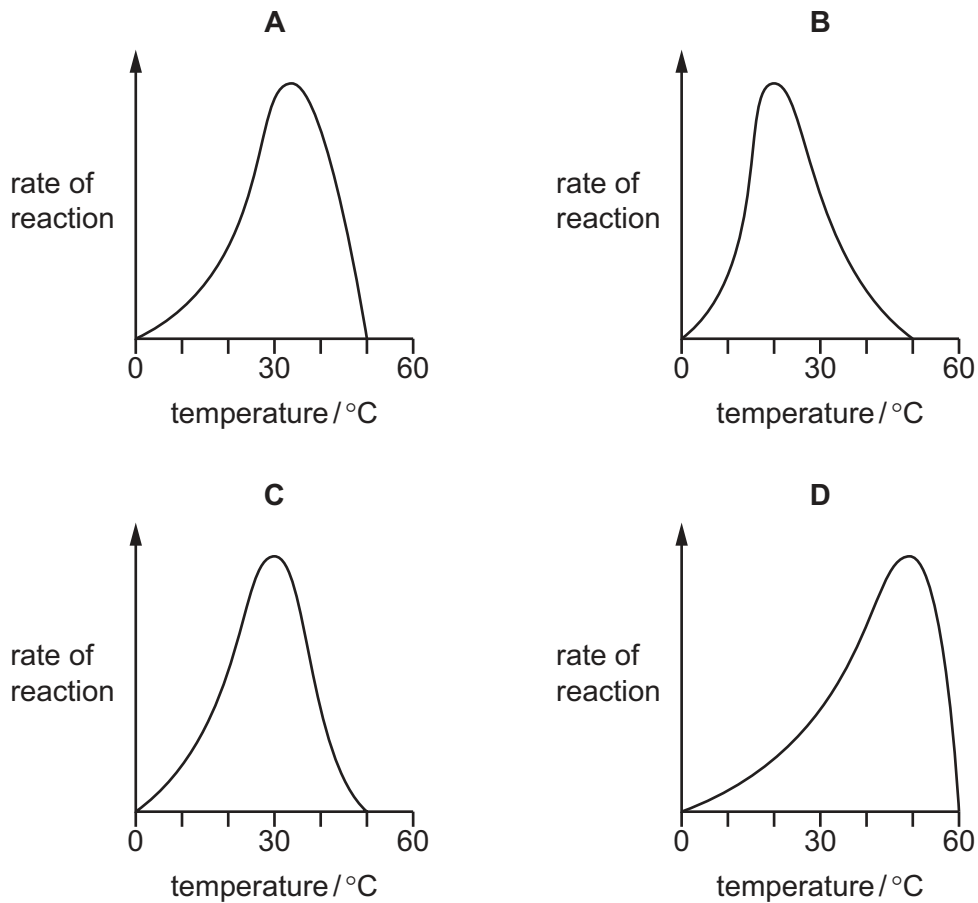
- A** flaccid
- B** plasmolysis
- C** turgid
- D** turgor pressure

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 |
|----------|----------------------|-----------------------|-----------------|--------------|
| A | aorta | oxygenated | right ventricle | body |
| B | pulmonary artery | oxygenated | left ventricle | lungs |
| C | pulmonary vein | deoxygenated | lungs | left atrium |
| D | 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?

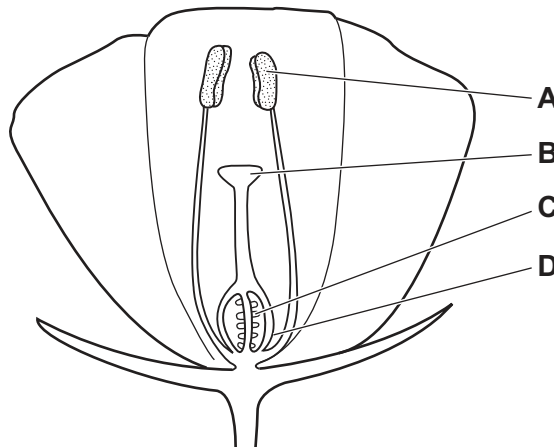
- A** alcohol
- B** carbon dioxide
- C** lactic acid
- D** water

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.

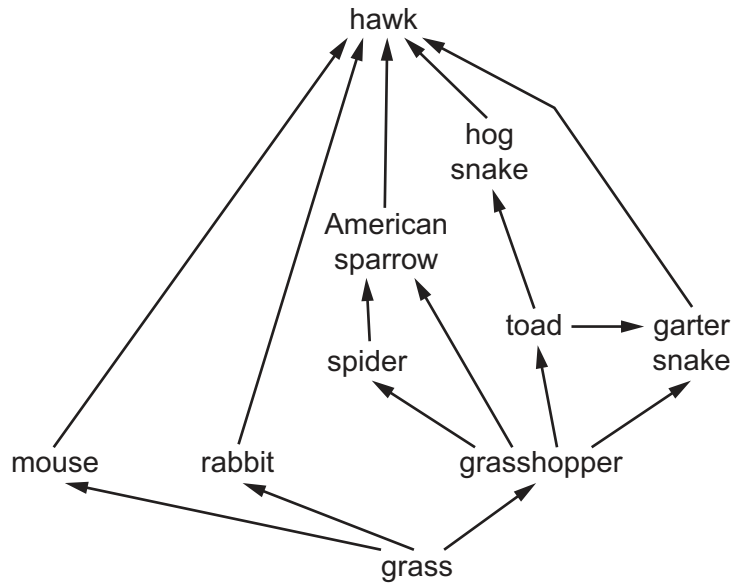
When pollination occurs, where must the pollen grains reach?



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.

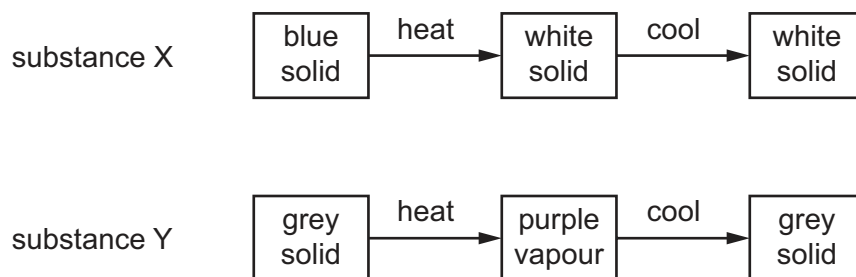
What effect does this have on the water?

| | oxygen concentration | bacterial activity |
|----------|----------------------|--------------------|
| A | decreases | decreases |
| B | decreases | increases |
| C | increases | decreases |
| D | 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 |
|----------|----------|----------|
| A | chemical | chemical |
| B | chemical | physical |
| C | physical | chemical |
| D | 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, H_2SO_4 , is 0.01 mol/dm^3 .

What is the mass of sulfuric acid in 1 dm^3 of the sample?

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

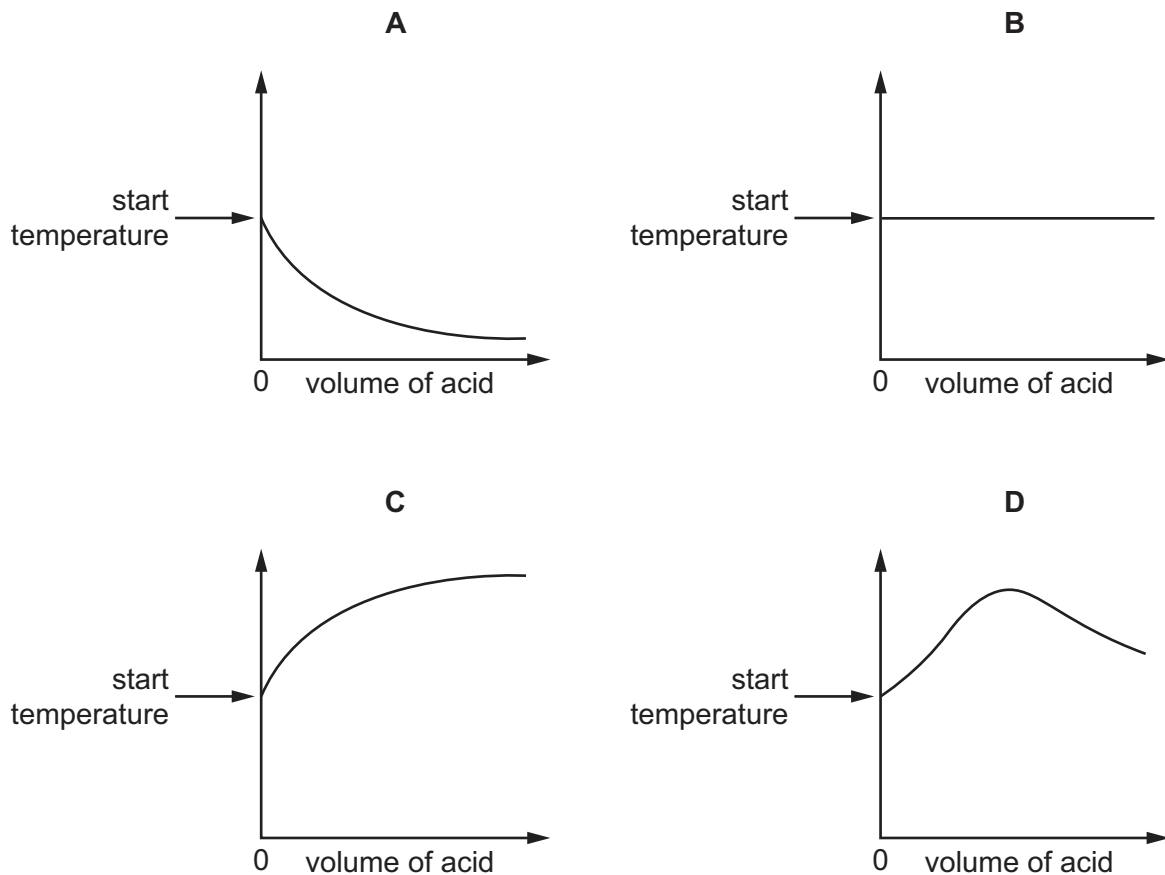
- 18 Which row identifies the products of the electrolysis of the named electrolyte using carbon electrodes?

| | electrolyte | product at anode | product at cathode |
|----------|--------------------------------------|------------------|--------------------|
| A | aqueous copper(II) sulfate | oxygen | copper |
| B | concentrated aqueous sodium chloride | chlorine | sodium |
| C | dilute sulfuric acid | hydrogen | oxygen |
| D | 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?



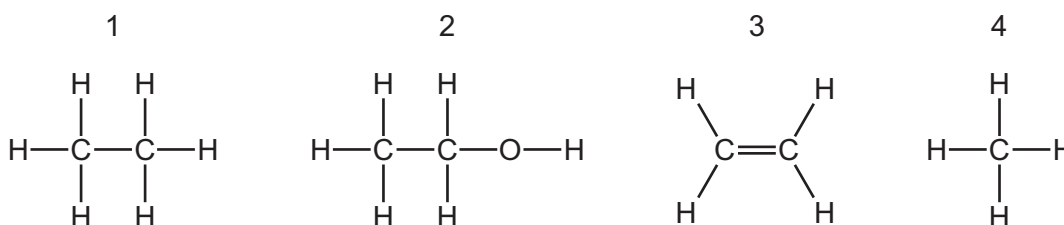
- 20** Which statement explains why increasing the concentration of a reactant increases the rate of reaction?
- A** A greater proportion of colliding particles possess activation energy.
 - B** The activation energy is lowered.
 - C** The reactant particles collide faster.
 - D** The reactant particles 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 |
|----------|-----------------------------------|-----------------------------------|-----------------------------------|
| A | using low sulfur petrol | using a catalytic converter | using a catalytic converter |
| B | using calcium oxide in a gas flue | using calcium oxide in a gas flue | using a catalytic converter |
| C | using calcium oxide in a gas flue | using a catalytic converter | using calcium oxide in a gas flue |
| D | 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 |
|----------|---------|---------|---------|---------|
| A | ethane | ethanol | ethene | methane |
| B | ethene | methane | ethanol | ethane |
| C | ethene | methane | ethane | ethanol |
| D | 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 |
|----------|-------------------|-------------------------------------|
| A | L larger than H | L greater than H |
| B | L larger than H | L less than H |
| C | L smaller than H | L less than H |
| D | 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 |
|----------|---------------------|-------------------------------|
| A | 0.50 | 16 |
| B | 1.0 | 8.0 |
| C | 8.0 | 2.0 |
| D | 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.

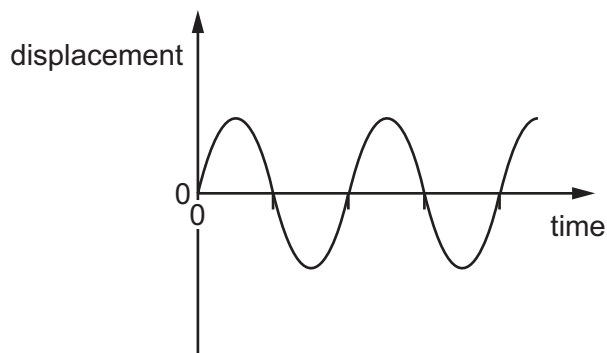
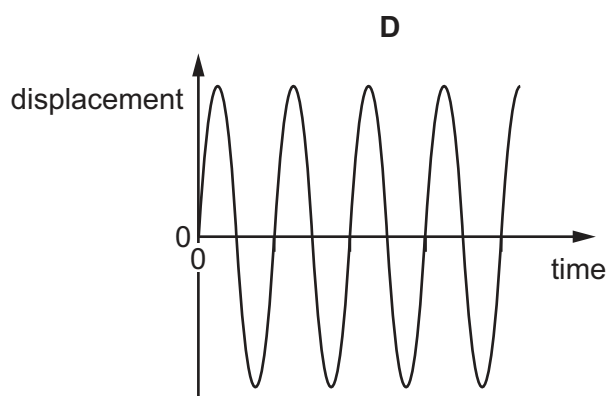
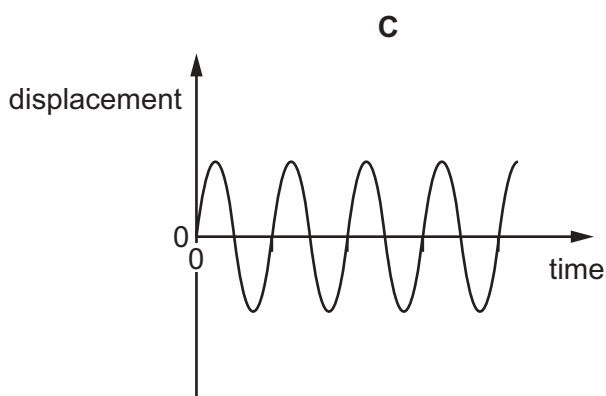
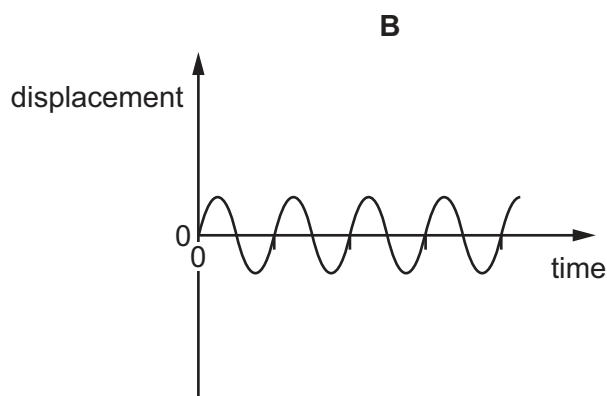
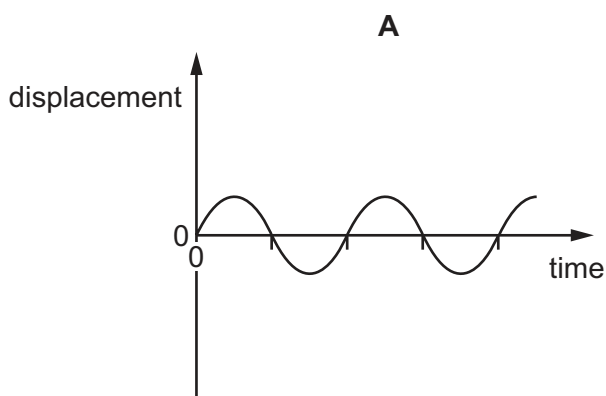


diagram 1

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?

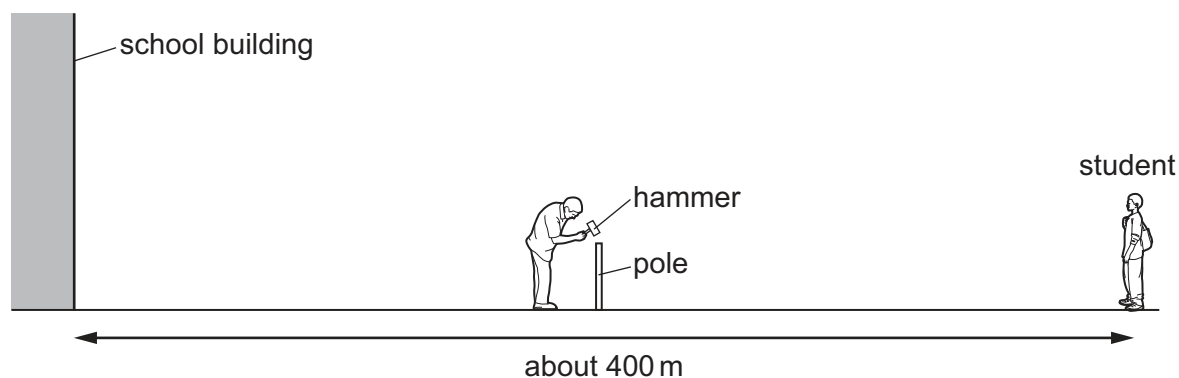
- A** The image is laterally inverted.
- B** The image is smaller than the student.
- C** The image is upright.
- D** The student and the image are equal distances from the mirror.

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.

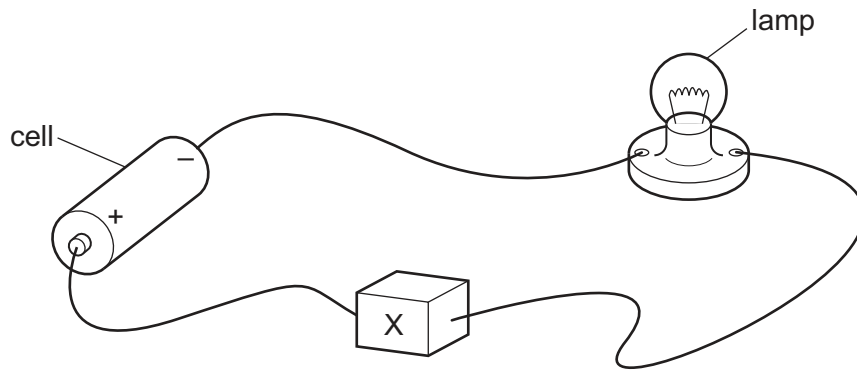


After the hammer hits the pole, the student hears two bangs.

Why does the student hear two bangs?

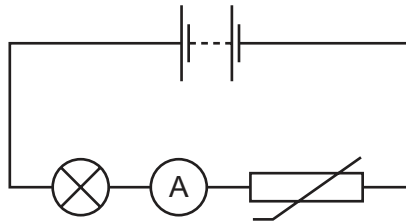
| | first bang caused by | second bang caused by |
|----------|---|---|
| A | sound of hammer hitting pole | sound of pole hitting hammer |
| B | sound reaching the student's left ear | sound reaching the student's right ear |
| C | sound reaching student directly | sound reflected back from school building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

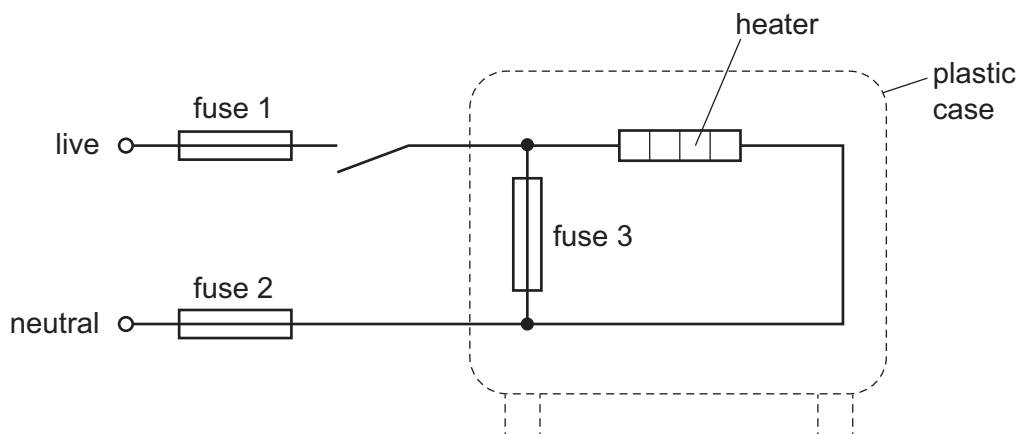


The NTC thermistor is now heated.

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

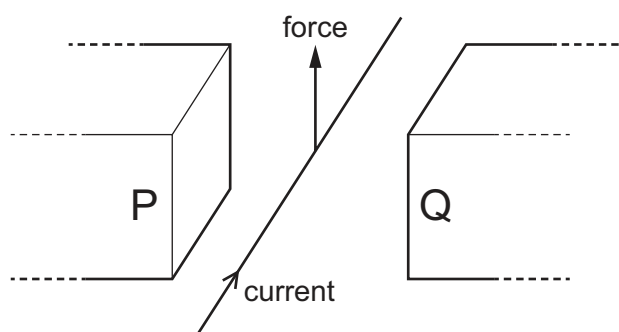
| | brightness of lamp | ammeter reading |
|---|--------------------|-----------------|
| A | decreases | decreases |
| B | decreases | increases |
| C | increases | decreases |
| D | increases | increases |

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

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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 | 1 H hydrogen 1 | 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 | Key atomic number atomic symbol name relative atomic mass | | 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 — | 114 Fl flerovium — | 116 Lv livermorium — | 118 Og oganeson — | 119 Uue unbinetium — | 120 Uuo unbinetium — | 121 Uuq unbinetium — | 122 Uub unbinetium — |

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 |
| 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 — |

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).