



**ST JOSEPH'S INSTITUTION
PRELIMINARY EXAMINATION 2021
(YEAR 4)**

CANDIDATE NAME

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CLASS

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INDEX
NUMBER

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CHEMISTRY

6092/01

Paper 1

30 August 2021

Additional Materials :
Multiple Choice Answer Sheet

1 hour
(09:45 – 10:45)

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the Answer Sheet in the spaces provided.
Do not use staples, paper clips, 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** or **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the 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 Question paper.

A copy of the Periodic Table is printed on page 2 of this question paper.

The use of an approved scientific calculator is expected, where appropriate.

The Periodic Table of Elements

[illegible]

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	euroium	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.).

- 1 100 cm³ of carbon dioxide, CO₂, diffused through a porous pot in 40 seconds. What would be the time taken for the same volume of ethene gas, C₂H₄, to diffuse?

A 25 seconds
B 35 seconds
C 40 seconds
D 55 seconds

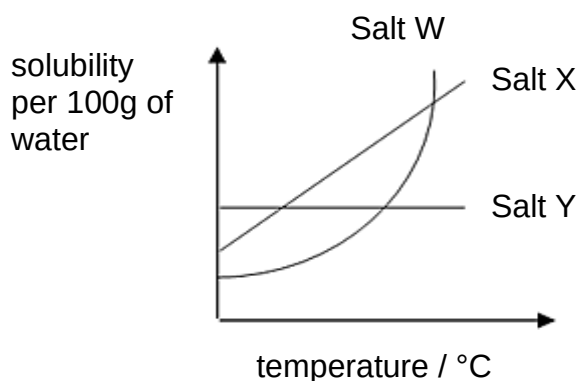
- 2 The melting points and the boiling points of four substances are listed in the table below.

substance	melting point / °C	boiling point / °C
argon	-189	-186
bromine	-7	59
chlorine	-101	-35
sulfur dioxide	-75	-10

Which substance exists as a liquid at -90 °C?

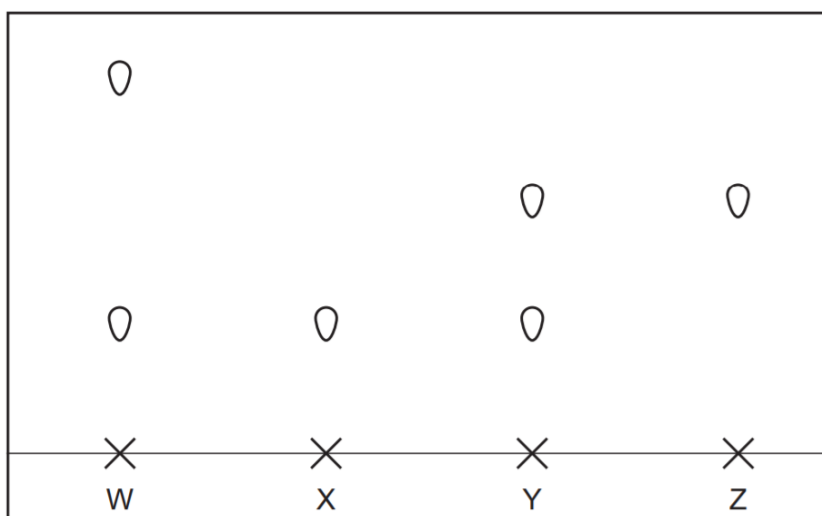
A argon
B bromine
C chlorine
D sulfur dioxide

- 3 The solubility curves of three salts are shown below. Which salts can be prepared by crystallisation?



A W only
B Y only
C W and X only
D X and Y only

- 4 The diagram below shows the chromatogram of four substances, W, X, Y and Z.



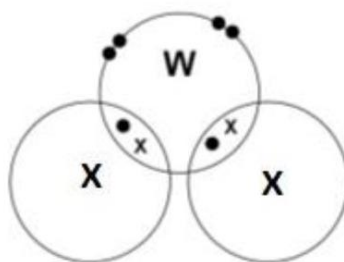
Which of the following statements is correct?

- A W contains X and Y.
 - B X is more soluble than Z.
 - C Y contains three components.
 - D Z has a larger R_f value than X.
- 5 A particle of an isotope of sulfur contains 18 neutrons and 18 electrons.

What is the symbol for this particle?

- A ${}^{34}_{16}\text{S}^{2+}$
- B ${}^{34}_{16}\text{S}^{2-}$
- C ${}^{36}_{16}\text{S}$
- D ${}^{36}_{18}\text{S}$

- 6 The diagram below shows the valence electrons of element W when combined with element X.

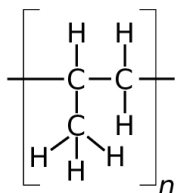


Which of the following statements is incorrect, given that W is found in period 3 of the Periodic Table?

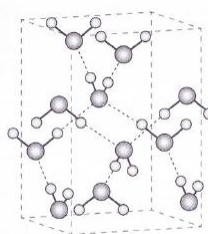
- A The oxide of W dissolves in water to form a solution which has pH >7.
 - B W can react with lithium to form an ionic compound.
 - C W cannot conduct electricity in any state.
 - D W is a solid at room temperature.
- 7 How do the atomic radii and the intermolecular forces of attraction vary going down Group VII?

	atomic radius	strength of intermolecular forces of attraction
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 8 The structure of two different substances are shown below.



substance E



substance F

Which option provides the most appropriate description of the two substances?

	substance E	substance F
A	covalent bonds present	ionic bonds present
B	intermolecular forces not present	intermolecular forces present
C	simple molecular structure	giant molecular structure
D	stronger intermolecular forces	weaker intermolecular forces

- 9 Substances X, Y and Z are all solids. Some of their physical properties are given in the table.

substance	X	Y	Z
melting point / °C	772	114	1610
boiling point / °C	1407	183	2205
electrical conductivity in the liquid state	conducts	does not conduct	does not conduct

What type of structure does each substance have?

	X	Y	Z
A	giant molecular	simple molecular	ionic
B	ionic	giant molecular	simple molecular
C	ionic	simple molecular	giant molecular
D	simple molecular	ionic	giant molecular

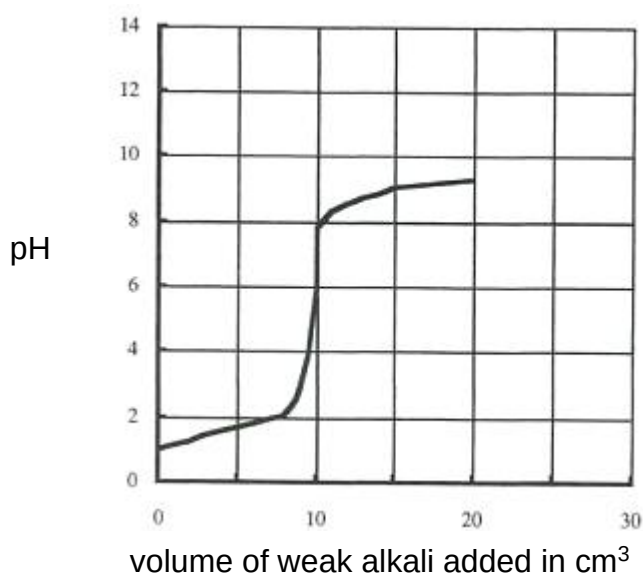
10 When a piece of calcium carbonate is placed in an excess of sulfuric acid, a few bubbles of carbon dioxide are seen and then the reaction appears to stop. What is the best explanation for this observation?

- A** Calcium carbonate is insoluble in water so it is unable to react with the acid.
- B** Calcium sulfate is produced which is insoluble and prevents the acid from reaching the calcium carbonate.
- C** The initial reaction is so fast that the acid is used up very quickly.
- D** The reaction is endothermic and seems to stop when it cools down.

11 Different indicators change colour over different pH ranges and it is important to choose the correct indicator to obtain an accurate result in a titration.

indicator	pH range for the colour change	colour	
		lower pH	higher pH
indigo carmine	11.6 to 14.0	blue	yellow
methyl red	4.2 to 6.3	red	yellow
methyl violet	0.3 to 3.0	yellow	violet
phenolphthalein	8.2 to 10.0	colourless	pink

If a weak alkali is added to a strong acid, the following titration curve is obtained.



Which of the indicators below would be the best choice to use in the titration?

- A** indigo carmine
- B** methyl red
- C** methyl violet
- D** phenolphthalein

- 12** What is the best method to prepare pure silver chloride?
- A** add aqueous silver nitrate to dilute hydrochloric acid
 - B** add aqueous silver nitrate to lead(II) chloride
 - C** add silver oxide to dilute hydrochloric acid
 - D** add silver to dilute hydrochloric acid
- 13** Which is the best method to obtain crystals of a pure soluble salt from dilute sulfuric acid?
- A** add excess aqueous barium nitrate, filter the mixture, rinse and dry the residue
 - B** add excess aqueous sodium hydroxide, filter the mixture, heat the filtrate to saturation
 - C** add excess copper(II) carbonate, filter the mixture, heat the filtrate to dryness
 - D** add excess zinc oxide, filter the mixture, heat the filtrate to saturation

- 14** A solution of compound T forms a white precipitate which is soluble in excess aqueous ammonia.

Upon adding acidified silver nitrate solution, a white precipitate is formed.

What is compound T?

- A** aluminium chloride
 - B** aluminium sulfate
 - C** zinc chloride
 - D** zinc sulfate
- 15** A white solid P produces a colourless gas Q on heating. Gas Q forms a white precipitate with aqueous calcium hydroxide.

Which of the following could solid P be?

- A** aluminium sulfate
- B** calcium chloride
- C** potassium carbonate
- D** zinc carbonate

- 16** A green solution Z turns yellow on addition of aqueous acidified potassium manganate(VII) solution. Addition of excess aqueous sodium hydroxide to the resulting solution causes a reddish brown precipitate to form.

When aluminium foil is added to the resulting mixture and warmed, a gas is evolved which turns moist red litmus blue.

What is the identity of Z?

- A** ammonium iodide
B iron(II) iodide
C iron(II) nitrate
D iron(III) nitrate
- 17** Which statement about the Haber Process is correct?
- A** Hydrogen is obtained from fractional distillation of liquid air.
B Nitrogen is recycled to increase the yield of ammonia.
C The Haber Process is favoured by low pressure.
D The Haber Process is favoured by high temperature.
- 18** Which method cannot reduce the amount of pollutant gases that cause acid rain?
- A** burn fuels with less than 2% sulfur content
B pass exhaust gases through catalytic converters in motor vehicles
C reduce usage of air-conditioners and refrigerants
D use limestone to absorb pollutant gases from factories
- 19** The pollutants released into the air from car exhausts and some power stations include oxides of the type XO and YO₂.

What are X and Y?

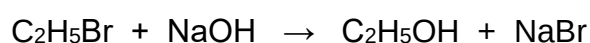
	X	Y
A	carbon only	nitrogen only
B	carbon only	nitrogen and sulfur
C	carbon and nitrogen	carbon and nitrogen
D	carbon and nitrogen	carbon, nitrogen and sulfur

- 20** One mole of a sugar, $C_6H_{12}O_6$, is burned.

What volume of oxygen, measured at room temperature and pressure, is required for complete combustion of the sugar?

- A** 24 dm³
- B** 36 dm³
- C** 144 dm³
- D** 216 dm³

- 21** The reaction for the conversion of bromoethane to ethanol is shown.

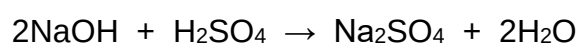


In an experiment, 10.90 g of bromoethane is converted into 3.45 g of ethanol.

What is the percentage yield of ethanol?

- A** 32 %
- B** 42 %
- C** 75 %
- D** 100 %

- 22** In a volumetric experiment, 25.0 cm³ of 0.100 mol/dm³ sodium hydroxide reacts exactly with 20.0 cm³ of sulfuric acid.



What is the concentration of sulfuric acid?

- A** 0.0625 mol/dm³
- B** 0.0800 mol/dm³
- C** 0.125 mol/dm³
- D** 0.250 mol/dm³

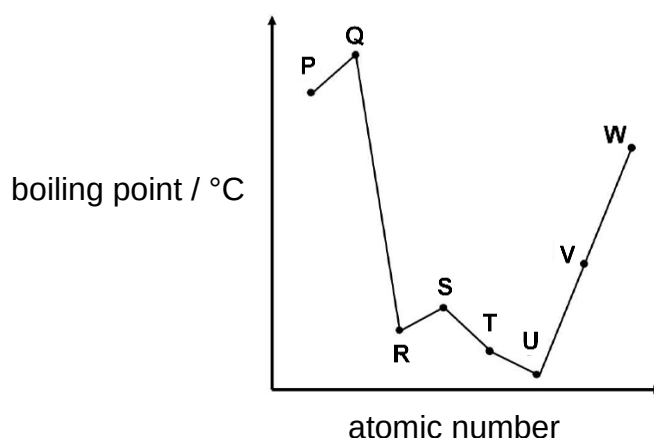
- 23** Iron(II) sulfate is a common nutritional supplement used in treating iron-deficiency anaemia.

A 5.00 g tablet containing iron(II) sulfate is dissolved in water and excess barium chloride solution is added. After mixing, 2.89 g of barium sulfate is precipitated out as white solid.

What is the percentage by mass of iron(II) sulfate in the tablet?

- A** 18.9 %
- B** 37.7 %
- C** 42.2 %
- D** 57.8 %

- 24** The graph below shows the variation in boiling points for eight consecutive elements with atomic numbers less than or equal to 20, in Periods 3 and 4 of the Periodic Table.



What can be deduced from the above?

- A** Element P has an electronic configuration of 2.8.1.
- B** Element S has a giant metallic structure.
- C** Element U exists as diatomic molecules.
- D** Element V reacts with water to form an alkali.

25 Part of the Periodic Table is shown below.

															Q		
	P															R	

What can be deduced about the three elements, P, Q and R?

- A** All three elements form ions with the noble gas configuration.
- B** P has three valence electrons as it is in Period 3.
- C** P forms a basic oxide, Q forms an amphoteric oxide and R forms an acidic oxide.
- D** The formula of the compound formed between P and R is PR .

26 Y is a Group I element in the Periodic Table. Which of the following statements is true about Y?

- A** Y reacts vigorously in water to form an oxide of Y.
B Y is a strong reducing agent.
C Y forms coloured compounds.
D Y reacts with hydrogen to form a compound YH_2 .

27 Which equations below represent redox reactions?

- 1 $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
- 2 $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$
- 3 $\text{Cl}_2 + 2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{Cl}^-$

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

28 In which of the following reactions is the underlined reactant reduced?

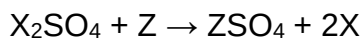
- A** $\underline{\text{Cu}^{2+}} + 2\text{OH}^- \rightarrow \text{Cu}(\text{OH})_2$
B $2\underline{\text{NH}_3} + 3\text{CuO} \rightarrow 3\text{Cu} + \text{N}_2 + 3\text{H}_2\text{O}$
C $\underline{\text{SO}_2} + 2\text{Mg} \rightarrow 2\text{MgO} + \text{S}$
D $\underline{\text{Zn}} + 2\text{AgNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{Ag}$

29 Separate samples of a solution X is added to aqueous potassium iodide and to acidified potassium manganate(VII). The iodide ions remain unchanged and the manganate(VII) ions are reduced in the reaction.

What are the observations?

	aqueous potassium iodide	acidified potassium manganate(VII)
A	brown solution turns colourless	colourless solution turns purple
B	colourless solution turns brown	purple solution turns colourless
C	solution remains brown	solution remains colourless
D	solution remains colourless	purple solution turns colourless

30 Metals X, Y and Z react in the following ways.



X_2CO_3 decomposes at a slower rate than YCO_3 .

What is the reactivity of the metals in decreasing order?

- A** X, Y, Z
B Y, X, Z
C Z, X, Y
D Z, Y, X

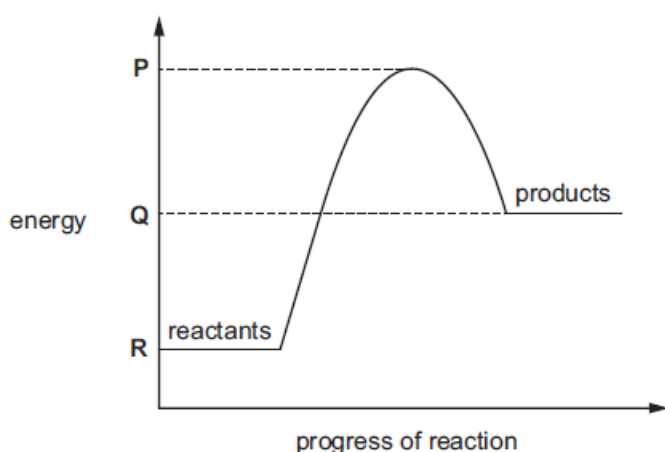
31 High carbon steel is used in various manufacturing processes. Which of the following statements is true about high carbon steel?

- A** It is hard because the carbon atoms prevent the iron atoms from sliding over each other easily.
- B** It is malleable because a large amount of carbon is added.
- C** It is resistant to corrosion because carbon forms a protective layer over the iron.
- D** It is strong because the iron atoms form strong covalent bonds with the carbon atoms.

32 Four steel paper clips are treated before being placed in a beaker of water. Which paper clip rusts most quickly?

- A** coated with grease
- B** dipped in paint and allowed to dry
- C** electroplated with zinc
- D** soldered to a piece of platinum

33 The energy profile diagram for a reaction is shown below.



Which statement about the reaction is correct?

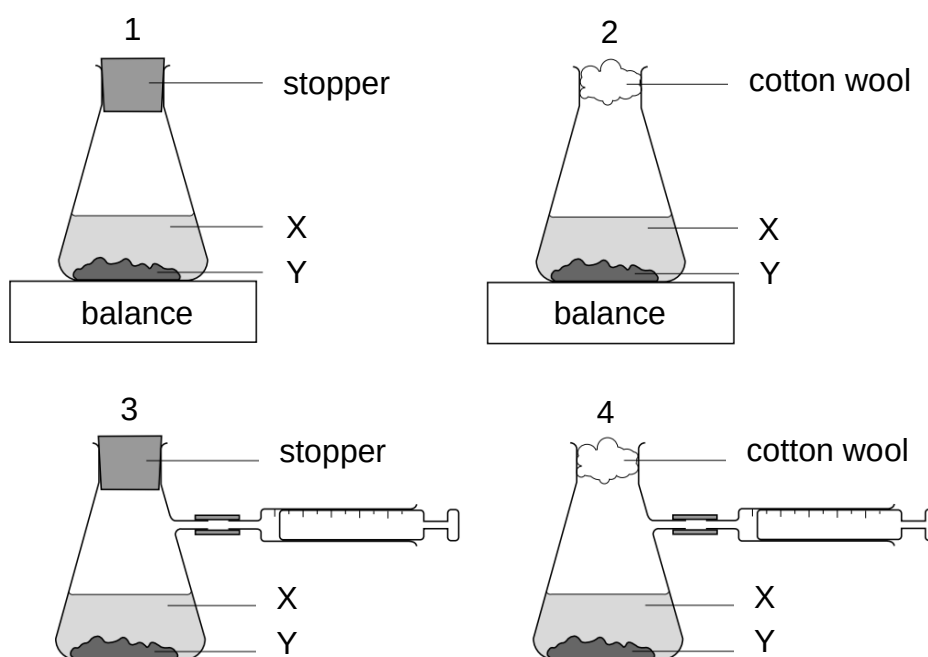
- A** It is endothermic and the activation energy is $P - Q$.
- B** It is endothermic and the activation energy is $P - R$.
- C** It is exothermic and the activation energy is $P - Q$.
- D** It is exothermic and the activation energy is $P - R$.

34 Which statement about the hydrogen fuel cell is incorrect?

- A** Chemical energy is converted into electrical energy.
- B** Hydrogen is oxidised.
- C** The reaction that occurs in the cell is endothermic.
- D** Water is the only product of the reaction.

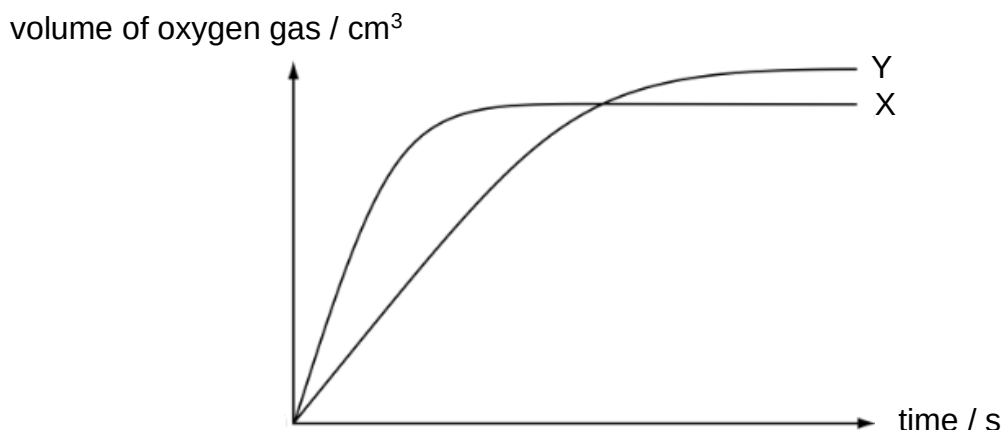
35 A reaction occurs between dilute sulfuric acid and a metal.

Which diagrams show suitable methods for investigating the speed of the reaction?



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

- 36 The diagram below shows curve X which was obtained by the decomposition of 100 cm³ of 1.00 mol dm⁻³ hydrogen peroxide using manganese(IV) oxide.



Which of the following changes made to the original experiment would produce curve Y?

- A adding 10.0 cm³ of water to hydrogen peroxide
 - B adding 10.0 cm³ of 0.500 mol dm⁻³ of hydrogen peroxide
 - C lowering the temperature of hydrogen peroxide by 10.0 °C
 - D reducing the mass of manganese(IV) oxide used
- 37 Different experiments were conducted to investigate the effect of different concentrations of reactants A, B and C on the rate of reaction.

The table below shows the results of the different experiments.

experiment	concentration of A / mol dm ⁻³	concentration of B / mol dm ⁻³	concentration of C / mol dm ⁻³	rate of reaction / mol dm ⁻³ s ⁻¹
1	0.200	0.300	0.100	0.0281
2	0.200	0.600	0.100	0.0562
3	0.400	0.300	0.100	0.112
4	0.200	0.300	0.200	0.0281
5	0.400	0.900	0.400	?

Which of the following shows the rate of reaction for experiment 5?

- A 0.0562 mol dm⁻³ s⁻¹
- B 0.224 mol dm⁻³ s⁻¹
- C 0.336 mol dm⁻³ s⁻¹
- D 0.448 mol dm⁻³ s⁻¹

38 A student carried out electrolysis and noted the observations:

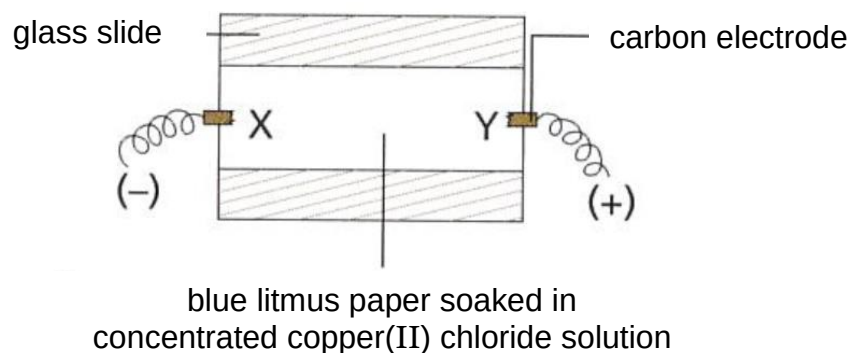
At the anode, size of electrode decreases.

At the cathode, bubbles of a colourless gas were given off.

Which of the following set of electrolyte and electrodes did the student use?

	electrolyte	anode	cathode
A	concentrated calcium chloride solution	carbon	iron
B	concentrated copper(II) sulfate solution	iron	copper
C	dilute calcium chloride solution	iron	copper
D	dilute copper(II) sulfate solution	carbon	iron

39 The apparatus shown below is connected to a battery.



Which statements are correct?

- 1 Litmus paper at X remains blue but is bleached at Y.
- 2 A gas is evolved at both X and Y.
- 3 A pinkish brown solid is deposited at point Y.
- 4 The electrolyte becomes increasingly dilute.

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

- 40** The same number of moles of a molten chloride of a Group I metal, XCl , and a molten chloride of a Group II metal, YCl_2 , are separately electrolysed using the same current for the same period of time.

Which statements about this experiment are correct?

- 1 The same number of moles of X and Y is deposited.
 - 2 The same number of moles of X and Cl_2 is formed.
 - 3 The same number of moles of Y and Cl_2 is formed.
 - 4 The same volume of Cl_2 is formed for XCl and YCl_2 , at room temperature and pressure.
- A** 1 and 2 only
B 2 and 3 only
C 2 and 4 only
D 3 and 4 only

- End of Paper -