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| Name: | Index Number: | Class: |
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**HUA YI SECONDARY SCHOOL**

**Preliminary Examination**

**4E**

**CHEMISTRY**

Paper 1

**4E**

**6092/1**

18 Sept 2020

1 hour

Candidates answer on the Multiple Choice Answer Sheet  
Additional Materials: Multiple Choice Answer Sheet

**READ THESE INSTRUCTIONS FIRST**

Write your Name, Index Number and Class on all the work you have done.  
Write in soft pencil.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

| For Examiner's Use |  |
|--------------------|--|
| Paper 1            |  |

This document consists of **20** printed pages including the cover page.

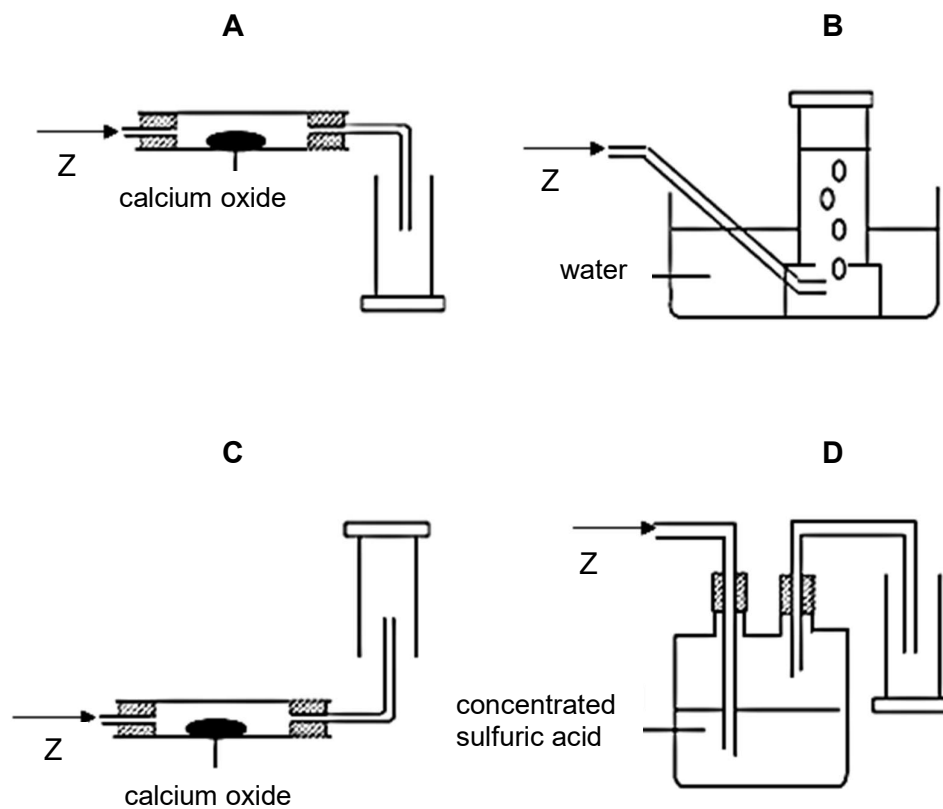
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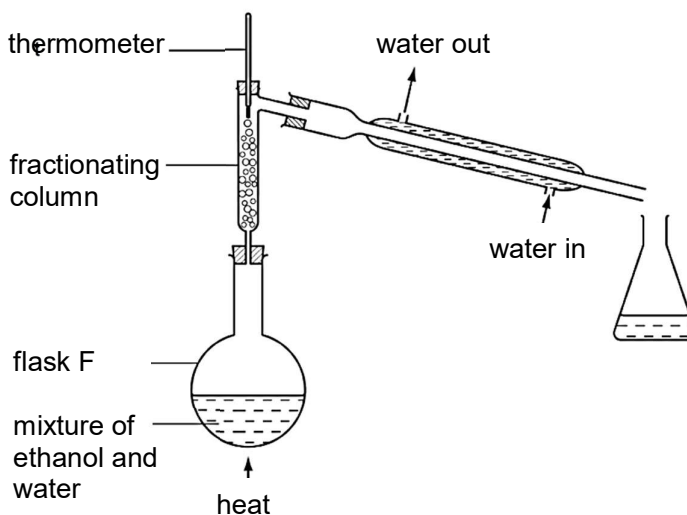
**[Turn Over**

- 1 A gas turns moist red litmus blue, is soluble in water and is less dense than air.

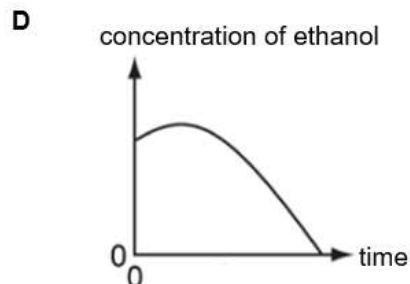
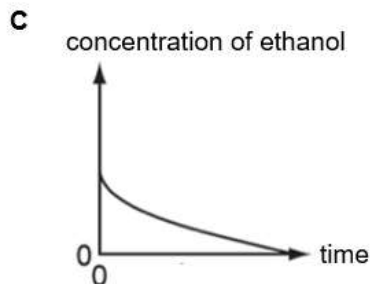
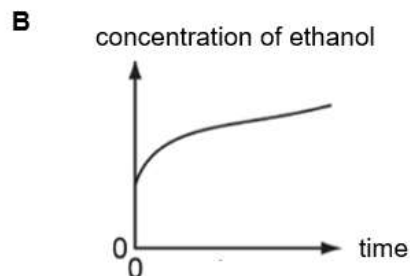
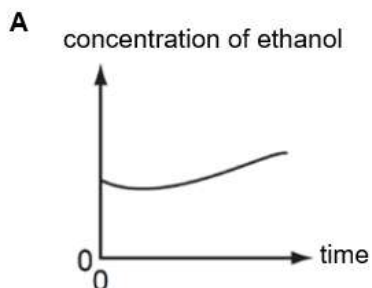
Which diagram shows a correct way of drying and collecting the gas?



- 2 The apparatus shown is used to distil ethanol (boiling point  $78^{\circ}\text{C}$ ) from a mixture of ethanol and water.



Which graph shows the change in concentration of ethanol in flask F as the distillation proceeds?



- 3 At which temperature does a concentrated aqueous solution of potassium nitrate begin to boil?

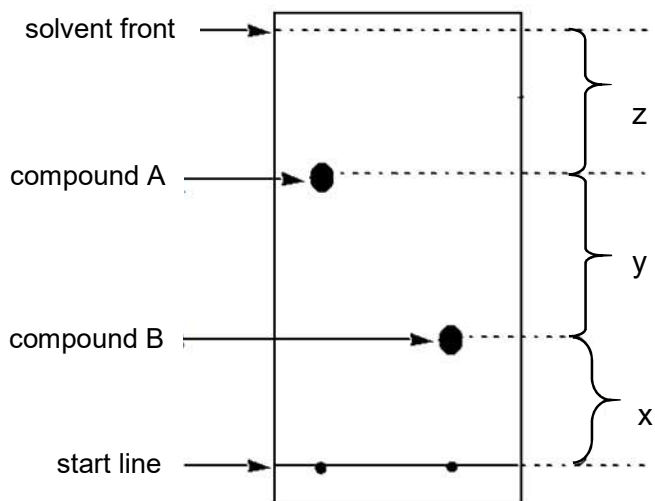
**A**  $96^{\circ}\text{C}$

**B**  $104^{\circ}\text{C}$

**C**  $396^{\circ}\text{C}$

**D**  $404^{\circ}\text{C}$

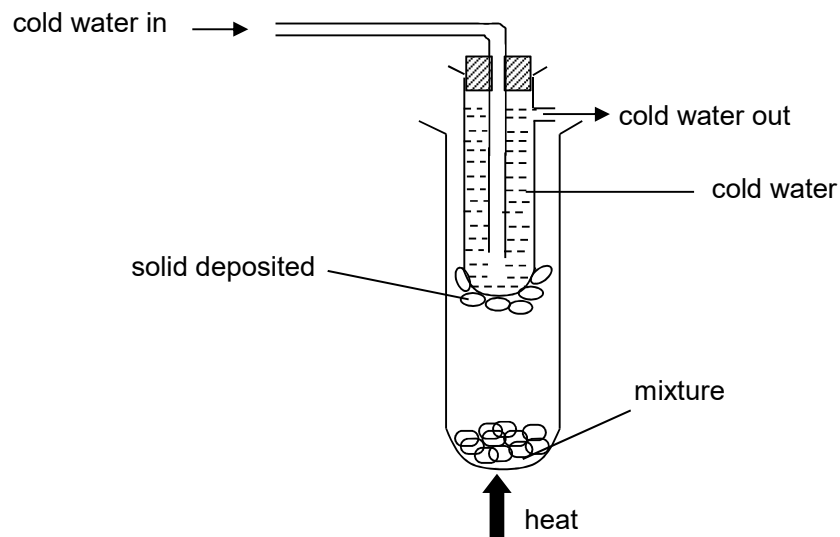
- 4 A paper chromatogram of two compounds A and B is shown in the diagram below.



Which statement regarding the paper chromatogram is correct?

- A  $R_f$  value of A is  $\frac{y}{y+x}$
  - B  $R_f$  value of A is  $\frac{y+x}{x+y+z}$
  - C compound A has a lower  $R_f$  value than compound B
  - D compound A is less soluble in the solvent than compound B
- 5 Which solutions, when mixed together, form an insoluble salt?
- A dilute hydrochloric acid and barium nitrate
  - B dilute hydrochloric acid and lead(II) nitrate
  - C dilute sulfuric acid and sodium hydroxide
  - D dilute sulfuric acid and zinc chloride

6

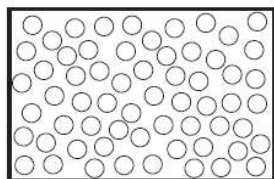


Which of the following mixtures can be separated using the set-up above?

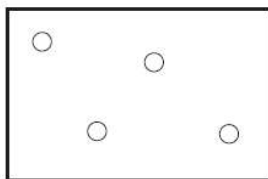
- 1 iodine and sodium chloride
- 2 potassium chloride and silicon dioxide
- 3 zinc chloride and ammonium chloride

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

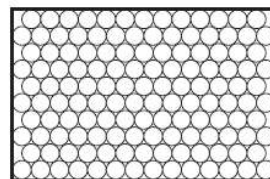
7 The diagrams show the arrangement of particles in three different physical states of substance X.



state 1



state 2

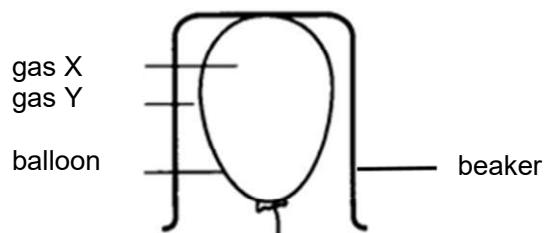


state 3

Which statement about the physical states of substance X is correct?

- A** Particles in state 1 vibrate about fixed positions.  
**B** State 1 changes to state 2 by diffusion.  
**C** State 2 changes to state 3 by sublimation.  
**D** The substance in state 3 has a fixed volume.

- 8 A balloon filled with gas X is placed inside a beaker that is filled with gas Y.



Which pair of gases would cause the balloon to shrink a few hours later?

- |          |                |                 |
|----------|----------------|-----------------|
|          | gas X          | gas Y           |
| <b>A</b> | ammonia        | nitrogen        |
| <b>B</b> | argon          | ammonia         |
| <b>C</b> | carbon dioxide | oxygen          |
| <b>D</b> | nitrogen       | carbon monoxide |

- 9  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  are two isotopes of chlorine.

- 1 Both isotopes have the same mass number.
- 2 Both isotopes have the same electronic configuration.
- 3 Both isotopes have similar physical properties.
- 4 Both isotopes have similar chemical properties.

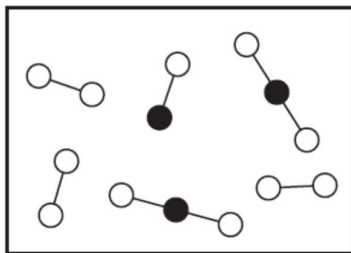
Which of the following statements are correct?

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

- 10 Which observation suggests that solid X is **not** an element?

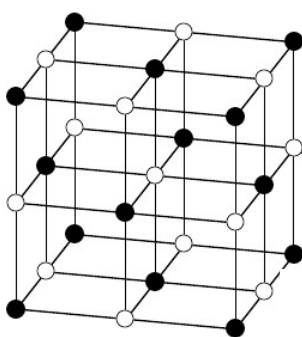
- A** X dissolves in water to form a colourless solution.  
**B** X forms oxides with two different chemical formulae when heated in air.  
**C** X gives out a colourless gas and leave behind a black residue when heated.  
**D** X melts at  $-1\text{ }^{\circ}\text{C}$  and boils at  $102\text{ }^{\circ}\text{C}$ .

- 11 The diagram shows the particles in a mixture of gases.



Which statement is **not** correct?

- A There are six molecules in the box.
  - B There are three different compounds in the box.
  - C There are three different types of molecule in the box.
  - D There are two different types of atom in the box.
- 12 The diagram shows the arrangement of the ions in an ionic crystal.



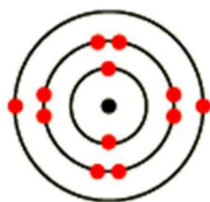
key

- = positive ion
- = negative ion

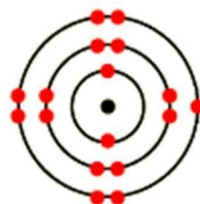
Which compound **cannot** have this arrangement of ions?

- A  $\text{Ba}(\text{NO}_3)_2$
- B  $\text{CaO}$
- C  $\text{FeSO}_4$
- D  $\text{RbCl}$

- 13 The electronic structures of two atoms X and Y are shown.



element X



element Y

X and Y combine together to form a compound.

Which row describes the formula and the properties of this compound?

|          | formula of compound | electrical conductivity                           | melting point |
|----------|---------------------|---------------------------------------------------|---------------|
| <b>A</b> | $XY_2$              | cannot conduct electricity                        | high          |
| <b>B</b> | $XY_2$              | conducts electricity in molten and aqueous states | high          |
| <b>C</b> | $X_2Y$              | cannot conduct electricity                        | low           |
| <b>D</b> | $X_2Y$              | conducts electricity in molten and aqueous states | low           |

- 14 An element M burns in oxygen gas to form a compound  $MO_2$ .

$MO_2$  cannot conduct electricity in all states.

What could be the electronic structure of M?

- A** 2, 1
- B** 2, 2
- C** 2, 4
- D** 2, 6

- 15 Which particles are responsible for the conduction of electricity through metals?

- A** electrons only
- B** positive ions only
- C** electrons and positive ions
- D** negative and positive ions

- 16 Z forms a phosphate with the formula of  $ZPO_4$ .

Given that the formula of calcium phosphate is  $Ca_3(PO_4)_2$ , what is the chemical formula of sulfate of Z?

- A  $ZSO_4$
- B  $Z_2SO_4$
- C  $Z_2(SO_4)_3$
- D  $Z_3(SO_4)_2$

- 17 Which compound contains the greatest mass of carbon in 100 g of the sample?

- A CO
- B  $C_2H_6O_2$
- C  $Cr_2(CO_3)_3$
- D  $CO_2$

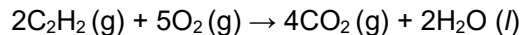
- 18 5.0 g of an oxide of bismuth contains 4.48 g of bismuth.

What is the molecular formula of this oxide?

- A BiO
- B  $BiO_2$
- C  $Bi_2O_3$
- D  $Bi_4O_3$

- 19 40.0 cm<sup>3</sup> of ethyne,  $C_2H_2$ , is reacted with 50.0 cm<sup>3</sup> of oxygen.

The equation for the reaction is

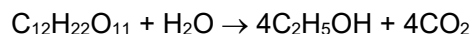


Assume that all volumes are measured at room temperature and pressure.

What is the total volume of gas remaining at the end of the reaction?

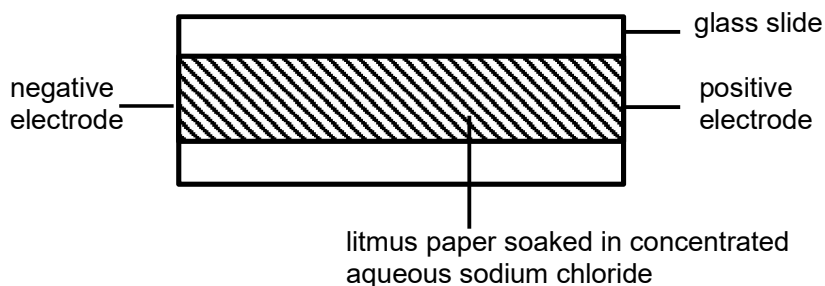
- A 40.0 cm<sup>3</sup>
- B 50.0 cm<sup>3</sup>
- C 60.0 cm<sup>3</sup>
- D 80.0 cm<sup>3</sup>

- 20 When sugar ( $M_r = 342$ ) is fermented using yeast, the following reaction takes place.



What volume of carbon dioxide, at room temperature and pressure, would be produced by the complete fermentation of 1 kg (1000 g) of sugar?

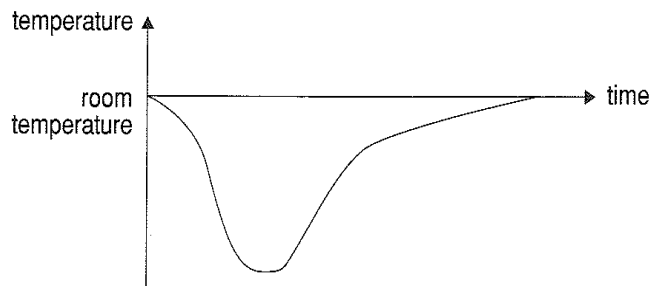
- A  $\frac{342 \times 4 \times 24}{1000} \text{ dm}^3$
- B  $\frac{1000 \times 24}{342 \times 4} \text{ dm}^3$
- C  $\frac{342 \times 24}{1000 \times 4} \text{ dm}^3$
- D  $\frac{1000 \times 4 \times 24}{342} \text{ dm}^3$
- 21 A piece of litmus is soaked in concentrated aqueous sodium chloride solution and supported on a glass slide. The paper was connected to a battery.



Which one of the following shows the correct observations near the negative electrode and positive electrode after the current had flowed for some time?

|   | negative electrode | positive electrode |
|---|--------------------|--------------------|
| A | bleached           | blue               |
| B | blue               | bleached           |
| C | red                | blue               |
| D | red                | bleached           |

- 22 Which of the following best describes what happens during the electrolytic refining of copper with aqueous copper(II) sulfate as the electrolyte?
- A Copper is deposited on the cathode and the solution becomes colourless.
  - B Copper is transferred from the anode to the cathode and the solution remains blue.
  - C Copper is transferred from the solution to the anode and the solution becomes colourless.
  - D Copper is transferred from the anode to the cathode and the solution becomes colourless.
- 23 Which statement describes what happens when hydrogen and oxygen are used in a fuel cell?
- A Electricity is generated directly.
  - B Electricity is used to produce water.
  - C Hydrogen is burned to form steam.
  - D Hydrogen reacts to form a hydrocarbon fuel.
- 24 The graph shows how the temperature of a solution changes when some crystals of potassium iodide are dissolved in water.

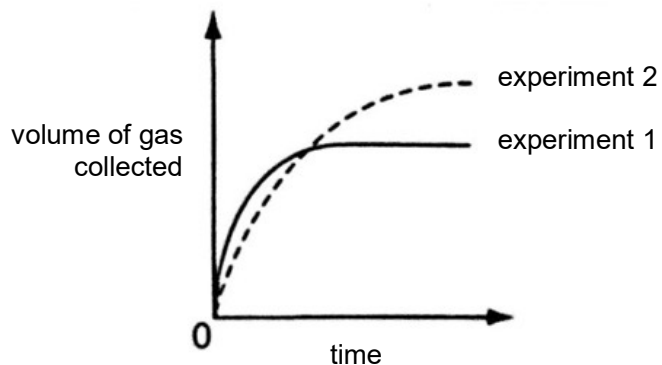


From the graph, which statement about the energy change in this process is correct?

- A More bonds are formed than broken.
  - B More energy is given out than energy is taken in.
  - C The reactants give out energy in order to form products.
  - D The reactants has less energy than the products.
- 25 In which reaction is the pressure least likely to affect the speed of reaction?
- A  $\text{C(s)} + \text{CO}_2\text{(g)} \rightarrow 2\text{CO(g)}$
  - B  $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \rightarrow 2\text{NH}_3\text{(g)}$
  - C  $\text{NaOH(aq)} + \text{HCl(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
  - D  $2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{SO}_3\text{(g)}$

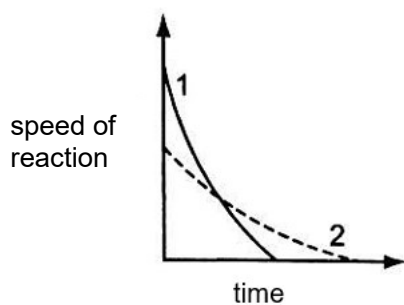
- 26** In two separate experiments, equal masses of a substance are decomposed. The gas evolved is collected.

The graph shows the total volume of gas collected against time for each experiment.

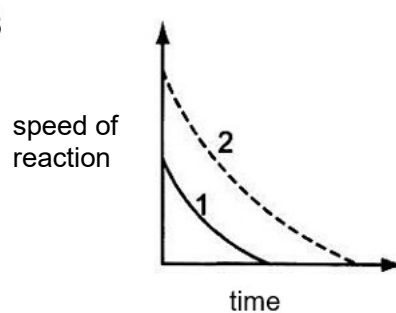


Which graph shows how the speed of reaction varies with time in each experiment?

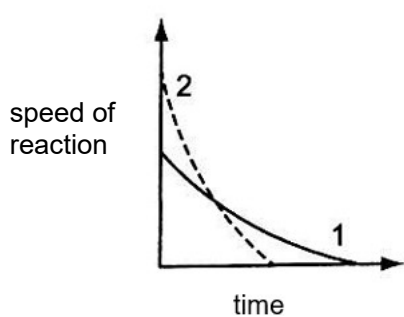
**A**



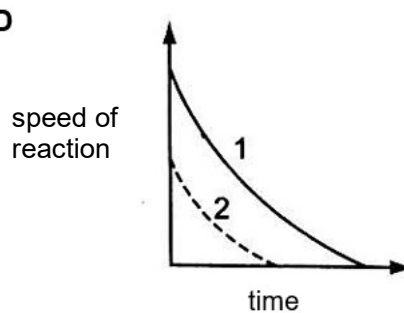
**B**



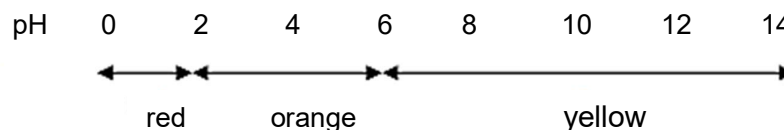
**C**



**D**



- 27 The colour of an indicator X in solutions of different pH is shown below.



Indicator X can be used to distinguish between

- A ethanoic acid and hydrochloric acid.
  - B hydrochloric acid and sulfuric acid.
  - C sodium chloride solution and sodium hydroxide solution.
  - D sodium hydroxide solution and aqueous ammonia.
- 28 A student dissolved an indigestion tablet in 200 cm<sup>3</sup> of water to form a tablet solution. He then titrated 25.0 cm<sup>3</sup> of the solution with dilute hydrochloric acid, using the same indicator.

He repeated the experiment 3 times.

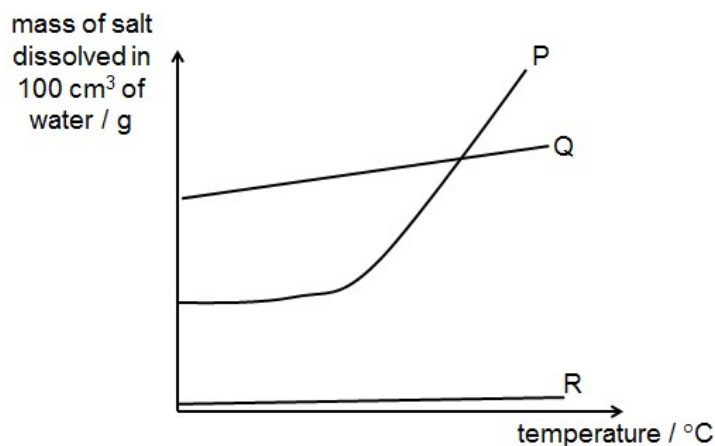
The results are shown in the table below.

| titration number                      | 1     | 2     | 3     | 4     |
|---------------------------------------|-------|-------|-------|-------|
| volume of acid used / cm <sup>3</sup> | 21.50 | 20.50 | 20.40 | 20.40 |

Which statement could explain the results obtained in titration number 1?

- A The burette was rinsed with hydrochloric acid before use.
  - B The flask was rinsed with the tablet solution before use.
  - C The pipette was rinsed with distilled water before use.
  - D The student had used too much indicator.
- 29 Which of the following equations suggests that a metal oxide, MO, has amphoteric properties?
- A  $\text{MO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{M}^{2+} \text{(aq)} + 2\text{OH}^- \text{(aq)}$
  - B  $\text{MO (s)} + 2\text{H}^+ \text{(aq)} \rightarrow \text{M}^{2+} \text{(aq)} + \text{H}_2\text{O (l)}$
  - C  $\text{MO (s)} + 2\text{OH}^- \text{(aq)} \rightarrow \text{MO}_2^{2-} \text{(aq)} + \text{H}_2\text{O (l)}$
  - D  $\text{MO (s)} + 2\text{NH}_4^+ \text{(aq)} \rightarrow \text{M}^{2+} \text{(aq)} + 2\text{NH}_3 \text{(g)} + \text{H}_2\text{O}$

- 30 The solubility of three salts, P, Q and R, over a range of temperatures is shown below.



Which methods should be used to obtain solid samples of the salts from its aqueous solution?

|          | P                      | Q                      | R                      |
|----------|------------------------|------------------------|------------------------|
| <b>A</b> | crystallisation        | precipitation          | evaporation to dryness |
| <b>B</b> | crystallisation        | evaporation to dryness | precipitation          |
| <b>C</b> | precipitation          | crystallisation        | evaporation to dryness |
| <b>D</b> | evaporation to dryness | crystallisation        | precipitation          |

- 31 Which one of the following statements correctly describes a trend in the properties of the elements, going from left to right of Period 3 of the Periodic Table?

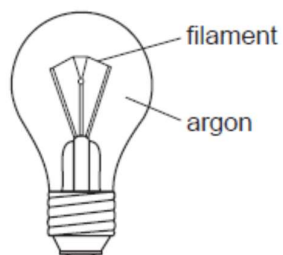
- A** The ability of the elements to conduct electricity increases.
- B** The number of neutrons in the atom increases.
- C** The number of valence electrons decreases in the atoms.
- D** The tendency to gain electrons increases.

- 32 A newly discovered element, P, is placed in the same group in the Periodic Table as sodium.

Which of the following is likely to be a property of the element P?

- A** It cannot be cut by knife.
- B** It has poor electrical conductivity.
- C** It reacts with bromine gas to form PBr.
- D** It reacts mildly with water to release hydrogen.

- 33 The diagram shows a light bulb.



Why is argon used instead of air in the light bulb?

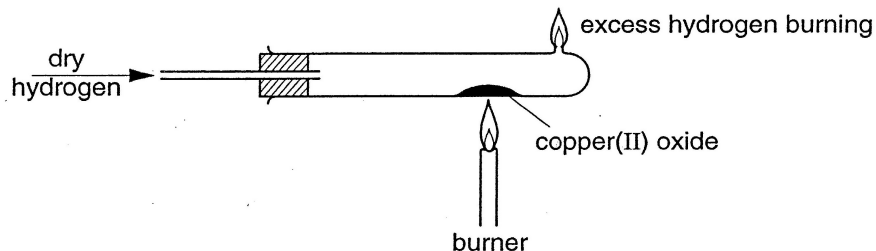
- A** Argon is a good conductor of electricity.  
**B** Argon is more reactive than air.  
**C** The filament does not react with the argon.  
**D** The filament glows more brightly
- 34 The following observations were made when nickel and iron were placed separately into solutions of metals S, T and U.

| metal  | salt solution of S | salt solution of T | salt solution of U |
|--------|--------------------|--------------------|--------------------|
| nickel | S displaced        | no reaction        | no reaction        |
| iron   | S displaced        | T displaced        | no reaction        |

What is the correct order in increasing reactivity of the five metals?

- A**  $S < Ni < Fe < T < U$   
**B**  $S < Ni < T < Fe < U$   
**C**  $U < Fe < T < Ni < S$   
**D**  $U < T < Fe < Ni < S$

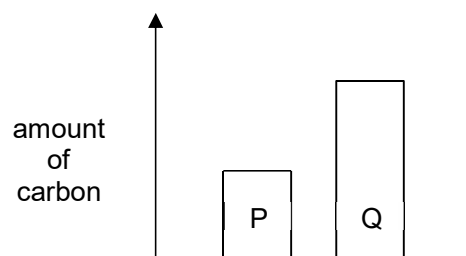
- 35** Copper(II) oxide is reduced to copper as shown. The burner is then turned off but the hydrogen is kept flowing until the tube is cold.



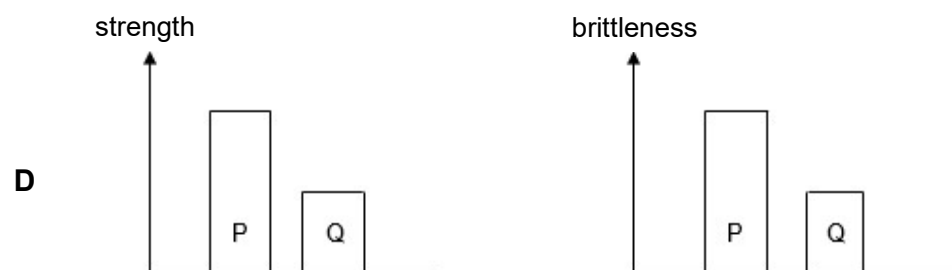
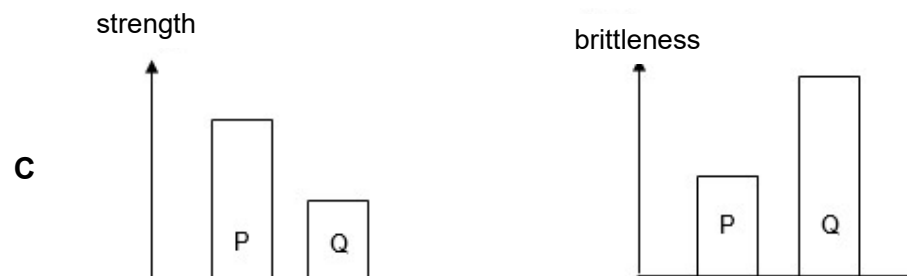
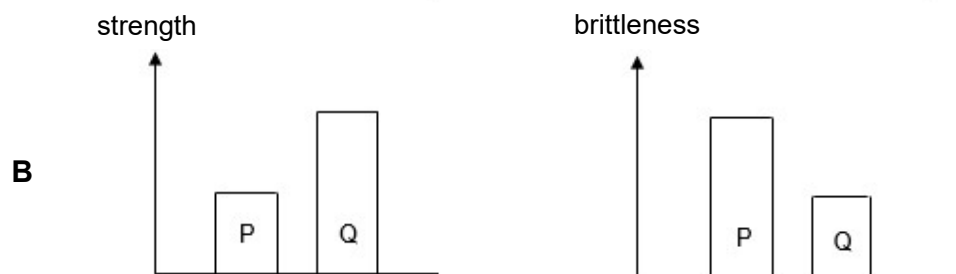
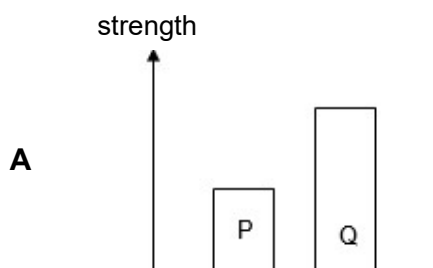
What is the main reason why the hydrogen is kept flowing?

- A** to ensure that the reaction is complete
  - B** to lessen the risk of explosion in the hot tube
  - C** to prevent the copper from reacting with the air
  - D** to remove any traces of water left in the tube
- 36** Recycling produces approximately 40% of all iron and steel.
- Which statements are correct reasons for recycling iron?
- 1 Iron, when obtained by a recycling process produces less carbon dioxide than the blast furnace process.
  - 2 Scrap steel contains a higher percentage of iron than iron ore.
  - 3 Scrap metal, if not recycled, would cause environmental problems due to disposal by landfill.
- A** 1 and 2 only
  - B** 1 and 3 only
  - C** 2 and 3 only
  - D** 1,2 and 3

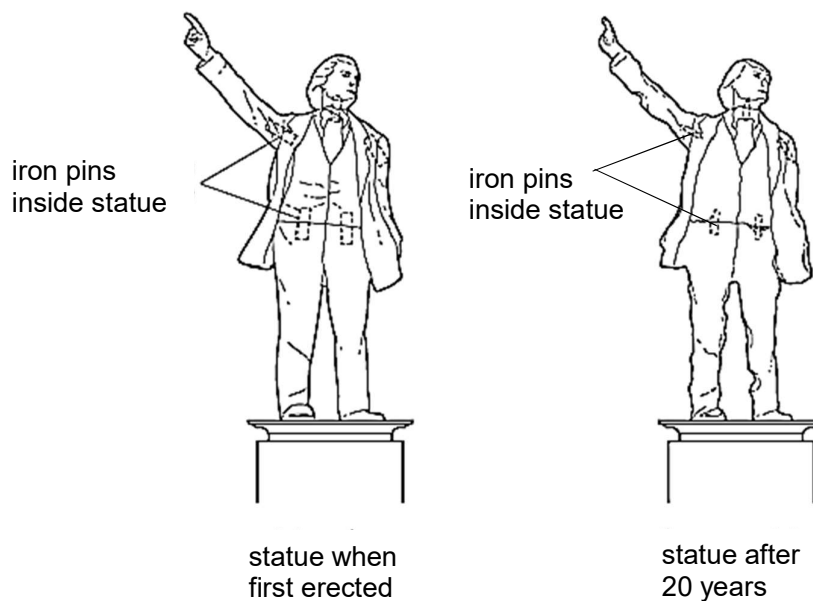
- 37 The diagram compares the amount of carbon in two steels, P and Q.



Which two diagrams correctly compare the strength and brittleness of P and Q?



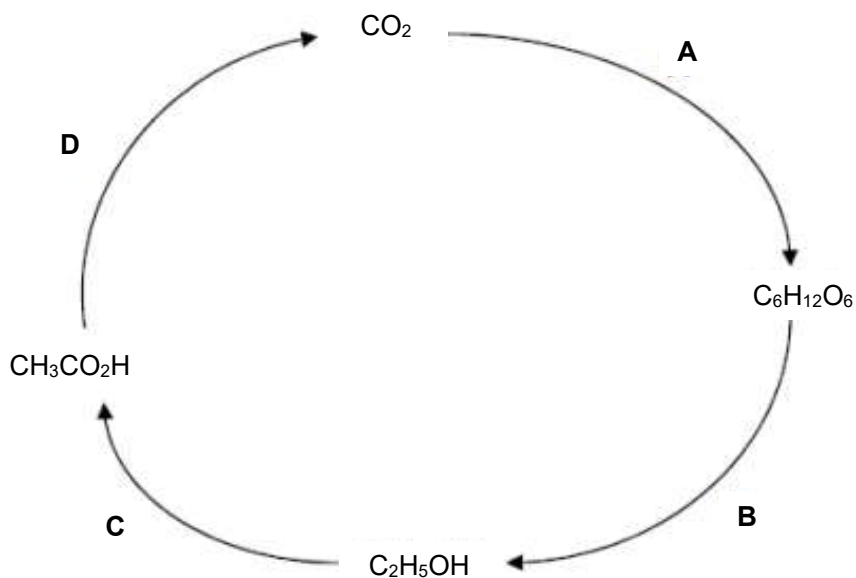
- 38 The diagram below shows a statue made from limestone.



What is the main cause of the iron pins inside the statue becoming smaller?

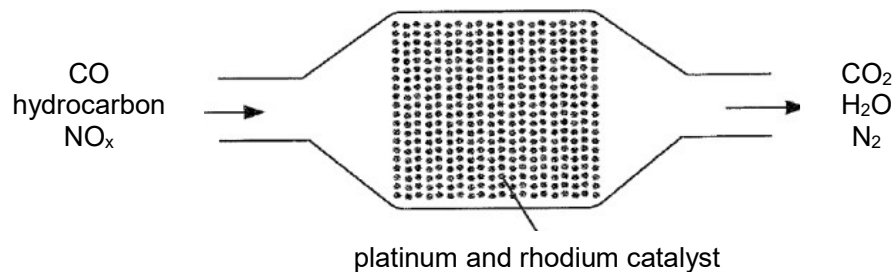
- A carbon dioxide emission from motor vehicles
  - B incomplete combustion of carbon-containing fuels
  - C increased temperature due to global warming
  - D lightning activity near the statue
- 39 The diagram shows the steps by which carbon dioxide can be converted into organic products and finally returned to the atmosphere.

Which step, **A**, **B**, **C** or **D** is endothermic?



- 40 The diagram below represents a section of a catalytic converter in the exhaust system of a car.

Harmful gases are converted into carbon dioxide, nitrogen and water vapour which come out of the catalytic converter.



Which processes take place in the catalytic converter?

- 1 Platinum and rhodium catalyse redox reactions.
- 2 Oxides of nitrogen are removed by the process of reduction.
- 3 Carbon monoxide and nitrogen oxides react together.

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

**End of Paper**

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lanthanoids