SCIENCE (PHYSICS, CHEMISTRY)   **5124/01**

Paper 1 Multiple Choice

October/November 2006

1 hour

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

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, 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.

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.
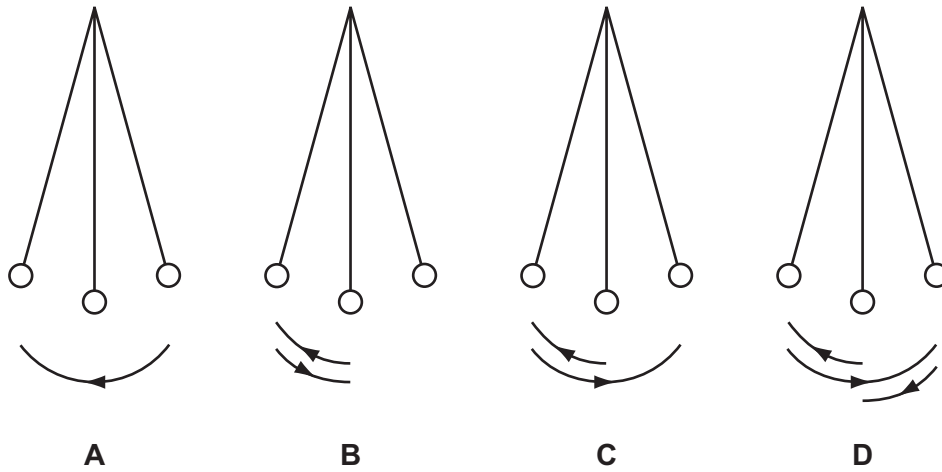Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.

UNIVERSITY *of* CAMBRIDGE
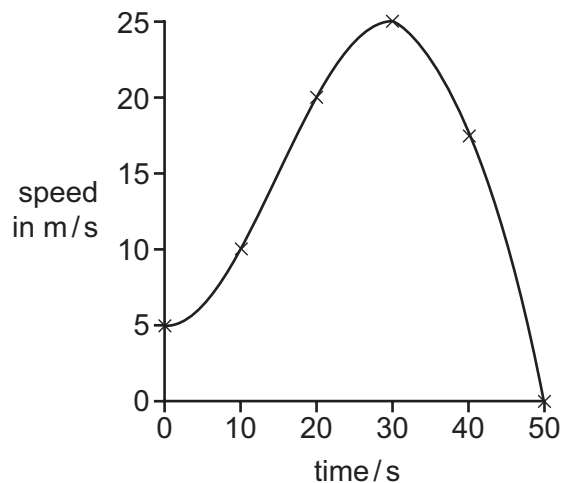International Examinations

[Turn over

1 The diagrams show a simple pendulum at the ends and centre of its swing.

Which labelled arrow shows the distance moved by the pendulum during one period?

2 The speed-time graph is for a car as it accelerates over a period of 50 s.

What is the acceleration of the car when the time is 30 s?

A $0 \, \text{m/s}^2$ **B** $\dfrac{25-5}{30} \, \text{m/s}^2$ **C** $\dfrac{25}{30} \, \text{m/s}^2$ **D** $25 \, \text{m/s}^2$

3 A car driver takes a total of two hours to make a journey of 75 km. During the journey she takes a break of half an hour and spends a quarter of an hour stationary in a traffic jam.

At what average speed must she travel during the rest of the time to complete the journey in two hours?

A 38 km/h   **B** 50 km/h   **C** 60 km/h   **D** 75 km/h

4 The mass and density of four objects are given in the table.

Which object has the largest volume?

|	$\dfrac{\text{density}}{\text{kg/m}^3}$	mass/kg
A	200	0.6
B	400	1.0
C	1000	2.0
D	1500	3.0

5 A uniform beam is balanced at its midpoint. An object is placed on the beam as shown in the diagram.
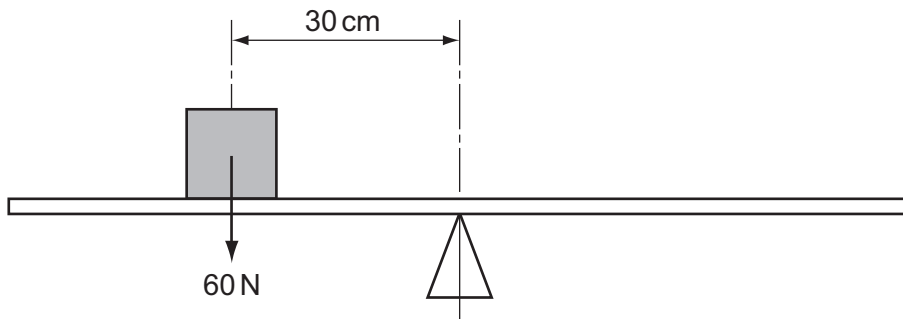

Which force will rebalance the system?

A 30 N acting upwards, 60 cm to the right of the midpoint

B 30 N acting upwards, 60 cm to the left of the midpoint

C 45 N acting downwards, 45 cm to the right of the midpoint

D 90 N acting downwards, 20 cm to the left of the midpoint

6 A ball is dropped from a height as shown.
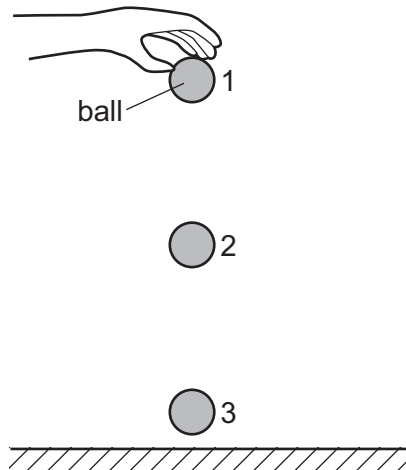
Ignoring the effects of air resistance, the **total** energy is

A greatest at point 1.

B greatest at point 2.

C greatest at point 3.

D the same at all points.

7 A 300 N force is applied to a box in the direction XY in order to move it up a ramp of the dimensions shown.
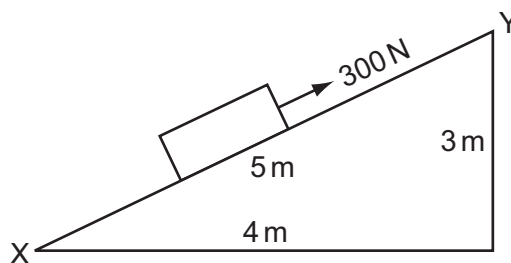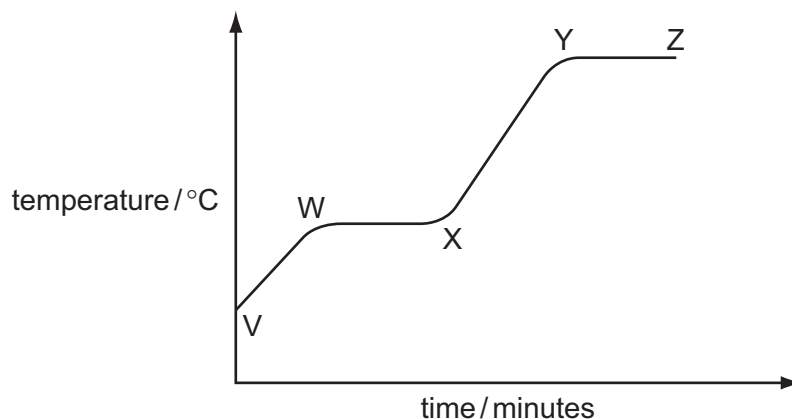

How much work is done when moving the box from X to Y?

A 900 J **B** 1200 J **C** 1500 J **D** 3000 J

8 Some ice is placed in a beaker and is heated.

The graph shows the temperature of the beaker and its contents during the experiment.

Between which two points on the graph does the beaker contain a mixture of liquid and gas?

A Y and Z   **B** X and Y   **C** W and X   **D** V and W

9 The diagram shows the variation of the displacement of a wave with distance from the source.
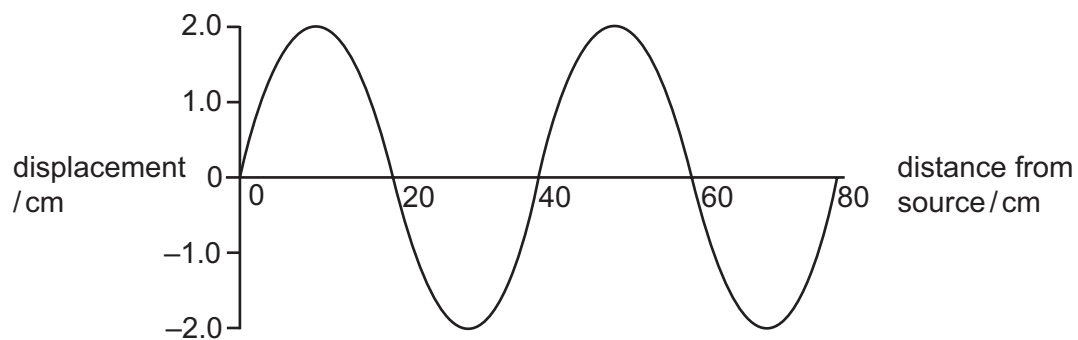
What is the amplitude of the wave?

A 2.0 cm   **B** 4.0 cm   **C** 20 cm   **D** 40 cm

10 Which block is made from the material with a refractive index of 1.52?

A

40°

20°

B
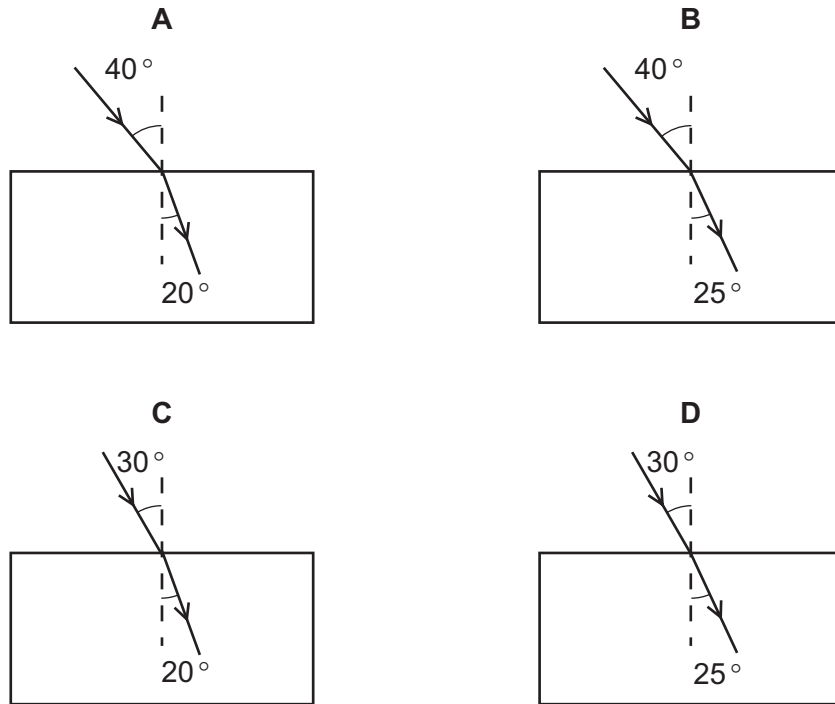
40°

25°

C

30°

20°

D

30°

25°

11 Radio waves, visible light and X-rays are all part of the electromagnetic spectrum.

What is the correct order of increasing wavelength?

	shortest wavelength	⟶	longest wavelength
A	visible light	radio waves	X-rays
B	visible light	X-rays	radio waves
C	X-rays	radio waves	visible light
D	X-rays	visible light	radio waves

12 A sonic 'tape measure' is used to measure the length of a room. It measures a time interval of 0.060 s between transmitting a sound pulse and receiving the echo. The speed of sound in air is 330 m/s.

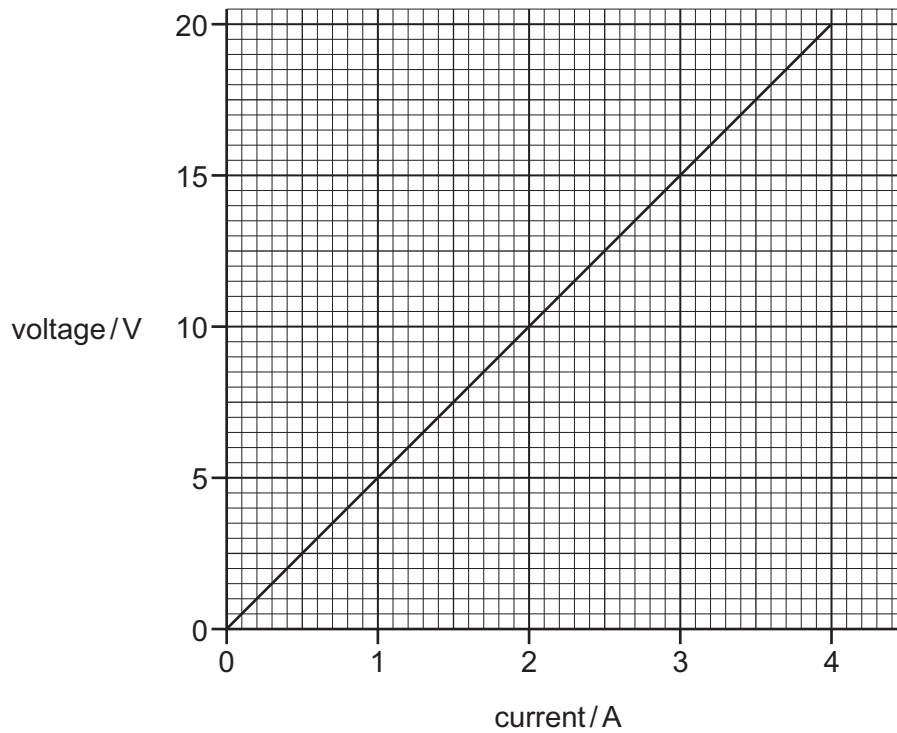How far is the reflecting wall from the 'tape measure'?

A 5.5 m   **B** 9.9 m   **C** 11 m   **D** 20 m

13 How could the unit of potential difference, the volt, also be written?

A A/s   **B** C/A   **C** C/J   **D** J/C

14 The graph shows the results of an experiment to determine the resistance of a wire.

What is the resistance of the wire?

A 0.2 Ω   **B** 4.0 Ω   **C** 5.0 Ω   **D** 80 Ω

15 The circuit shows three voltmeters being used to measure potential differences in a series circuit.
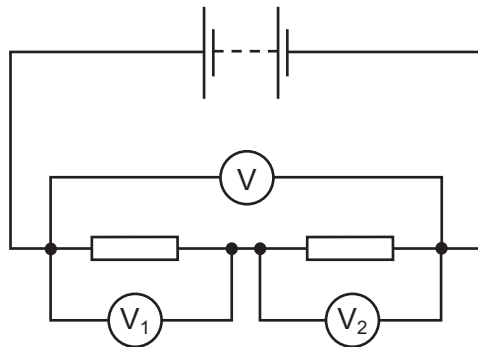
Which of the following is correct?

A $V = V_1 = V_2$

B $V = V_1 + V_2$

C $V = V_1 - V_2$

D $V = V_1 \times V_2$

16 Which diagram shows the correct connections for a switch and a lamp in a lighting circuit?

key	
L	live
N	neutral
E	earth
☐	metal case
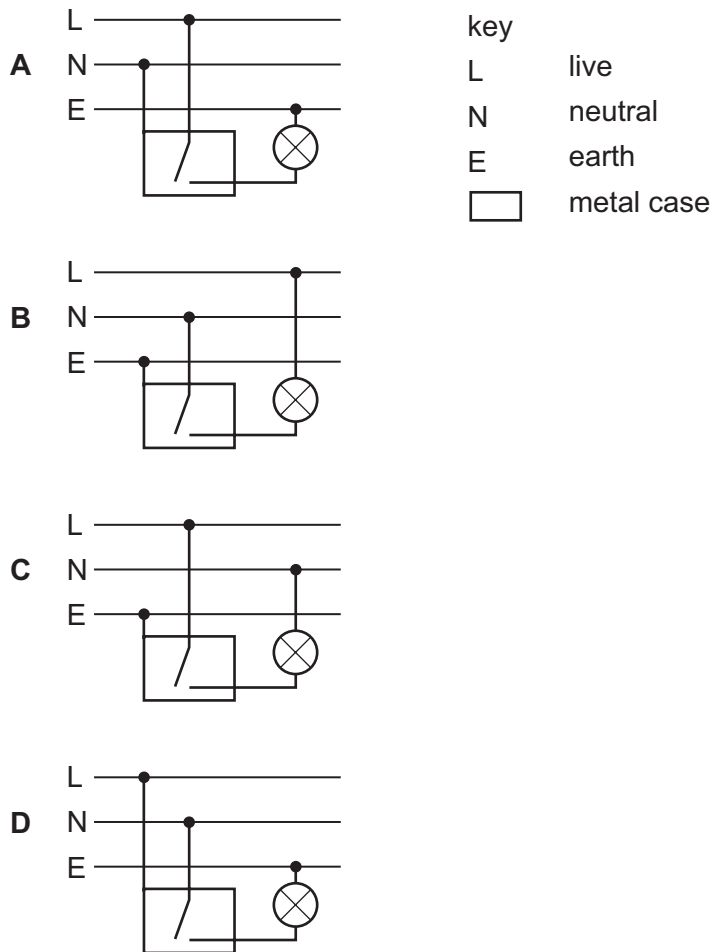
17 What will prove that a metal bar is a permanent magnet?

    A   It attracts another magnet.

    B   It attracts both ends of a compass needle.

    C   It conducts electricity.

    D   It repels another magnet.

18 What is the main function of a basic iron-cored transformer?

    A   to change d.c. to a.c.

    B   to change to a higher or a lower a.c. voltage

    C   to provide a constant voltage source

    D   to store electrical energy

19 The diagram represents a nucleus of element **X**.

key

$\oplus$ proton

⚫ neutron
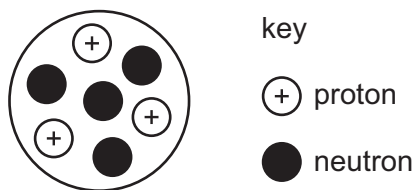
Which of the following represents the nuclide of this element?

A $\frac{3}{4}$**X** **B** $\frac{4}{3}$**X** **C** $\frac{7}{3}$**X** **D** $\frac{7}{4}$**X**

20 A research worker wants to use a radioactive source with a count rate of 100 counts per second for an experiment he plans to start at 10.00 a.m.

He has four different sources, each of which has a count rate of 400 per second at 9.00 a.m.

Which source should he choose?

A a source with a half-life of 15 minutes

B a source with a half-life of 20 minutes

C a source with a half-life of 30 minutes

D a source with a half-life of 40 minutes

21 Potassium nitrate crystals can be separated from sand by using the processes shown.

What is the correct order for the processes?

	first ————————————→ last			
A	filter	dissolve	evaporate	crystallise
B	dissolve	evaporate	crystallise	filter
C	dissolve	evaporate	filter	crystallise
D	dissolve	filter	evaporate	crystallise

22 Which statement about the molecules in ice is correct?

A The molecules all move with the same speed.

B The molecules are diatomic.

C The molecules move randomly.

D The molecules vibrate about fixed positions.

23 Strontium has an isotope of nucleon number 90.

How many protons, neutrons and electrons are present in an atom of this isotope?

	protons	neutrons	electrons
A	38	50	38
B	38	52	38
C	38	52	40
D	40	50	38

24 Under what conditions does sodium chloride conduct electricity?

	conducts electricity		
	when solid	when molten	in aqueous solution
A	no	no	no
B	no	yes	yes
C	yes	no	no
D	yes	yes	yes

25 How many electrons are shared in the covalent bonds in a methane molecule?

A 2 **B** 4 **C** 6 **D** 8

26 A 6 g sample of pure carbon is completely burned in oxygen.

$$C + O_2 \rightarrow CO_2$$
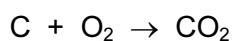
Which mass of carbon dioxide is produced?

A 12 g **B** 22 g **C** 38 g **D** 44 g

27 A thermometer is placed in water and the temperature is measured as shown.
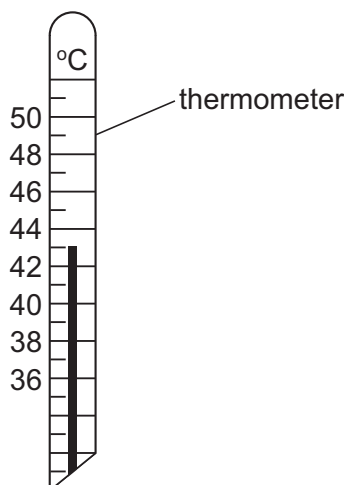
°C
— thermometer
50
48
46
44
42
40
38
36

An endothermic change takes place as a solid is dissolved in the water. The temperature changes by 4.5°C.

What is the final temperature?

A 38.0°C **B** 38.5°C **C** 47.0°C **D** 47.5°C

28 In an experiment, 0.325 g of zinc reacts with an excess of 1.0 mol/dm^3 hydrochloric acid. The graph shows how the volume of hydrogen collected varies with time.

In a second experiment, 0.650 g of zinc reacts with an excess of 1.0 mol/dm^3 hydrochloric acid.

For the second experiment, at which point does the graph become horizontal?

volume of
hydrogen
/ cm^3

240
180
120
60
0

A

B

C

D

0 10 20 30 40 50 60 70 80 90 100 110 120 130

time / s

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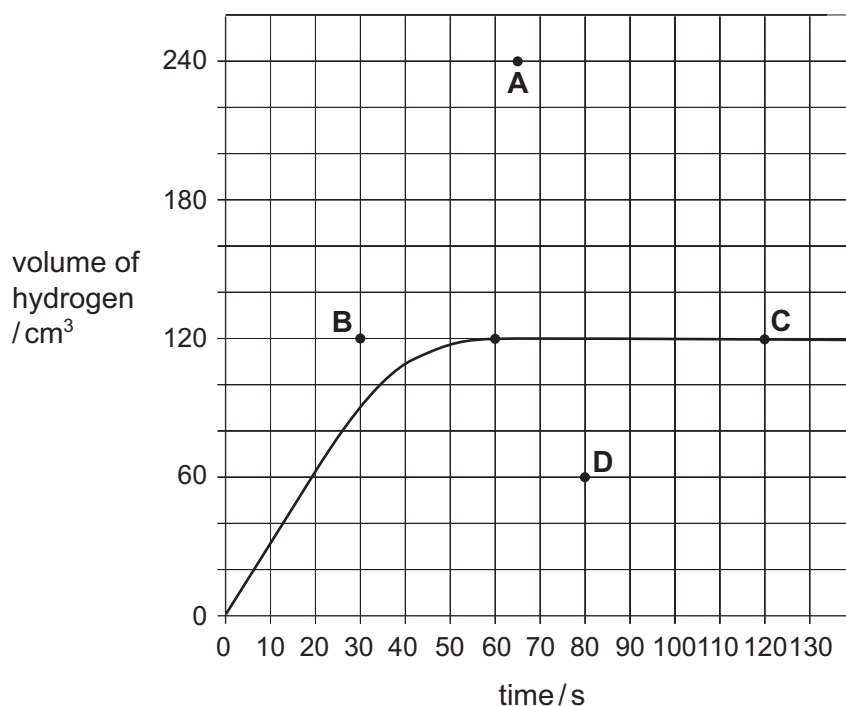
29 The pH values of four aqueous solutions are shown.

Which solution contains a weak acid?

	pH value
A	2
B	5
C	7
D	9

30 Which statement about the elements in Group I of the Periodic Table is correct?

A The proton (atomic) number of an element is one greater than that of the element above it.

B They are equally reactive.

C They become less metallic as the proton (atomic) number increases.

D They form chlorides of similar formula.

31 An experiment is carried out to find the order of reactivity of some metals.

Three metals are placed in separate solutions containing an aqueous metal ion.

The results are shown.

metal	aqueous metal ion				key
	Mg^{2+}	Al^{3+}	Fe^{2+}	Zn^{2+}	✓ = reaction observed
Mg	✗	✓	✓	✓	
Fe	✗	✗	✗	✗	✗ = no reaction observed
Zn	✗	✗	✓	✗	

What is the order of reactivity of the metals (most reactive first)?

A Mg   Zn   Fe   A*l*

B Fe   Zn   A*l*   Mg

C Mg   A*l*   Zn   Fe

D Mg   A*l*   Fe   Zn

32 Underground steel tanks can be prevented from rusting by sacrificial protection.
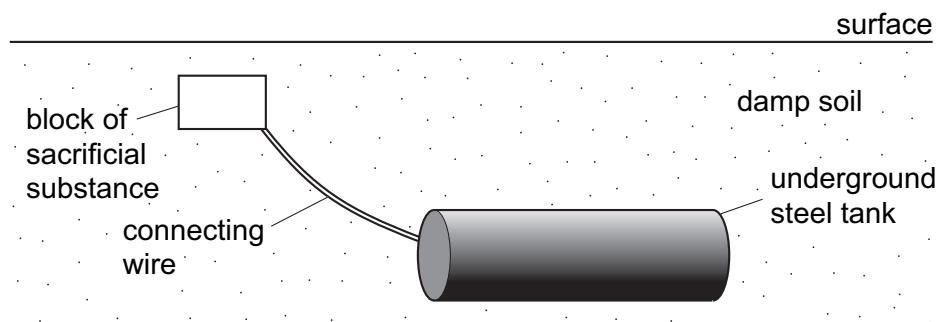
Which element is most suitable for use as the sacrificial substance?

A carbon

B copper

C iron

D magnesium

33 Aluminium cooking utensils are used in many kitchens.

What property of aluminium is **not** important for this use?

A It has a high melting point.

B It is a good conductor of electricity.

C It is a good conductor of heat.

D It is resistant to corrosion.

34 Methane, sulphur dioxide and carbon dioxide are gases which affect the atmosphere and the environment.

In what way do these gases affect the environment?

	methane	sulphur dioxide	carbon dioxide
A	depletion of the ozone layer	acid rain	global warming
B	global warming	photochemical smog	acid rain
C	photochemical smog	global warming	depletion of the ozone layer
D	global warming	acid rain	global warming

35 What is the main constituent of natural gas?
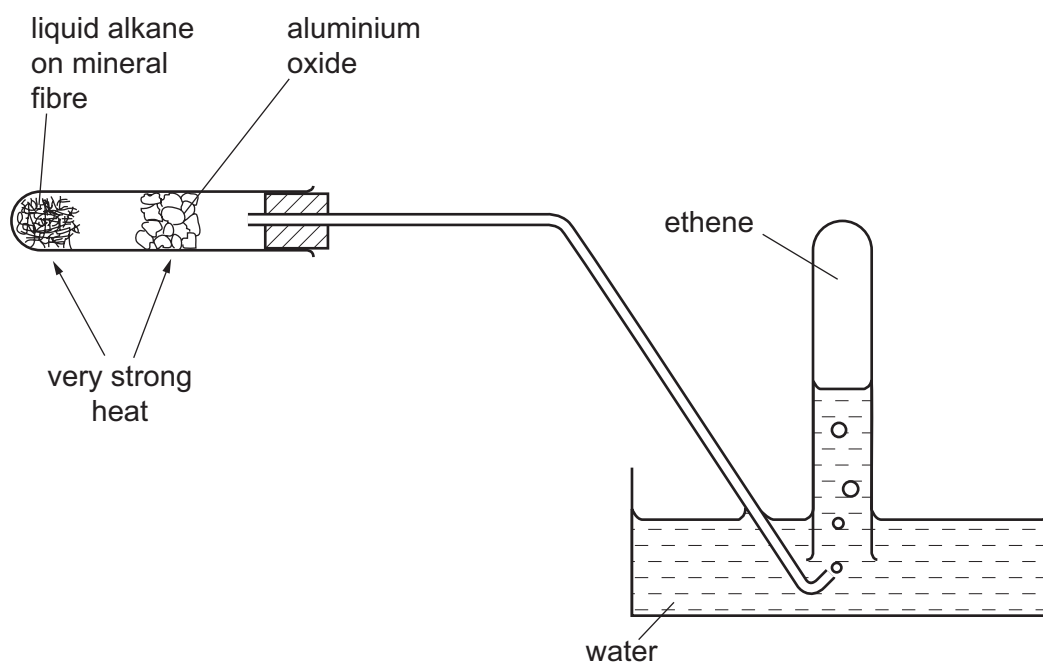
    A   ethane

    B   helium

    C   hydrogen

    D   methane

36 Octane is an alkane containing eight carbon atoms per molecule.

What is its molecular formula?

    A C_8H_{14} **B** C_8H_{16} **C** C_8H_{18} **D** C_8H_{20}

37 The experiment shown is carried out.

Which process occurs?

    A   cracking

    B   dehydrogenation
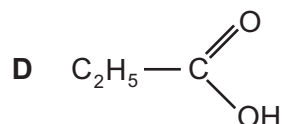
    C   distillation
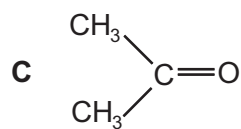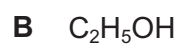
    D   polymerisation

38 A hydrocarbon has the formula C_6H_{12}.

Which observation could confirm the homologous series to which the hydrocarbon belongs?

A burning in air with a sooty flame

B decolourising aqueous bromine

C effervescence when mixed with sodium carbonate solution

D turning Universal Indicator blue

39 Wine can deteriorate after a period of time because of atmospheric oxidation.

Which compound is formed by the oxidation of the alcohol in the wine?

A CH_3—C $\underset{OH}{\overset{O}{\diagup\diagdown}}$

B C_2H_5OH

C $\underset{CH_3}{\overset{CH_3}{\diagdown\diagup}}$C=O

D C_2H_5—C $\underset{OH}{\overset{O}{\diagup\diagdown}}$
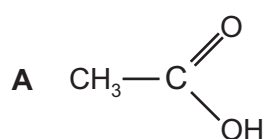
40 Which of the following contains the $-\overset{\overset{\displaystyle O}{\|}}{C}-\underset{\underset{\displaystyle H}{|}}{N}-$ linkage?

A fats

B nylon

C poly(ethene)

D *Terylene*

DATA SHEET
The Periodic Table of the Elements

Group

I	II		III	IV	V	VI	VII	0
								4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4		11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12		27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulphur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27
59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45
106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77
195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †						

1 **H** Hydrogen 1

*58-71 Lanthanoid series
†90-103 Actinoid series

| 140 **Ce** Cerium 58 | 141 **Pr** Praseodymium 59 | 144 **Nd** Neodymium 60 | **Pm** Promethium 61 | 150 **Sm** Samarium 62 | 152 **Eu** Europium 63 | 157 **Gd** Gadolinium 64 | 159 **Tb** Terbium 65 | 162 **Dy** Dysprosium 66 | 165 **Ho** Holmium 67 | 167 **Er** Erbium 68 | 169 **Tm** Thulium 69 | 173 **Yb** Ytterbium 70 | 175 **Lu** Lutetium 71 |
| 232 **Th** Thorium 90 | **Pa** Protactinium 91 | 238 **U** Uranium 92 | **Np** Neptunium 93 | **Pu** Plutonium 94 | **Am** Americium 95 | **Cm** Curium 96 | **Bk** Berkelium 97 | **Cf** Californium 98 | **Es** Einsteinium 99 | **Fm** Fermium 100 | **Md** Mendelevium 101 | **No** Nobelium 102 | **Lr** Lawrencium 103 |

Key

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

a
X
b

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