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ADMIRALTY SECONDARY SCHOOL

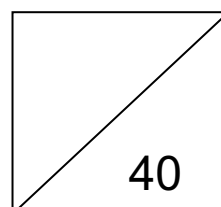


PRELIMINARY EXAMINATION 2020

SUBJECT : Chemistry
CODE/PAPER : 6092/1
LEVEL/STREAM : Secondary 4 Express
DATE : 01 Sep 2020
TIME : 1120h – 1220h
DURATION : 1 hour

Instructions to candidates:

1. The paper consists of **forty** questions. Answer **all** questions. For each question there are four possible answers **A, B, C** or **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the Optical Answer Sheet (OAS) provided.
2. You may use an approved scientific calculator for this paper.
3. A copy of the Periodic Table is available in the data page for your reference.



DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of **13** printed pages including this cover page.

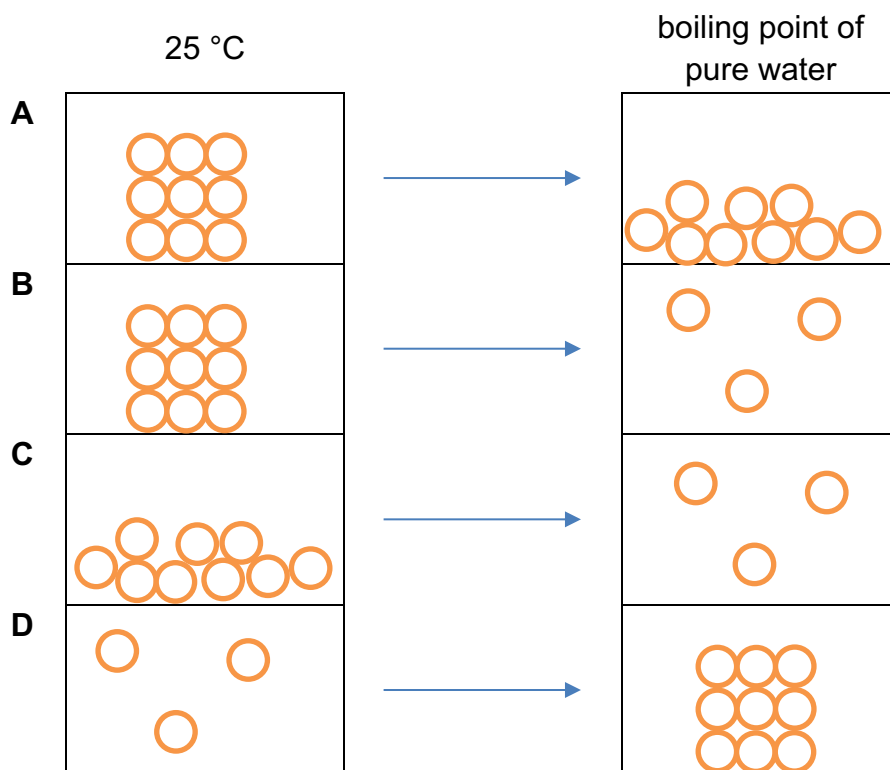
- 1 The rate of diffusion of gas A ($M_r = 28$) and gas B ($M_r = 64$) was compared at 30 °C and 80 °C.

Which would have the fastest rate of diffusion?

- A gas A at 30 °C
- B gas B at 30 °C
- C gas A at 80 °C
- D gas B at 80 °C

- 2 Substance P has a melting point of 99 °C and a boiling point of 101 °C.

Which of the following shows the arrangement of particles in substance P as it is heated from 25 °C to the boiling point of pure water?



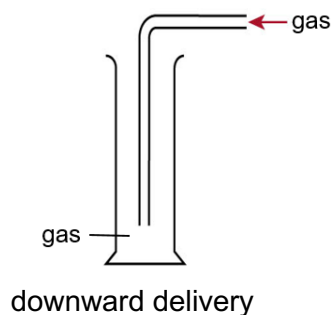
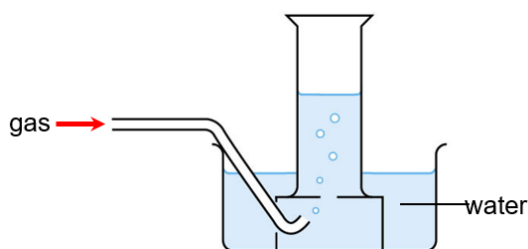
- 3 Which of the following substances should be used as a drying agent to obtain a sample of dry carbon dioxide?

- | | |
|------------------------------|------------------------|
| A calcium oxide | B calcium hydroxide |
| C concentrated sulfuric acid | D dilute sulfuric acid |

- 4 The table gives the density and solubility in water of four gases.

gas	solubility in water	density
1	soluble	denser than air
2	soluble	less dense than air
3	insoluble	denser than air
4	insoluble	less dense than air

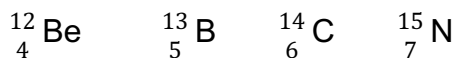
Two methods of collection of gases are displacement of water and downward delivery.



Which row correctly shows whether each of these methods could or could not be used to collect each gas?

	gas	Method of collection	
		displacement of water	downward delivery
A	1	no	no
B	2	yes	no
C	3	yes	yes
D	4	no	yes

- 5 Four atoms are shown.



Which statement about all four atoms is correct?

- A** They have the same number of electrons.
- B** They have the same number of neutrons.
- C** They have the same number of nucleons.
- D** They have the same number of protons.

- 6** Which element has the least number of electrons in the outermost shell (energy level) of its atoms?

A aluminium

B chlorine

C helium

D sodium

- 7** An element, Q, has p protons and n neutrons in its nucleus.

Which row gives a possible number of protons, neutrons and electrons in a positive ion of an isotope of Q?

	protons	neutrons	electrons
A	p	$n - 1$	$p - 1$
B	p	$n - 1$	$p + 1$
C	$p - 1$	n	$p - 1$
D	$p - 1$	n	$p + 1$

- 8 Which statements correctly describe the properties of mixture of copper and sulfur, and the compound copper(II) sulfide, CuS ?

	mixture of copper and sulfur	compound copper(II) sulfide
1	copper and sulfur mix without chemically reacting	copper and sulfur combined in a chemical reaction to form copper(II) sulfide
2	the ratio of copper to sulfur in mixture can vary	the ratio of copper to sulfur in copper(II) sulfide is always the same
3	the mixture does not have the properties of copper or sulfur	copper(II) sulfide has the properties of copper and sulfur

A 1 only

B 1 and 2 only

C 2 and 3 only

D 3 only

- 9 Which of the following solids does **not** contain covalent bonds?

A ammonium chloride

B graphite

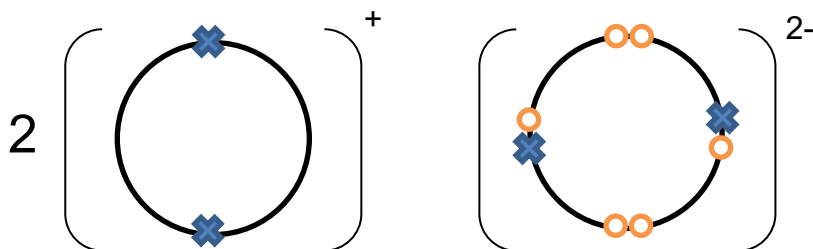
C iodine

D sodium

- 10 In which compound does one of the atoms **not** achieve the electronic configuration of 2,8?

A carbon tetrachloride B carbon dioxide
C magnesium oxide D sodium fluoride

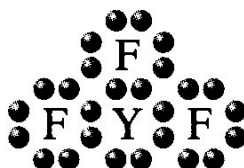
- 11 The dot-and-cross diagram for compound Q is shown below. Only the valence electrons are shown.



Which of the following correctly shows the elements present in compound Q?

	element 1	element 2
A	beryllium	fluorine
B	magnesium	chlorine
C	sodium	sulfur
D	lithium	oxygen

- 12 The following diagram shows the electronic structure of a compound formed between an element Y and fluorine (showing only the valence electrons).



What would be the formula of the compound formed between Y and magnesium?

A MgY B MgY₃ C Mg₂Y₃ D Mg₃Y₂

- 13 Which ionic equation represents the reaction when aqueous barium nitrate is added to sulfuric acid?

A $2\text{H}^+ (\text{aq}) + \text{SO}_4^{2-} (\text{aq}) \rightarrow \text{H}_2\text{SO}_4 (\text{aq})$
B $\text{Ba}^{2+} (\text{aq}) + \text{SO}_4^{2-} (\text{aq}) \rightarrow \text{BaSO}_4 (\text{s})$
C $2\text{H}^+ (\text{aq}) + \text{Ba}^{2+} (\text{aq}) \rightarrow \text{H}_2 (\text{g}) + \text{Ba} (\text{s})$
D $\text{H}^+ (\text{aq}) + \text{NO}_3^- (\text{aq}) \rightarrow \text{HNO}_3 (\text{aq})$

- 14 How many moles of iron can be extracted from 464 g of Fe_3O_4 ?
- A 4.0 mol B 6.0 mol C 8.0 mol D 12.0 mol
- 15 Which of the following has a mass equal to that of one mole of water?
- A 24 dm³ of water
B one mole of steam
C one molecule of water
D two moles of hydrogen molecules and one mole of oxygen molecules
- 16 A solution containing one mole of sodium hydroxide is added to a solution containing one mole of iron(III) sulfate. The equation for this reaction is shown below.
- $$\text{Fe}_2(\text{SO}_4)_3 + 6\text{NaOH} \rightarrow 2\text{Fe}(\text{OH})_3 + 3\text{Na}_2\text{SO}_4$$
- What is the number of moles of iron(III) hydroxide precipitated?
- A 0.33 mol B 0.50 mol C 0.67 mol D 1.0 mol
- 17 1.0 g of each of the metals calcium, iron, magnesium and zinc was placed in separate test-tubes, each containing excess dilute hydrochloric acid. The gas evolved from each test-tube was collected and its volume was measured.
- Which metal produced the greatest volume of gas on completion of the reaction?
- A calcium B iron
C magnesium D zinc
- 18 Which particle is found in a solution of butanoic acid?
- A H B H^+ C H_2^+ D $\text{C}_4\text{H}_9\text{CO}_2^-$
- 19 Which of the following statements does **not** describe a property of a weak acid in solution?
- A It has a pH between 8 to 10.
B It forms a salt with sodium hydroxide.
C It is only partially dissociated into ions.
D It reacts with sodium carbonate to produce carbon dioxide.

- 20** A **dilute** aqueous solution of a strong alkali, XOH, contains molecules of water and the ions X^+ and OH^- .

Which statement is correct?

- A** The solution also contains H^+ ions.
- B** The pH value of the alkali is below 7.
- C** The solution contains more OH^- ions than water molecules.
- D** The solution contains a high concentration of XOH molecules.

- 21** In which equation does the metal oxide act as an acidic oxide?

- A** $Na_2O (s) + H_2O (l) \rightarrow 2NaOH (aq)$
- B** $Na_2O (s) + 2HCl (aq) \rightarrow 2NaCl (aq) + H_2O (l)$
- C** $Al_2O_3 (s) + 6HCl (aq) \rightarrow 2AlCl_3 (aq) + 3H_2O (l)$
- D** $Al_2O_3 (s) + 3H_2O (l) + 2OH^- (aq) \rightarrow 2Al(OH)_4^- (aq)$

- 22** In the preparation of hydrated magnesium sulfate crystals, excess magnesium is added to dilute sulfuric acid in the initial step. What is the purpose of adding excess magnesium to dilute sulfuric acid?

- A** to react away all the sulfuric acid
- B** to increase the speed of the reaction
- C** to lower the activation energy for effective collision
- D** to ensure the homogenous mixing of the two reactants

- 23** An excess of sodium hydroxide is added to an aqueous solution of salt X and boiled. Ammonia gas was given off. When no more ammonia gas is given off, aluminium foil was added into the solution and boiled. Ammonia gas was given off again. What could X be?

- | | |
|----------------------------|---------------------------|
| A aluminium nitrate | B ammonium nitrate |
| C zinc chloride | D sodium sulfate |

- 24** When substance Y is added to aqueous potassium iodide, the colour of aqueous potassium iodide changes from colourless to brown. What can we deduce about the nature of substance Y?

- | | |
|--------------------------|-------------------------|
| A acid | B alkali |
| C oxidising agent | D reducing agent |



- Which properties show an increase as period moves from left to right?

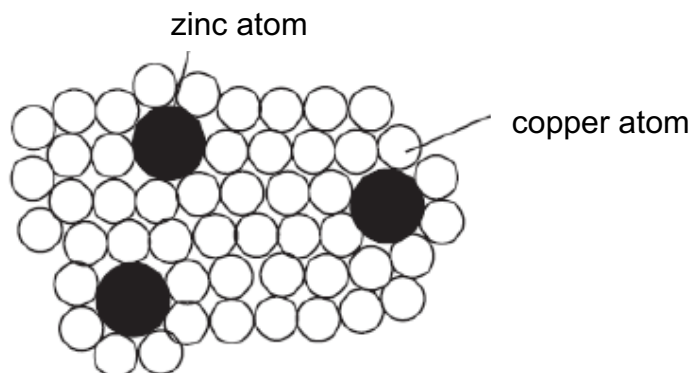
- 27** Which metal should be used in the sacrificial protection of the hull of a boat made of iron?

- 28** A substance M is heated in a dish until there is no further change.

What could M be?

- A** copper
B copper(II) carbonate
C copper(II) oxide
D hydrated copper(II) sulfate

29 The structure of brass is shown below.



Why is brass harder than pure copper?

- A The zinc atoms form strong ionic bonds with copper atoms.
 - B The zinc atoms disrupt the electronic structure of the copper atoms.
 - C The 'sea of electrons' from zinc act as 'glue', holding the atoms strongly.
 - D The difference in atomic size of the zinc atoms prevent sliding of copper atoms.
- 30 Which statement about the extraction of iron in a blast furnace is **not** correct?
- A The main impurity in the iron is slag.
 - B Coke is burnt in air to produce carbon dioxide.
 - C Haematite, containing mainly iron(III) oxide, is reduced.
 - D Slag is formed due to a reaction between an acidic oxide and a basic oxide.
- 31 A molten compound is electrolysed. Two atoms of **X** are deposited at the cathode at the same time as three atoms of **Y** are deposited at the anode.

These results show that:

X is a¹.....; **Y** is a².....; the formula of the compound is³.....

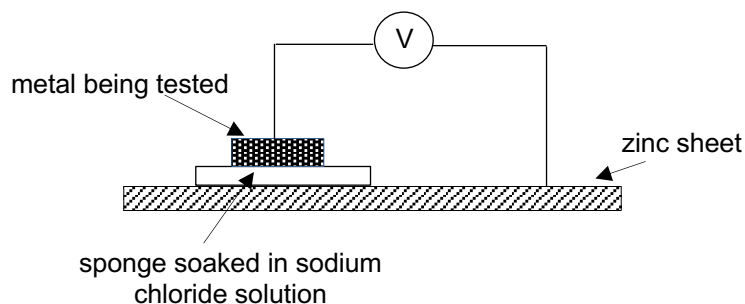
Which of the following correctly fills in the blanks 1, 2 and 3?

	1	2	3
A	metal	non-metal	X_3Y_2
B	metal	non-metal	X_2Y_3
C	non-metal	metal	X_3Y_2
D	non-metal	metal	X_2Y_3

32 What happens to the ions that move to the positive electrode during the electrolysis of molten potassium iodide?

- A** The ions are oxidised. **B** The ions gain electrons.
C The ions form isotopes. **D** The ions increase in speed.

33 An experiment was conducted on three unknown metals P, Q and R. The set-up is shown in the diagram below.



The results of the experiment are shown in the table below.

metal tested	voltage / V	direction of electron flow
P	0.2	zinc to metal P
Q	0.5	metal Q to zinc
R	1.1	zinc to metal R

Which of the following shows the order of reactivity of the three metals, starting from the least reactive?

- A** P, Q, R **B** P, R, Q **C** Q, P, R **D** R, P, Q

34 The table shows the densities of chlorine and bromine at room temperature and pressure.

element	density g/cm ³
chlorine	0.03
bromine	3.12

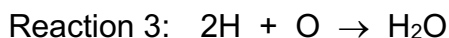
What is the main reason that the densities of chlorine and bromine are so different?

- A** Bromine has a darker colour compared to chlorine.
B Bromine has a higher molecular mass compared to chlorine.
C Bromine atoms have more electron shells than chlorine atoms.
D Bromine exists as a liquid while chlorine exists as a gas at room temperature.

35 Which property is **not** typical of transition metals?

- A They have low densities.
- B They have high melting points.
- C They formed coloured compounds.
- D They show variable oxidation states.

36 The equations for three reactions are given below:



Which of the above reactions are endothermic?

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

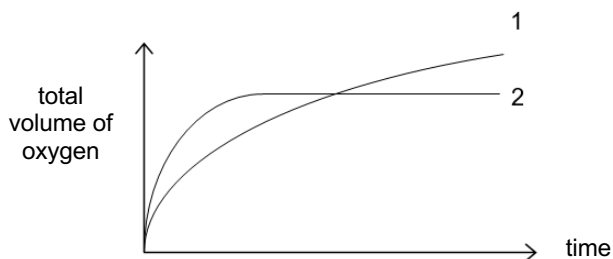
37 In which process is energy released?

- A electrolysis of water to form hydrogen and oxygen
- B forming a hydrogen molecule from two hydrogen atoms
- C fractional distillation of crude oil
- D photosynthesis

38 Which change will increase the speed of reaction between 1 mole each of two gases?

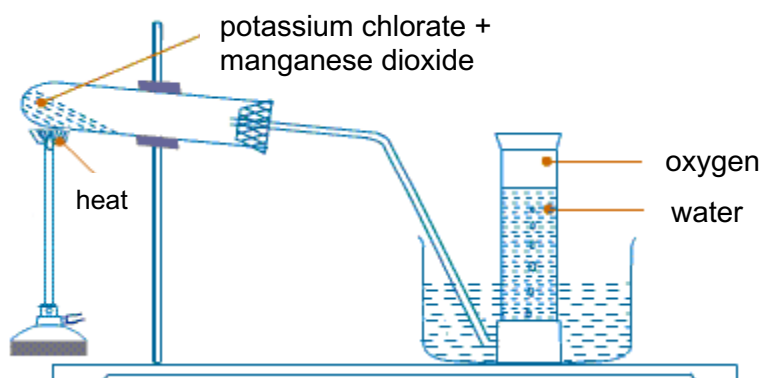
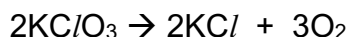
- A a decrease in temperature
- B a decrease in surface area of the catalyst
- C a decrease in the volume of the reaction flask
- D a decrease in the pressure of the reaction flask

- 39 Manganese(IV) oxide catalyses the decomposition of aqueous hydrogen peroxide into water and oxygen. In order to study the rates of this reaction for two different solutions of hydrogen peroxide, the total volumes of oxygen evolved were recorded at regular time intervals and the results were plotted. In each experiment, the same mass of catalyst was used and the temperature was the same.



If curve 1 corresponds to 20 cm³ of a 4.0 mol/dm³ solution, which of the following corresponds to curve 2?

- | | |
|---|---|
| A 8 cm ³ of a 8.0 mol/dm ³ solution | B 8 cm ³ of a 2.0 mol/dm ³ solution |
| C 10 cm ³ of a 8.0 mol/dm ³ solution | D 10 cm ³ of a 2.0 mol/dm ³ solution |
- 40 A sample of potassium chlorate was heated with manganese dioxide catalyst to produce oxygen gas. The oxygen was collected as shown in the diagram.



Which substance contaminated the first few tubes of oxygen collected?

- | | |
|-------------------------|-----------------------------|
| A carbon dioxide | B manganese dioxide |
| C nitrogen | D potassium chloride |

END OF PAPER

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