



# Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/12

Paper 1 Multiple Choice (Core)

February/March 2022

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

## INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

## INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **20** pages. Any blank pages are indicated.



1 Which processes occur in **both** animals **and** plants?

	excretion	movement	respiration
<b>A</b>	✓	✓	✓
<b>B</b>	✓	✓	x
<b>C</b>	✓	x	✓
<b>D</b>	x	✓	✓

2 Which statements about osmosis are correct?

- 1 Osmosis requires a membrane.
- 2 Water can move out of cells by osmosis.
- 3 Water can move into cells by osmosis.

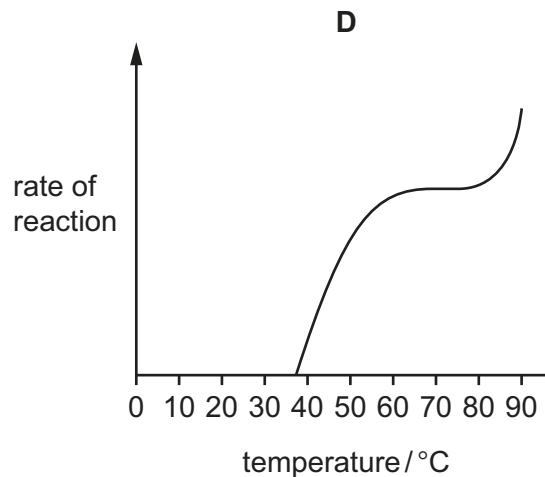
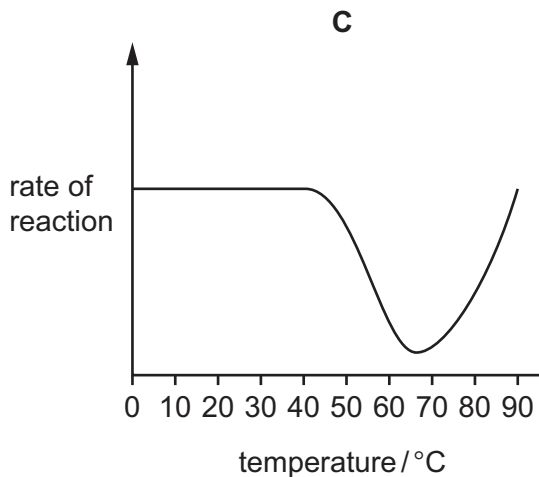
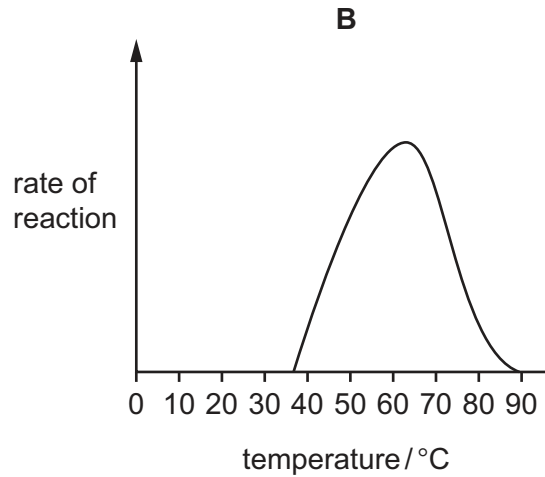
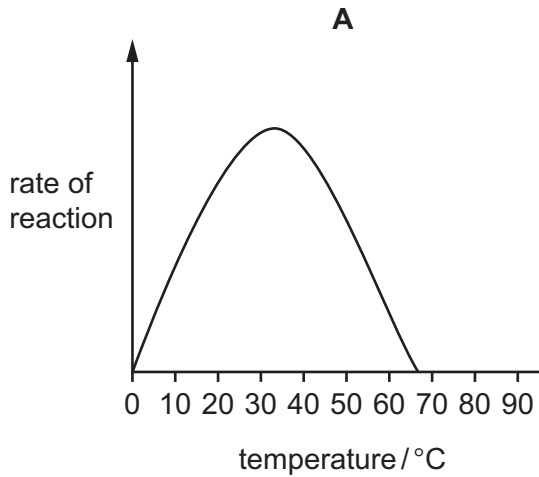
**A** 1 and 2 only    **B** 1 and 3 only    **C** 1, 2 and 3    **D** 2 and 3 only

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

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

- 4 The Pompeii worm lives in deep-sea hydrothermal vents where **average** temperatures are often as high as 68 °C.

Which graph represents the activity of enzymes found in the Pompeii worm?



- 5 Which **ion** is important for chlorophyll production in plants?

- A calcium
- B iron
- C magnesium
- D nitrate

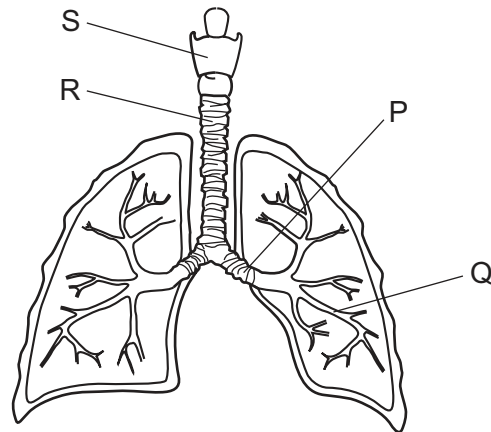
- 6 What is assimilation?

- A the movement of digested food molecules into the cells of the body where they are used, becoming part of the cells
- B the movement of digested food molecules through the wall of the intestine into the blood
- C the passing out of food that has not been digested, as faeces, through the anus
- D the taking of food and drink into the body through the mouth

7 In which conditions will the rate of transpiration be greatest?

- A 10°C and high humidity
- B 10°C and low humidity
- C 30°C and high humidity
- D 30°C and low humidity

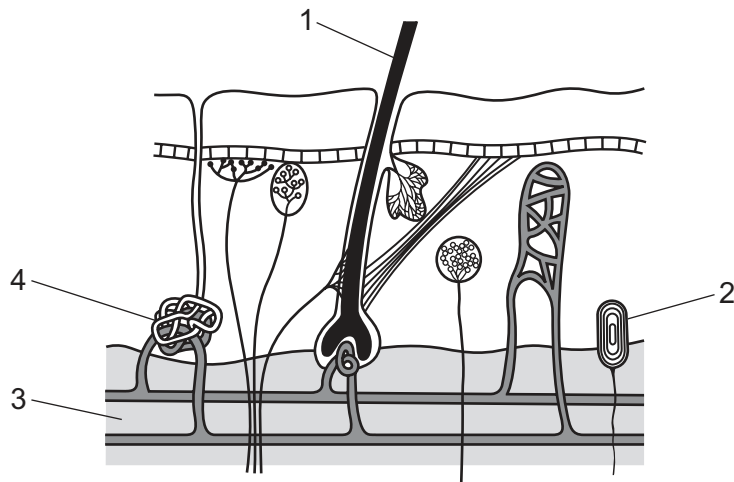
8 The diagram shows the main structures in the breathing system of humans.



Which row identifies the larynx, bronchus, trachea and bronchioles?

	larynx	bronchus	trachea	bronchioles
<b>A</b>	P	Q	R	S
<b>B</b>	R	P	S	Q
<b>C</b>	S	P	R	Q
<b>D</b>	S	Q	P	R

9 The diagram shows a section through the skin.



Which labelled structures help to maintain body temperature in the cold?

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

10 During the menstrual cycle, an egg is released at ovulation.

The egg passes out of the body if it is not fertilised.

What is the correct order of structures through which the egg passes?

- A** cervix → oviduct → uterus → vagina  
**B** oviduct → uterus → cervix → vagina  
**C** oviduct → vagina → cervix → uterus  
**D** uterus → oviduct → vagina → cervix

11 Which statement is correct?

- A** An allele is a version of a gene.  
**B** DNA is only found in gametes.  
**C** A gene is a length of DNA that codes for fats.  
**D** Cells of human males contain two X chromosomes.

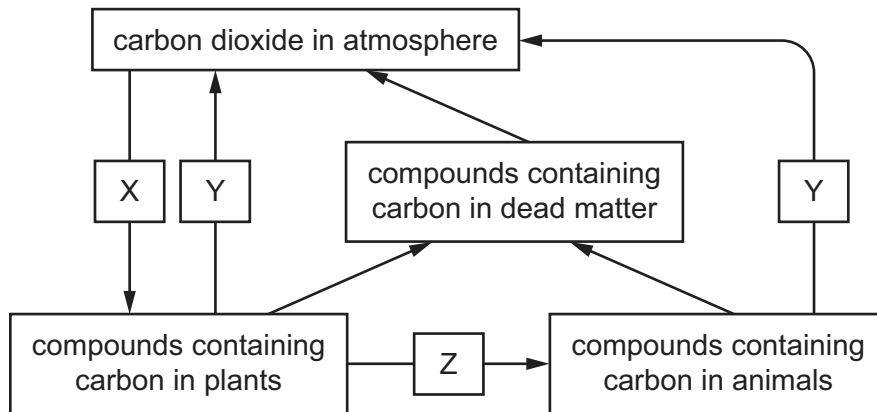
12 The diagram shows a food chain.

beech tree → insect → shrew → owl

Which statement is correct?

- A The beech tree is a consumer.
- B The insect is a producer.
- C The owl is a carnivore.
- D The shrew is a herbivore.

13 The diagram shows part of the carbon cycle.



What are processes X, Y and Z?

	X	Y	Z
<b>A</b>	decomposition	respiration	feeding
<b>B</b>	photosynthesis	respiration	feeding
<b>C</b>	photosynthesis	decomposition	respiration
<b>D</b>	decomposition	photosynthesis	respiration

14 Substance P is separated into different parts using simple physical techniques.

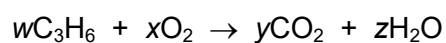
Substance Q is only separated into simpler parts using chemical processes.

Substance R is not separated into simpler parts by either physical or chemical processes.

Which type of substance are P, Q and R?

	P	Q	R
<b>A</b>	compound	mixture	element
<b>B</b>	element	compound	mixture
<b>C</b>	mixture	element	compound
<b>D</b>	mixture	compound	element

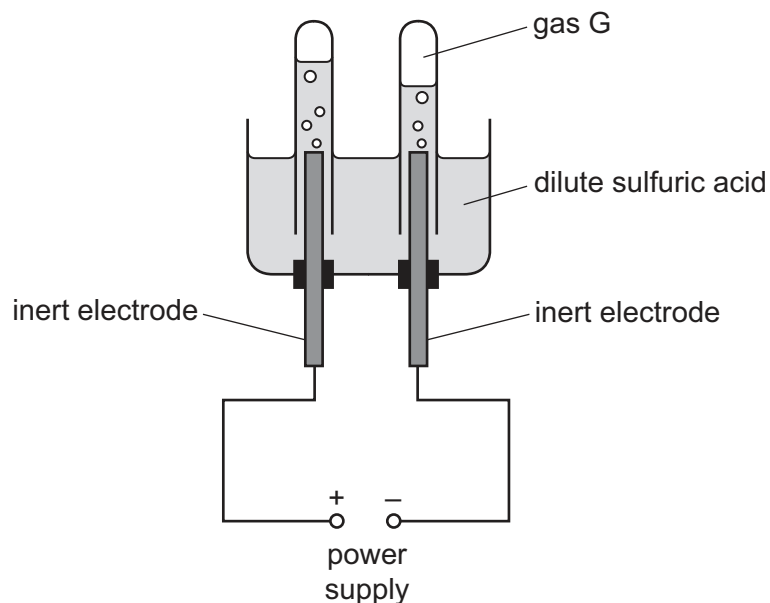
15 Propene,  $C_3H_6$ , burns in excess oxygen to form carbon dioxide and water.



Which values of  $w$ ,  $x$ ,  $y$  and  $z$  balance this equation?

	$w$	$x$	$y$	$z$
<b>A</b>	1	9	3	3
<b>B</b>	1	5	3	6
<b>C</b>	2	9	6	6
<b>D</b>	2	5	6	3

16 The diagram shows the electrolysis of dilute sulfuric acid.



Gas G ignites with a 'pop' when it is tested with a lighted splint.

What is gas G and at which electrode is it formed?

	gas G	electrode
<b>A</b>	hydrogen	anode
<b>B</b>	hydrogen	cathode
<b>C</b>	oxygen	anode
<b>D</b>	oxygen	cathode

17 Ammonium nitrate is dissolved in a beaker of water.

The temperature of the water decreases by 5 °C.

Which type of reaction occurs?

- A** endothermic
- B** exothermic
- C** oxidation
- D** reduction



18 Which reaction is **not** a redox reaction?

- A iron oxide + carbon  $\rightarrow$  iron + carbon dioxide
- B silver nitrate + sodium chloride  $\rightarrow$  silver chloride + sodium nitrate
- C copper oxide + hydrogen  $\rightarrow$  copper + water
- D magnesium + oxygen  $\rightarrow$  magnesium oxide

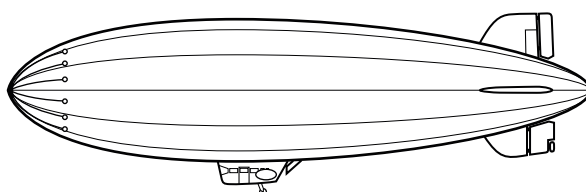
19 Which test and its result identifies aqueous bromide ions?

- A adding acidified aqueous silver nitrate forming a cream precipitate
- B adding acidified aqueous silver nitrate forming a white precipitate
- C adding aluminium foil and heating with sodium hydroxide forming a gas that turns red litmus paper blue
- D adding dilute acid forming a gas that produces a white precipitate when bubbled through limewater

20 Which row about the trends in the elements going down Group I of the Periodic Table is correct?

	reactivity	melting point
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

21 An airship containing an unreactive gas floats in air, as shown.



Which gas is used to fill the airship?

- A carbon dioxide
- B helium
- C hydrogen
- D nitrogen

22 Duralumin and magnalium are alloys used in the manufacture of aircraft.

They both contain aluminium and another metallic element.

The alloys are made up of .....1..... of each element.

They are used because they are .....2..... than the pure metals.

Which words complete gaps 1 and 2?

	1	2
<b>A</b>	atoms	harder
<b>B</b>	atoms	softer
<b>C</b>	molecules	harder
<b>D</b>	molecules	softer

23 Which metal is extracted from its ore by heating with carbon?

- A** copper
- B** magnesium
- C** potassium
- D** sodium

24 Anhydrous cobalt(II) chloride changes colour when water is added.

Which row shows the colour before and after water is added?

	before	after
<b>A</b>	blue	pink
<b>B</b>	blue	white
<b>C</b>	white	blue
<b>D</b>	white	pink

25 Which substances neutralise acids?

- 1 lime
- 2 limestone
- 3 calcium hydroxide

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

26 Butane is a hydrocarbon.

What is the word equation for the complete combustion of butane?

- A butane + oxygen  $\rightarrow$  carbon + water
- B butane + oxygen  $\rightarrow$  carbon dioxide + carbon monoxide + water
- C butane + oxygen  $\rightarrow$  carbon dioxide + water
- D butane + oxygen  $\rightarrow$  carbon monoxide + water

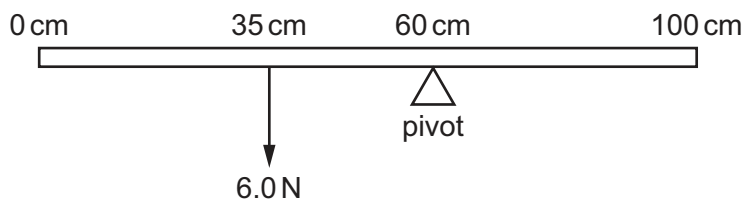
27 Which statement about poly(ethene) is correct?

- A It is an alkene.
- B It is formed in a reaction called cracking.
- C It is obtained from the bitumen fraction of petroleum.
- D It is made by an addition reaction.

28 Which expression is the definition of density?

- A  $\frac{\text{mass}}{\text{volume}}$
- B  $\frac{\text{volume}}{\text{mass}}$
- C area  $\times$  mass
- D mass  $\times$  volume

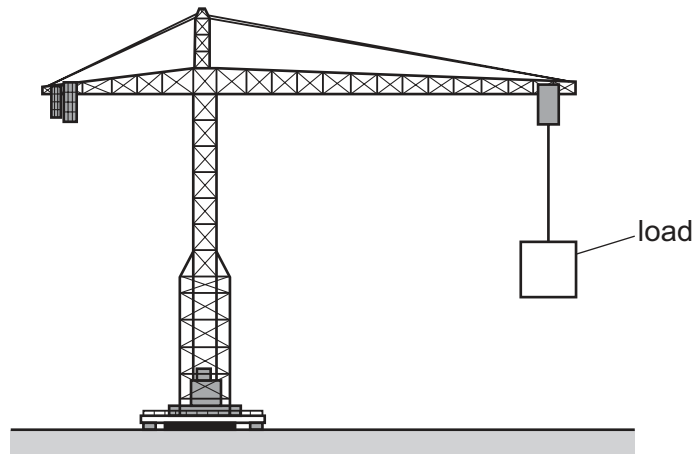
29 The diagram shows a metre rule with a pivot at the 60 cm mark. A force of 6.0 N is applied at the 35 cm mark in the direction shown.



What is the moment of the 6.0 N force about the pivot?

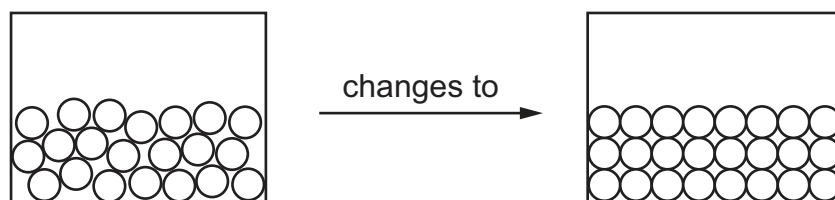
- A 150 N cm
- B 210 N cm
- C 360 N cm
- D 390 N cm

30 A crane does work on a load by lifting it vertically upwards.



Which action decreases the work done on the load?

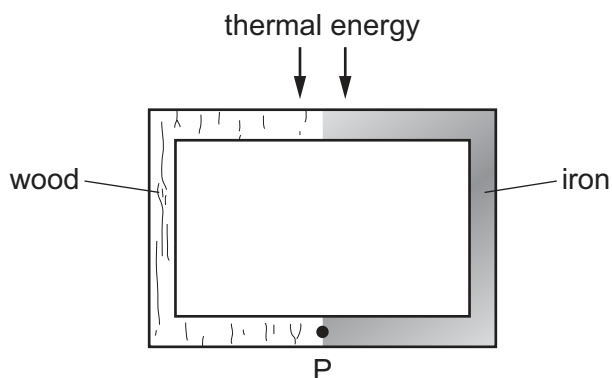
- A lifting the load higher
  - B lifting the load more slowly
  - C reducing the mass of the load
  - D using a more powerful crane
- 31 Which source of energy is non-renewable?
- A hydroelectric
  - B nuclear fission
  - C tides
  - D waves
- 32 The diagram shows the change in the arrangement of the atoms in a substance that is changing state.



What is the change of state?

- A boiling
- B condensation
- C melting
- D solidification

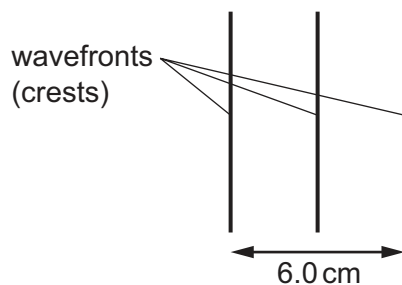
- 33 The diagram shows an object made partly of wood and partly of iron. Thermal energy is supplied in the position shown. Point P is marked at the bottom of the object.



How does most thermal energy reach point P?

- A by conduction through the iron
  - B by conduction through the wood
  - C by convection through the iron
  - D by convection through the wood
- 34 The diagram shows a water wave seen from above.

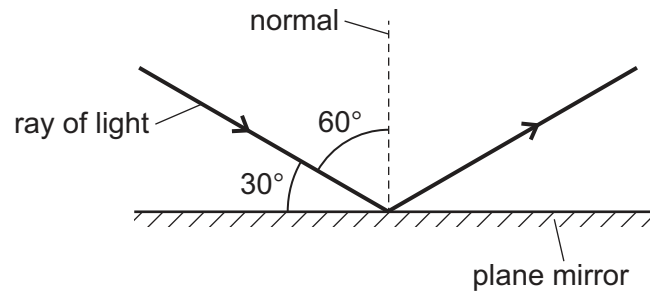
One wavefront (crest) is made every 0.50 s.



What is the frequency of the wave and what is its wavelength?

	frequency / Hz	wavelength / cm
<b>A</b>	0.50	3.0
<b>B</b>	0.50	6.0
<b>C</b>	2.0	3.0
<b>D</b>	2.0	6.0

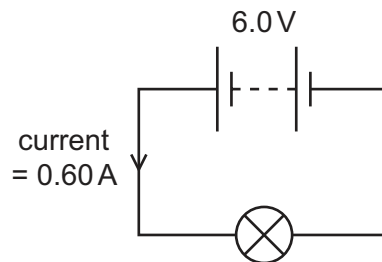
35 The diagram shows a ray of light which is reflected from a plane mirror.



What is the angle of incidence and what is the angle of reflection?

	angle of incidence / °	angle of reflection / °
<b>A</b>	30	30
<b>B</b>	30	60
<b>C</b>	60	30
<b>D</b>	60	60

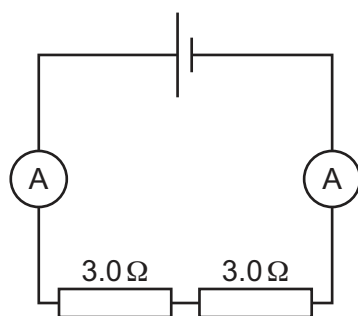
36 A 6.0 V battery is connected to a lamp. The current in the circuit is 0.60 A.



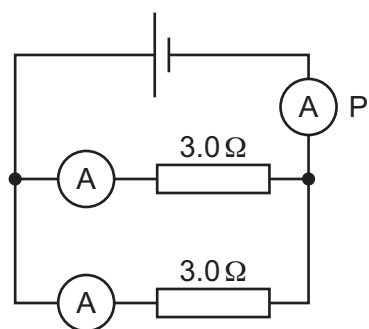
What is the resistance of the lamp?

- A** 0.10 Ω      **B** 3.6 Ω      **C** 10 Ω      **D** 36 Ω

- 37 The diagrams show a series circuit and a parallel circuit. One ammeter in the parallel circuit is labelled P.



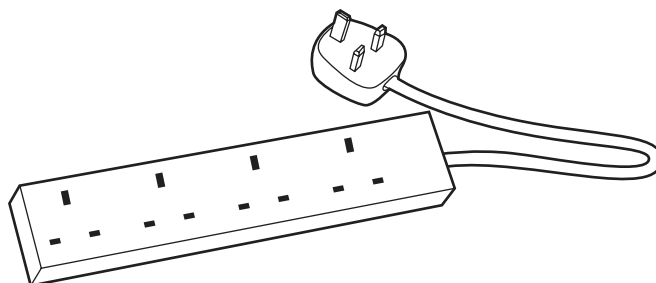
series circuit



parallel circuit

Which statement is correct?

- A** The total resistance of the series circuit is  $3.0\ \Omega$ .
- B** The total resistance of the parallel circuit is  $6.0\ \Omega$ .
- C** In the series circuit, the readings on the ammeters are the same.
- D** In the parallel circuit, the reading on ammeter P is less than the reading on either of the other two ammeters.
- 38 An electrical extension block has four sockets, a cable which can safely take a current of 6 A and a plug. It is protected by a fuse rated at 5 A.



The extension block is used with four appliances and the 5 A fuse blows. The owner replaces the 5 A fuse with a 13 A fuse.

Why is the extension block now dangerous?

- A** The appliances may not receive enough current.
- B** The cable may overheat before the fuse blows.
- C** The sockets may burn out before the fuse blows.
- D** The 13 A fuse may blow too soon.

- 39 How do the ionising effect and the penetrating ability of alpha-emissions compare with those of beta-emissions?

	ionising effect	penetrating ability
<b>A</b>	alpha more ionising than beta	alpha more penetrating than beta
<b>B</b>	alpha more ionising than beta	alpha less penetrating than beta
<b>C</b>	alpha less ionising than beta	alpha more penetrating than beta
<b>D</b>	alpha less ionising than beta	alpha less penetrating than beta

- 40 A radioactive isotope has a half-life of 18 years. A sample contains 80 million atoms of this isotope.

How long does it take for the number of atoms of this isotope in the sample to decrease to 10 million?

- A** 2.25 years
- B** 6.0 years
- C** 54 years
- D** 180 years







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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

lanthanoids	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
actinoids	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 —

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