Name: ..... Register no: ..... Class: .....

# NGEE ANN SECONDARY SCHOOL

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## PRELIMINARY EXAMINATION

**SCIENCE PHYSICS/CHEMISTRY** **5086/01**

**PAPER 1** **23 August 2024**

**1 h**

Additional Materials: Optical Answer Sheet

**READ THESE INSTRUCTIONS FIRST**

1. Write in soft pencil.
2. Do not use staples, paper clips, highlighters, glue or correction fluid.
3. Write your name and index number on the Optical Answer Sheet in the spaces provided unless this has been done for you.
4. There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
5. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Optical Answer Sheet.
6. **Read the instructions on the Optical Answer Sheet very carefully.**
7. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. The total number of marks for this paper is **40**.
8. Any rough working should be done in this booklet.
9. A copy of the Data sheet and Periodic Table are printed on page **20** and 21 respectively.
10. The use of an approved scientific calculator is expected, where appropriate.

This document consists of **21** printed pages and **1** blank page.

**1** Which pair consists of two vector quantities?

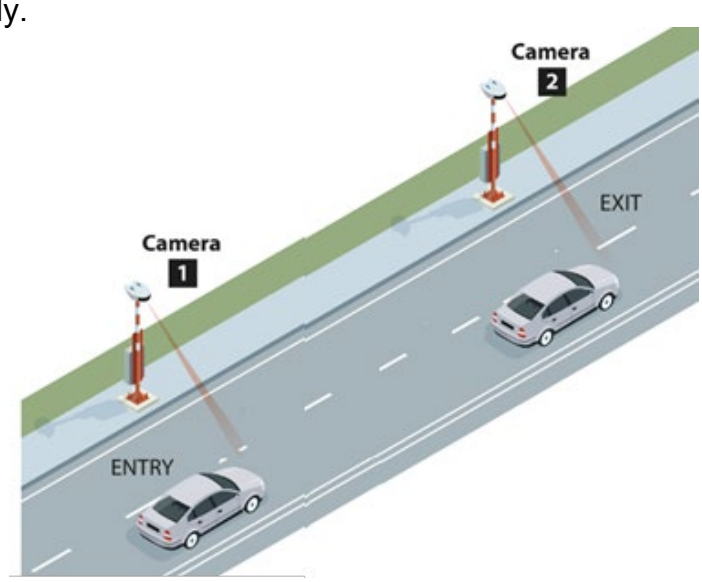
**A** velocity and moment

**B** pressure and force

**C** mass and energy

**D** potential difference and acceleration

**2** The diagram shows two cameras used to determine the average speed of a car along a stretch of road. Cameras 1 and 2 detect the entry and exit of the vehicle along that stretch respectively.




The diagrams below show the times at which cameras 1 and 2 capture the entry and the exit of the vehicle. The distance between the two cameras is 800 m.


At entry

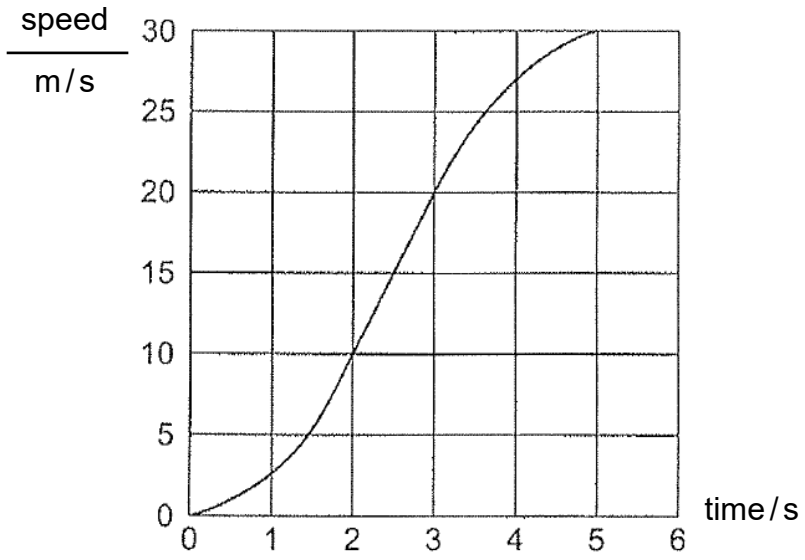

At exit

What is the average speed of the vehicle between the two cameras?

**A** 6.6 m/s **B** 7.4 m/s **C** 8.4 m/s **D** 31 m/s

**3** The graph shows the speed of a car as it starts from rest.

During part of this time, the acceleration is uniform.




What is the magnitude of this uniform acceleration?

**A** 5.0 m/s$^2$ **B** 6.0 m/s$^2$ **C** 10 m/s$^2$ **D** 20 m/s$^2$

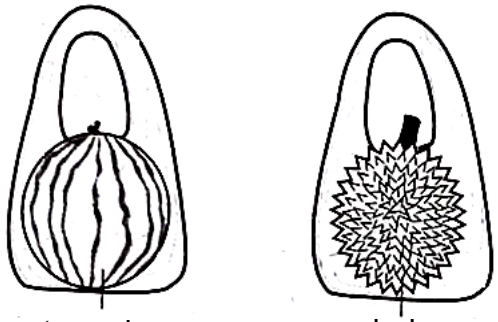
**4** An astronaut sits in a space shuttle which takes off from the surface of the Earth.

During his journey into space, what happens to the mass and weight of the astronaut due to the gravitational field of the Earth?

| | mass | weight |
|---|---|---|
| **A** | unchanged | increases |
| **B** | unchanged | decreases |
| **C** | decreases | increases |
| **D** | decreases | decreases |

**5** The diagram shows a watermelon and durian placed in two similar plastic bags.

Both the watermelon and durian have the same mass.




Why is the plastic bag containing the durian more likely to tear than the one containing the watermelon?

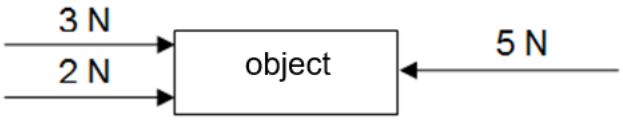
**A** The force exerted by the durian on the plastic bag is larger than that exerted by the watermelon on the plastic bag.

**B** The force exerted by the durian on the plastic bag is smaller than that exerted by the watermelon on the plastic bag.

**C** The pressure exerted by the durian on the plastic bag is smaller.

**D** The pressure exerted by the durian on the plastic bag is larger.

**6** An object is moving to the right at constant speed. It is then acted upon by the three forces as shown in the diagram below.




What is the effect of these three forces on the motion of the object?

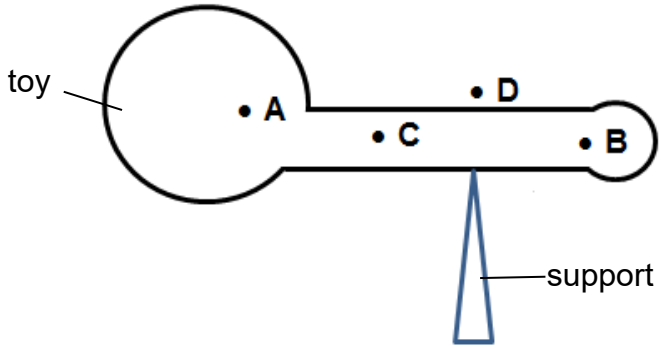
**A** The object moves to the right with constant speed.

**B** The object moves to the right with a constant acceleration.

**C** The object moves to the left with constant speed.

**D** The object comes to a stop immediately.

**7** The diagram shows a toy being balanced on the tip of a support




Which point is likely to be the centre of gravity of the toy?

**8** A boat pulls a fishing net with some fish for 5.0 km. The force it has to apply is 2000 N.

What is the work done in pulling the net with the fish?

**A** 10 kJ **B** 10 MJ **C** 10 GJ **D** 10 TJ

**9** A substance consists of particles that are close together and moving past each other at random.

During heating, the substance changes its state of matter.

What happened to the substance and its internal kinetic energy during change in state?

| | substance | internal kinetic energy |
|---|---|---|
| **A** | changes from solid to liquid | unchanged |
| **B** | changes from solid to liquid | increases |
| **C** | changes liquid to gas | unchanged |
| **D** | changes liquid to gas | increases |

**10** A sound wave travels from a point X to a point Y.


Which diagram represents the movement of the air molecules, due to the sound waves, in the region between X and Y?

**A**

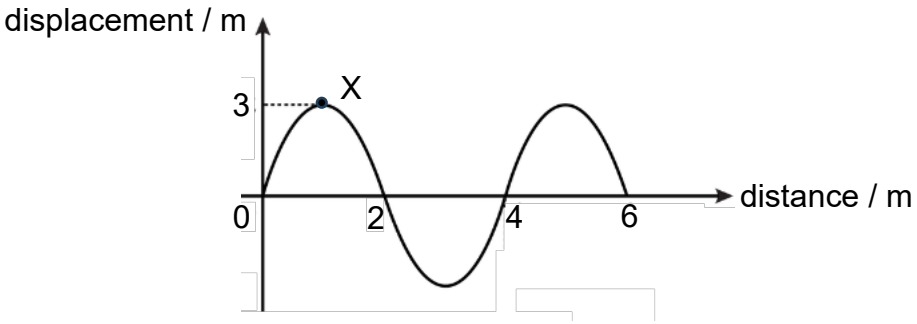
**B**

**C**

**D**

**11** The diagram shows the displacement-distance graph of a wave travelling along a rope at a particular instant. Particle X in the rope has a displacement of 3 m.

For the next 0.2 s, particle X moves a distance of 3 m.




Which statement is correct?

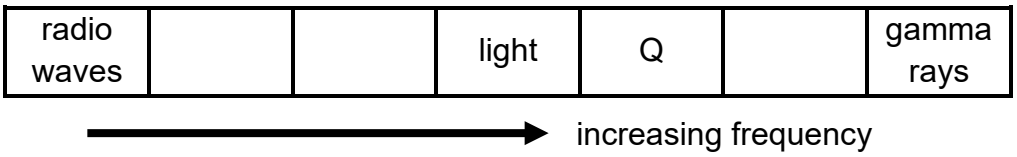
**A** The period of the wave is 0.8 s.

**B** The wavelength of the wave is 2 m.

**C** The wave is a longitudinal wave.

**D** The speed of the wave is 0.8 m/s.

**12** The diagram shows the main components of the electromagnetic spectrum arranged in the order of increasing frequency. Some of the components are labelled.



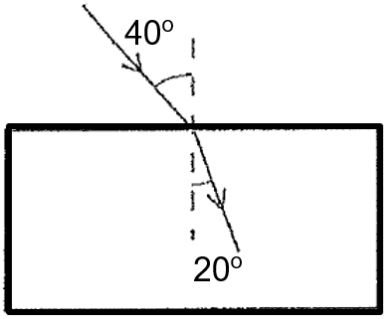

Which row describes electromagnetic wave Q?

| | name of Q | application of Q |
|---|---|---|
| **A** | infrared waves | sterilise medical equipment |
| **B** | infrared waves | television remote controller |
| **C** | ultraviolet waves | sterilise medical equipment |
| **D** | ultraviolet waves | television remote controller |

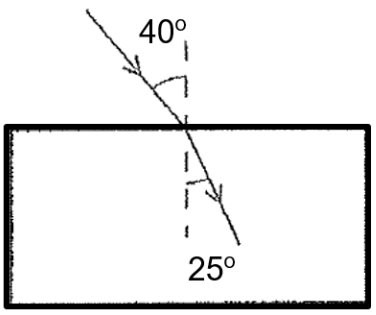
**13** Light travels from air into a transparent block.

Which block is made from the material in which the speed of light is $1.97 \times 10^8$ m/s ?

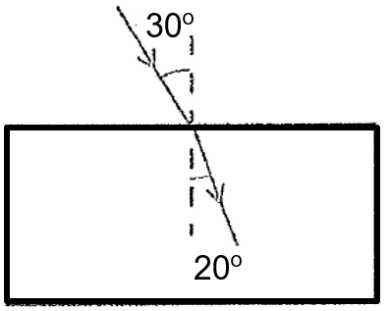
**A**



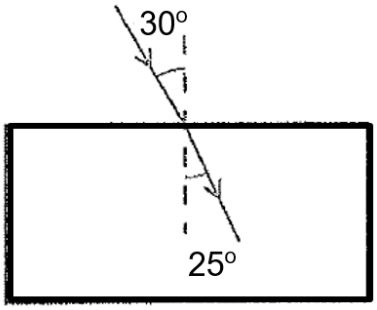

**B**



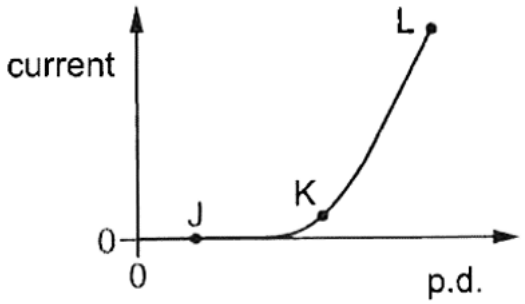

**C**




**D**



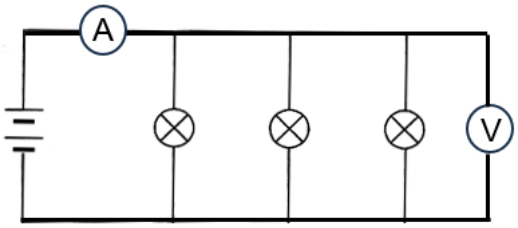
**14** The graph shows how the current in an electrical device varies with the potential difference (p.d) across it.




What is the order of the resistance values of the electrical device at points J, K and L?

| | largest → smallest | | |
|---|---|---|---|
| **A** | J | K | L |
| **B** | J | L | K |
| **C** | K | L | J |
| **D** | L | K | J |

**15** Three similar light bulbs are connected to a set of batteries as shown in the diagram.




The filament of one of the bulbs breaks.

What happens to the voltmeter reading and ammeter reading?

| | voltmeter reading | ammeter reading |
|---|---|---|
| **A** | decreases | increases |
| **B** | decreases | decreases |
| **C** | unchanged | increases |
| **D** | unchanged | decreases |

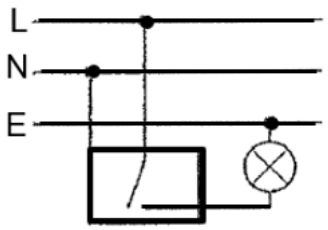
**16** The power rating of a 37-inch LCD television is 300 W. The consumer is charged 30 cents per kWh of energy transferred electrically from the mains supply.

What is the cost of using LCD television for 5 hours?

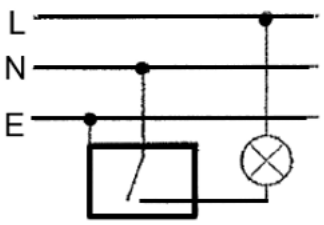
**A** 45 cents **B** 450 cents **C** 4500 cents **D** 45 000 cents

**17** Which diagram shows the correct connections for a switch and lamp in a light circuit?

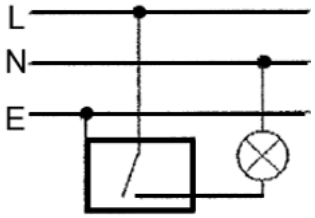
**A**



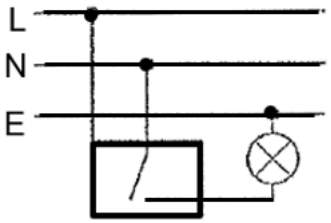

**B**




**C**



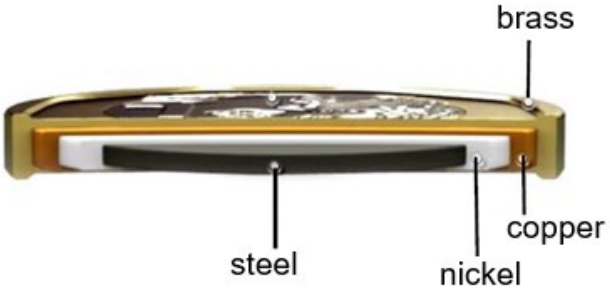

**D**




key

| | |
|---|---|
| L | live |
| N | neutral |
| E | earth |
| ▭ | metal case |

**18** The diagram shows the cross-sectional composition of a third series Singapore $1 coin and the metals that are used to construct the coin.




A magnet is placed near to the coin and the coin is attracted to the magnet.

Which of the following pair of metals accounts for the attraction?

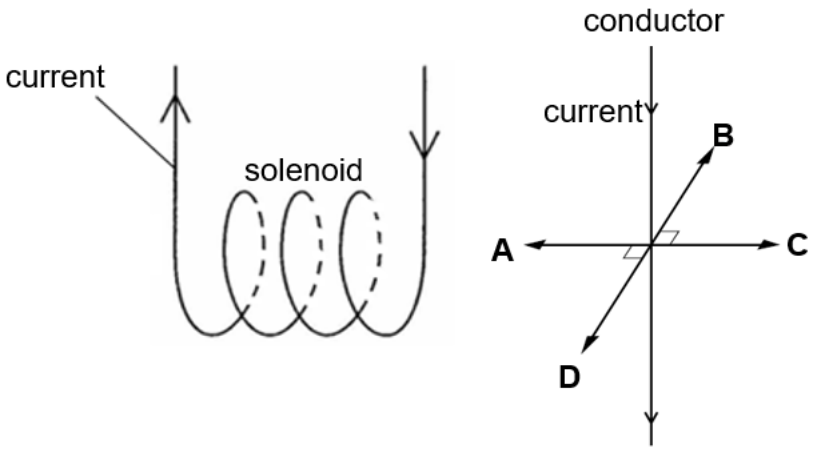
**A** steel and copper

**B** copper and brass

**C** brass and nickel

**D** steel and nickel

**19** The diagram shows a solenoid near to a conductor. Current flows through the solenoid and conductor in the direction as shown.




A magnetic force exerts on the conductor.

What is the direction of the force on the conductor?

**20** A researcher 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 am.

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

Which source should he choose?

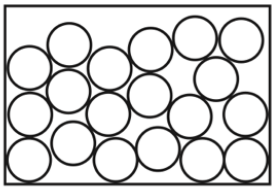
**A** a source with a half-life of 15 minutes

**B** a source with a half-life of 20 minutes

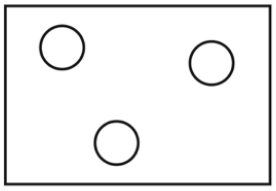
**C** a source with a half-life of 30 minutes

**D** a source with a half-life of 60 minutes

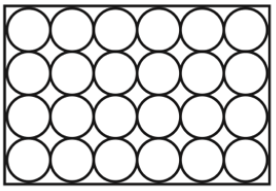
**21** The arrangements of particles of a substance in three different physical states are shown.



state 1



state 2



state 3

Which statement is correct?

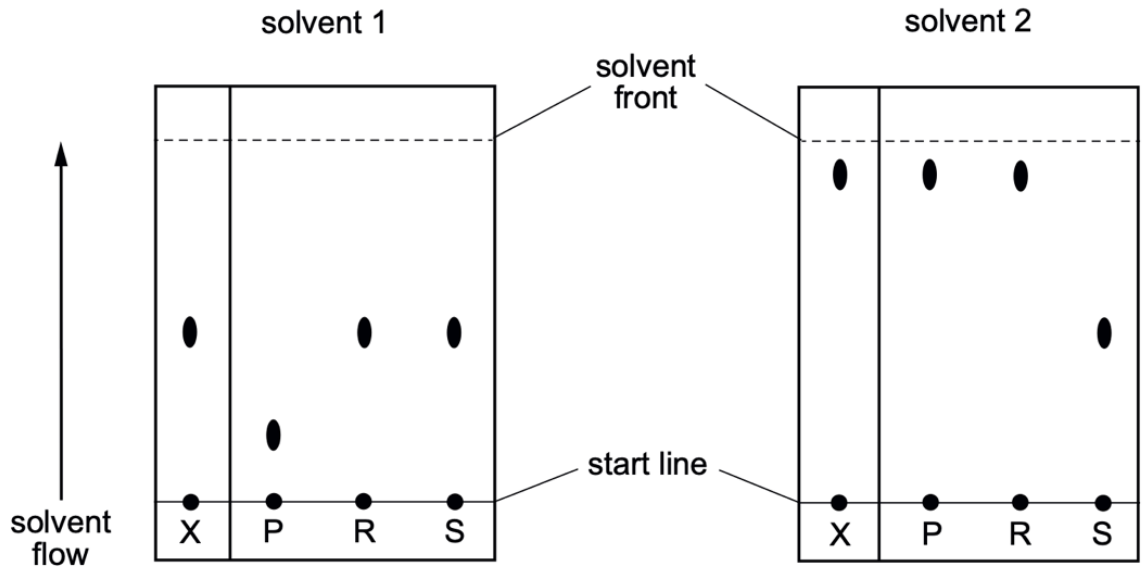
**A** State 1 changes to state 3 by evaporation.

**B** State 2 changes to state 1 by freezing.

**C** State 1 changes to state 2 by condensing.

**D** State 3 changes to state 2 by sublimation.

**22** Solution X contains one or more of three substances, P, R and S. Two different solvents are used to produce two chromatograms comparing solution X with the three substances. The results are shown.




What does X contain?

**A** R only

**B** P and R

**C** R and S

**D** P, R and S

**23** The relative abundance of three different isotopes of lead in a sample of lead ore is shown in the following table.

| isotope | % abundance | Ar |
|---|---|---|
| 1 | 50 | 206 |
| 2 | 25 | 208 |
| 3 | 25 | 209 |

What is the relative atomic mass of the lead in the sample?

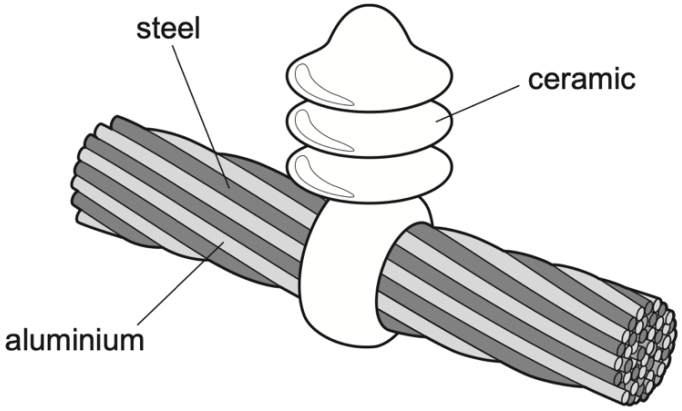
**A** 207.00

**B** 207.25

**C** 207.50

**D** 207.67

**24** The diagram shows a section of an overhead power cable.




Which statement explains why a particular substance is used?

**A** Aluminium has a low density and is a good conductor of electricity.

**B** Ceramic is a good conductor of electricity.

**C** Steel can rust in damp air.

**D** Steel is more dense than aluminium.

**25** A compound of element X has the formula $XCl_4$ and a relative formula mass of 190. What is element X?

**A** cadmium, Cd

**B** gadolinium, Gd

**C** sulfur, S

**D** titanium, Ti

**26** The pH value of some of the common household substances are shown below.

| household substance | pH value |
|---|---|
| bicarbonate of soda | 9 |
| bleach | 12 |
| drain cleaner | 14 |
| lemonade | 2 |
| milk | 6 |
| vinegar | 3 |

Which statement is correct?

**A** Drain cleaner can neutralise bicarbonate of soda.

**B** Lemonade, milk and bicarbonate of soda are all acidic.

**C** Milk, lemonade and vinegar are all bases.

**D** Vinegar can neutralise bicarbonate of soda.

**27** 54.75 g of hydrated calcium chloride crystals are heated to produce anhydrous calcium chloride and water vapour.

$$CaCl_2 \bullet 6H_2O\ (s) \rightarrow CaCl_2\ (s) + 6H_2O\ (g)$$

What is the mass of anhydrous calcium chloride formed?

**A** 0.5 g

**B** 25.9 g

**C** 27.8 g

**D** 43.7 g

**28** Y gives a white precipitate when aqueous silver nitrate is added.

When heated with aqueous potassium hydroxide, Y gives off a gas that turns moist litmus paper blue.

What is Y?

**A** ammonium chloride

**B** ammonium sulfate

**C** sodium chloride

**D** sodium hydroxide

**29** X, Y and Z are three metals.

When Z is heated with the oxide of X, the metal X is formed.

When X is added to a solution of $Y^{2+}$ ions, no reaction takes place. What is the order of reactivity of the metals?

| | least reactive | ⟶ | most reactive |
|---|---|---|---|
| **A** | X | Y | Z |
| **B** | Y | X | Z |
| **C** | Y | Z | X |
| **D** | Z | Y | X |

**30** Which statements about elements in Group 1 of the Periodic Table are correct?

1 They become less reactive going down the group.
2 Sodium forms positive ions more easily than lithium.
3 Their melting points increase going down the group.
4 Rubidium is more dense than sodium.

**A** 1 and 2

**B** 1 and 3

**C** 2 and 4

**D** 3 and 4

**31** Carbon dioxide reacts with carbon to form carbon monoxide.

$$CO_2 + C \rightarrow 2\ CO$$

Which row describes what happens to the carbon dioxide and to the carbon during the reaction?

| | carbon dioxide | carbon |
|---|---|---|
| **A** | oxidised | oxidised |
| **B** | oxidised | reduced |
| **C** | reduced | oxidised |
| **D** | reduced | reduced |

**32** Excess magnesium ribbon is reacted with 10 $cm^3$ of dilute hydrochloric acid. The hydrogen gas produced is collected and measured.

Which change to the reaction conditions would increase the rate of reaction **and** the volume of the hydrogen produced?

**A** Use a lower temperature.

**B** Use a transition metal catalyst.

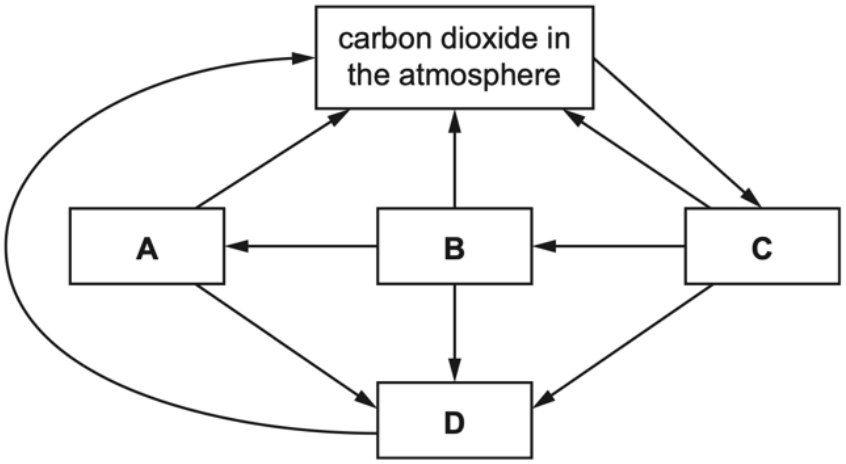
**C** Use concentrated hydrochloric acid.

**D** Use powdered magnesium.

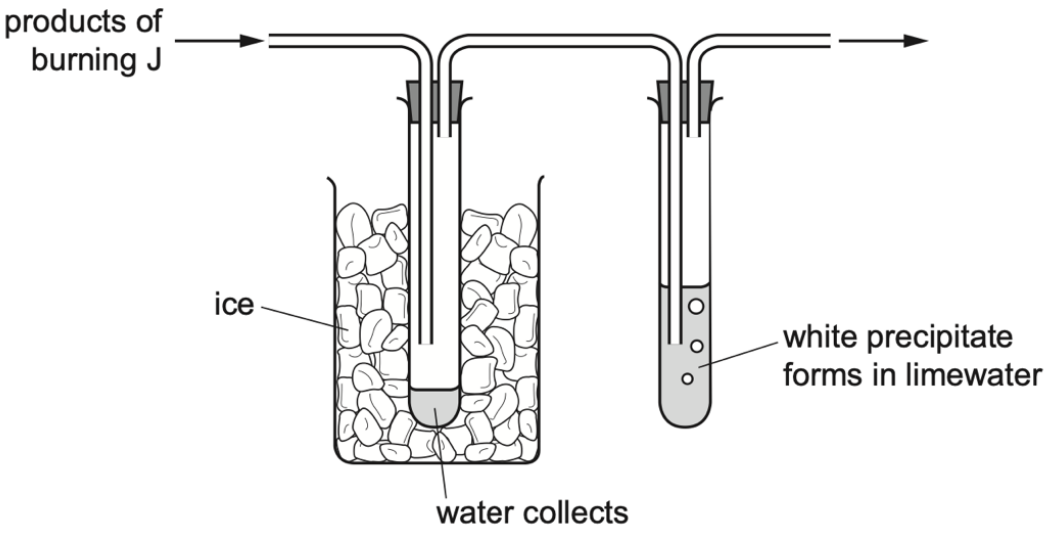
**33** Which row identifies a substance present in clean air and a substance that is a pollutant in air?

| | present in clean air | pollutant in air |
|---|---|---|
| **A** | oxides of nitrogen | nitrogen |
| **B** | carbon dioxide | sulfur dioxide |
| **C** | carbon monoxide | lead compounds |
| **D** | nitrogen | argon |

**34** Which labelled box represents plants in the carbon cycle?




**35** The products formed by burning substance J are passed through the apparatus shown.




What is substance J?

**A** carbon monoxide

**B** hydrogen

**C** propane

**D** sulfur

**36** Methane reacts with an excess of chlorine in the presence of ultraviolet light to form a mixture of products.

How many of these products contain one carbon atom and one or more chlorine atoms?

**A** 1

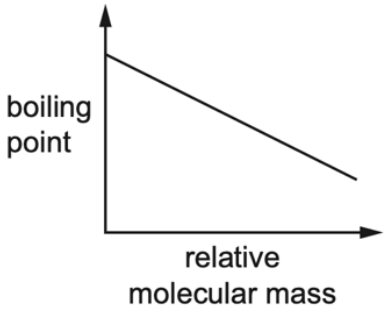
**B** 2

**C** 3

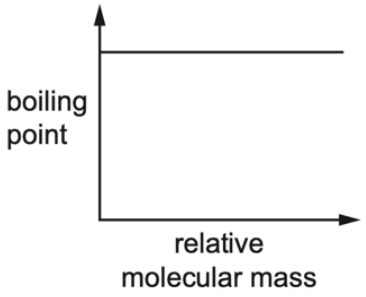
**D** 4

**37** Which graph represents the change in boiling point of the alcohols as their relative molecular mass increases?

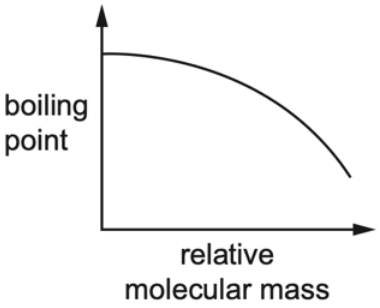
**A**



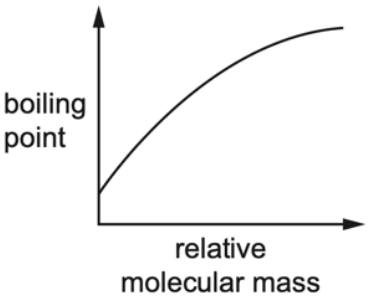

**B**




**C**




**D**




**38** Ethanoic acid, $CH_3COOH$, reacts with magnesium carbonate.

Which of the following equation represents the reaction?

**A** $CH_3COOH + MgCO_3 \rightarrow CH_4C_2O_5Mg$

**B** $CH_3COOH + MgCO_3 \rightarrow CH_2COOMg + H_2O + CO_2$

**C** $2CH_3COOH + MgCO_3 \rightarrow (CH_4C_2O_3)_2Mg$

**D** $2CH_3COOH + MgCO_3 \rightarrow (CH_3COO)_2Mg + H_2O + CO_2$

**39** Some plastics can be recycled using the physical method or the chemical method. Before recycling is carried out, the plastic waste needs to undergo the pre-treatment process.

Which of the following is the correct sequence to the pre-treatment process?

**A** manual sorting → shredding into smaller pieces → washing

**B** manual sorting → washing → shredding into smaller pieces

**C** shredding into smaller pieces → washing → manual sorting

**D** washing → shredding into smaller pieces → manual sorting

**40** What happens to plastic waste when left in the environment?

**A** It is a biodegradable material so it eventually disintegrates.

**B** It never fully goes away as it breaks into little pieces.

**C** The animals will consume the plastic waste.

**D** There is no plastic waste as all plastic is recycled.

**-- End of paper --**

## Data Sheet

### Colours of Some Common Metal Hydroxides

| | |
|---|---|
| **aluminium hydroxide** | **white** |
| **calcium hydroxide** | **white** |
| **copper(II) hydroxide** | **light blue** |
| **iron(II) hydroxide** | **green** |
| **iron(III) hydroxide** | **red-brown** |
| **zinc hydroxide** | **white** |

# The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 |
| | | | | | | | 1 H hydrogen 1 | | | | | | | | | | 2 He helium 4 |
| 3 Li lithium 7 | 4 Be beryllium 9 | | Key: proton (atomic) number; atomic symbol; name; relative atomic mass | | | | | | | | | 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 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 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 Mc moscovium – | 116 Lv livermorium – | 117 Ts tennessine – | 118 Og oganesson – |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 $dm^3$ at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$.

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