Form Class	Teaching Group	Name and Index Number

PEI HWA SECONDARY SCHOOL

MID-YEAR EXAMINATION 2021

Secondary Four Express

CHEMISTRY **6092/02**

Paper 2 Theory **12 May 2021**

1 hour 45 mins

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

1. Write your name, class and index number in the spaces above.
2. There are altogether 2 sections in this paper: Sections **A** and **B**.
3. **Section A: Structured Questions**
   Answer **ALL** questions.
4. **Section B: Free Response Questions**
   Answer **ALL** questions, the last question is in the form either/or.
5. Candidates are to show all their working in a clear and orderly manner.

A copy of the Periodic Table is printed on page 19.

Section		Mark
Paper 1		/40
Paper 2	A	/50
	B	/30
Total		/120

This question paper consists of **19** printed pages, inclusive of this cover page.

Section A

Answer **all** the questions in the spaces provided.
The total mark for this section is 50.

A1 Titan is the largest moon of the planet Saturn. It is the only body in space, other than Earth, where clear evidence of liquid has been found on the surface.
The surface temperature of Titan is -178 °C. It contains the following substances.

substance	melting point / °C	boiling point / °C
hydrogen	-259	-252
nitrogen	-210	-196
argon	-189	-186
ethane	-183	-89
methane	-182	-162
water	0	100

(a) On Earth, the sea consists of liquid water.

(i) Do you expect the sea on Titan to consist of water?
Explain your answer.

.....[1]

(ii) Based on the information in the table above, suggest the composition of the sea on Titan.
Explain your answer.

.....

.....[2]

(b) Based on the information in the table above, suggest the likely composition of the atmosphere of Titan.

.....[1]

[Total: 4]

A2 Use the information in the following passage to answer the questions that follow.

Selenium (Se) is an element in Group VI of the Periodic Table and it has a relative atomic mass of 79. The chemistry of selenium closely resembles that of sulfur.

Selenium burns in oxygen to form an oxide which contains 71.2% by mass of selenium. When this oxide is heated with an excess of magnesium metal, a mixture of magnesium oxide and magnesium selenide is formed. Addition of dilute hydrochloric acid to this mixture results in the formation of a gas, hydrogen selenide.

(a) Draw a dot-and-cross diagram to show the bonding in a molecule of hydrogen selenide. You need to only show the valence electrons.

[2]

(b) Determine the empirical formula of the oxide of selenium described above.

[3]

(c) Write

(i) the formula of hydrogen selenide, and

..... [1]

(ii) the chemical equation for the reaction when selenium oxide is heated with an excess of magnesium metal.

..... [1]

(d) Explain why hydrogen selenide gas obtained through the addition of hydrochloric acid is usually contaminated with hydrogen.

..... [1]

[Total: 8]

A3 Ammonia is manufactured commercially by the Haber Process. The percentage of ammonia present at equilibrium at different temperatures and pressures is shown in the table below.

pressure /atm	ammonia present at equilibrium / %				
	temperature / °C				
	100	200	300	400	500
10	88.2	50.7	14.7	3.9	1.2
25	91.7	63.6	27.4	8.7	2.9
50	94.5	74.0	39.5	15.3	5.6
100	96.7	81.7	52.5	25.2	10.6
200	98.4	89.0	66.7	38.8	18.3
400	99.4	94.6	79.7	55.4	31.9
1000	99.9	98.3	92.6	79.8	57.5

(a) Use the information in the table to answer the following questions.

(i) Deduce how the percentage of ammonia present at equilibrium is affected by an increase in temperature.

..... [1]

(ii) Deduce how the percentage of ammonia present at equilibrium is affected by an increase in pressure.

..... [1]

(iii) From the information provided in the table, state the optimal conditions for the Haber Process.
Describe the problems posed by these conditions to the manufacturing process.

.....

.....

.....

..... [3]

(b) Ammonia is used to manufacture nitric acid, by a two-stage process.

Stage 1 : The ammonia is converted to nitrogen monoxide.
$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$ $\Delta H = -950$ kJ/mol

Stage 2 : The nitrogen monoxide is converted to nitric acid.
$4NO(g) + 2H_2O(g) + 3O_2(g) \rightarrow 4HNO_3(aq)$

Overall equation : $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$

(i) During the reaction in Stage 1, the ammonia and oxygen are passed through a powdered catalyst.
Deduce how the temperature of the catalyst changes during the reaction.

..... [1]

(ii) Calculate the mass of nitric acid that could be produced from 720 dm^3 of ammonia and 3600 dm^3 of oxygen.

[2]

[Total: 8]

A4 The elements in Group VII of the Periodic Table are also known as halogens.

(a) Complete the table below.

element	molecular formula	state at room temperature and pressure	colour
F	F_2	gas	pale yellow
Cl	Cl_2		
Br		liquid	
I	I_2		

[3]

(b) The halogens react with hydrogen to form hydrogen halides.

(i) Pure hydrogen halides are poor conductors of electricity. However, when hydrogen halides dissolve in water, the solutions are good electrical conductors.
Explain this phenomenon.

.....

.....

..... [2]

(ii) Astatine is an element found below iodine in Group VII of the Periodic Table. Do you expect astatine to have the same chemical properties as other elements in the same group? Explain why.

.....

.....

..... [1]

[Total: 6]

A5 The element hydrogen has three isotopes, hydrogen, H, deuterium, D and tritium, T. The nucleon (mass) numbers of the isotopes are one, two and three respectively.

isotope	nucleon number	proton	neutron
hydrogen	1		
deuterium	2		
tritium	3		

(a) Complete the table above to show the numbers of the particles in the three nuclei. [3]

(b) The boiling point of D_2O is 101.6 °C but that of H_2O is 100 °C.
Suggest a reason for this difference.

..... [1]

(c) Calcium reacts with cold water.
Construct a chemical equation for the reaction between D_2O and calcium.

..... [1]

[Total: 5]

A6 Solder is an alloy of tin and lead.
Phosphorus can exist in two allotropes, namely red phosphorus and white phosphorus.

(a) Is solder a compound?
Explain your answer.

.....

..... [2]

(b) Compare and explain the electrical conductivity between solder and phosphorus.

.....

.....

..... [2]

(c) Liquid solder is used to join metal pieces together.
Suggest why solder must be an alloy and not a pure metal.

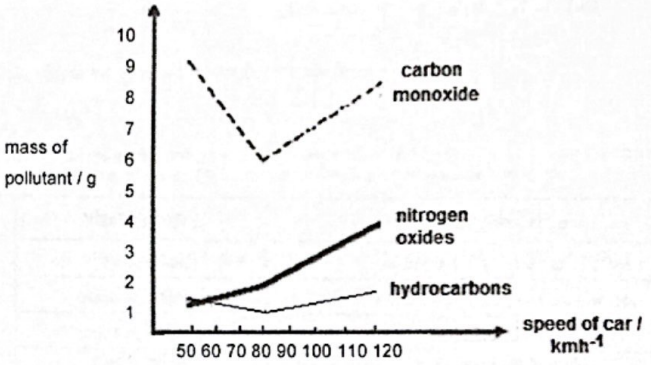
.....

.....

..... [2]

[Total: 6]

A7 The graph below shows the mass of gaseous pollutants released from an exhaust pipe of a car travelling at different speeds.



(a) State the pollutant that is released at the highest rate when the car increases its speed from 50 to 120 kmh^{-1}?
Explain how this pollutant is formed.

.....

.....

..... [2]

(b) Describe and explain the trend of carbon monoxide emissions as shown in the graph as the speed of the motor car increases from 50 to 120 kmh^{-1}.

.....

.....

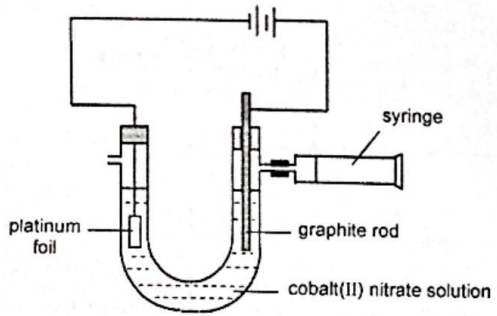
.....

.....

..... [3]

[Total: 5]

A8 Cobalt(II) nitrate solution is red. Cobalt is a grey metal and is below hydrogen in the reactivity series. A dilute solution of cobalt(II) nitrate was electrolysed as shown below.



(a) State the formulae of the ions present in the electrolyte.

..... [1]

(b) Construct the half-equation, with state symbols, for the reaction that occurred at the cathode.

..... [1]

(c) As the electrolysis progresses, describe the observations

(i) at cathode, and

..... [1]

(ii) of the electrolyte.

..... [1]

(d) During electrolysis, bubbles of gas appeared around the hot graphite. The gas was collected in the syringe. When tested with glowing splint, the splint was **not** relighted.

(i) Construct the half-equation, with state symbols, for the reaction that occurred at the anode.

..... [1]

(ii) Suggest the identity of the gas collected in the syringe.

..... [1]

(iii) Explain how the gas was formed.

.....

.....

..... [2]

[Total: 8]

Section B

Answer all **three** questions from this section.

The last question is in the form of an either/or and only one of the alternatives should be attempted.

B9 Jaylen conducted three experiments to investigate the chemical properties of four different metals: J, K, L and M. The results of the three experiments are recorded as shown in the table below.

no.	experiment	observations with metals			
		J	K	L	M
1	passing steam through the metal	a colourless gas is evolved	a colourless gas is evolved	no observable change	reacts very vigorously and a colourless gas is evolved
2	placing metal in silver nitrate solution	shiny silver solids form on the surface of the metal	shiny silver crystals form on the surface of the metal	shiny silver crystals form on the surface of the metal	reacts very vigorously and a colourless gas is evolved
3	heating metal carbonate at 1000 °C	no observable change	a colourless gas is evolved	formation of a black solid and a colourless gas is evolved	no observable change

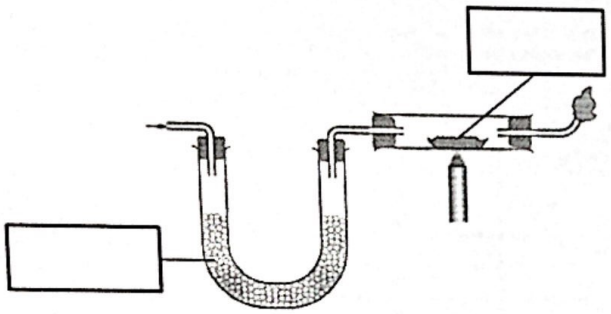
Jaylen further conducted a fourth experiment to determine the reactivity of hydrogen as compared to that of metals J, K, L and M. Dry hydrogen gas was passed over heated oxides of the metals separately.

The results are recorded in the table as shown below.

metal oxide	observable change
oxide of metal J	remains white
oxide of metal K	yellow when hot, white when cold
oxide of metal L	colour turns from black to brown
oxide of metal M	remains white

(a) Jaylen used the following experimental set-up as shown in Fig. 9.1 to determine the reactivity of hydrogen compared to the four metals.

Complete the labels in Fig. 9.1.



[2]

Fig. 9.1

(b) (i) Place the metals J, K, L and M in order of reactivity, starting with the least reactive metal.

..... [1]

(ii) Explain why a colourless gas is produced when M is placed in the silver nitrate solution.

.....

..... [2]

(iii) Write an ionic equation with state symbols for the reaction between L and silver nitrate solution.

..... [2]

(c) Suggest what happens when L is put in contact with iron in a beaker for a few weeks. Explain your answer.

.....

.....

.....

..... [3]

[Total: 10]

B10 Brine is an impure solution of sodium chloride. The main impurity in brine is calcium chloride. It is removed by treating brine solution with sodium carbonate. The equation of the reaction is shown below.

$$CaCl_2\,(aq) + Na_2CO_3\,(aq) \rightarrow CaCO_3\,(s) + 2NaCl\,(aq)$$

(a) State the type of the reaction shown above.

..... [1]

(b) In an industrial process, an excess amount of aqueous sodium carbonate was added to a solution of brine. 50 tonnes of calcium carbonate was obtained.

(1 tonne = 1000 kg)

(i) Calculate the mass of calcium chloride present in the brine solution.

[2]

(ii) If the percentage purity of the brine solution is 85%, calculate the mass of sodium chloride in the solution.

[1]

(iii) State one assumption made in the calculations in (ii).

..... [1]

(iv) Draw a cross-and-dot diagram to show the bonding in calcium chloride. Show only the electrons in the outermost shell.

[2]

(c) Cement is made by heating clay with crushed calcium carbonate. During this process, calcium carbonate is coverted to calcium oxide (lime).

(i) State the name of this chemical reaction.

..... [1]

(ii) Slaked lime (calcium hydroxide) is commonly used by farmers to neutralise excess acidity in the soil.
In an attempt to grow more crops, some farmers decided to mix slaked lime with ammonium nitrate to enrich the soil with nutrients. The crop yield turns out to be poorer than expected.

Explain why.

.....

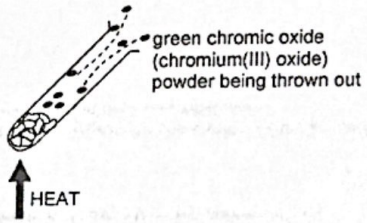
.....

..... [2]

[Total: 10]

EITHER

B11 Ammonium dichromate, $(NH_4)_2Cr_2O_7$, is an orange crystalline substance. When heated, it starts decomposing with sparks of evolution of heat. The reaction then proceeds with its own heat, and a green powder called chromic oxide (chromium(III) oxide) is thrown out of the test tube. The other products are water vapour and nitrogen.



(a) (i) Construct the balanced chemical equation, including state symbols, for this reaction.

..... [2]

(ii) State if chromium has been oxidised or reduced in this reaction.
Explain your answer in terms of oxidation states.

.....

.....

..... [2]

(iii) Explain, using the information given, if the reaction is an exothermic or endothermic reaction.

.....

..... [2]

(b) (i) Chromic oxide reacts with both acids and bases to form salt and water.
What can you deduce about chromic oxide?

..... [1]

(ii) Chromic oxide is used as an abrasive compound to polish knives and razors. State the physical property chromic oxide possesses that allows it to be used as an abrasive and relate this physical property to the structure and bonding of chromic oxide.

.....

.....

.....

..... [3]

[Total: 10]

OR

B12 A series of tests was carried out to investigate the effect of different catalysts on the rate of a reaction.

The table below shows the time taken for the reaction to complete when different metal compounds were used as catalysts in tests A to G. The metal compounds contain Group I metals, Group II metals or transition metals.

tests	catalyst	initial temperature /°C	total time taken /s
A	sodium chloride	19	45
B	cobalt(II) chloride	19	26
C	cobalt(II) sulfate	22	23
D	sodium nitrate	19	45
E	cobalt(II) nitrate	22	23
F	iron(II) nitrate	19	26
G	lithium nitrate	19	46

(a) Explain why is it important to take note of the temperature at the start of the reaction.

..... [1]

(b) **(i)** Explain how catalyst affects the speed of reaction.

..... [1]

(ii) Other than affecting the speed of reaction, list two other characteristics of a catalyst.

.....

..... [2]

(iii) What can you conclude about the effectiveness of Group I metal compounds as catalyst compared to transition metal compounds?
Explain your answer using the information in the table.

.....

.....

..... [3]

(c) A student wrote this conclusion from the results in the table.

"The type of anion in the catalyst compound does not affect the rate of reaction".

(i) Do you agree with this conclusion?
Use the information in the table to explain your reasoning.

.....

..... [2]

(ii) Predict the time taken for the reaction to complete if iron(II) chloride was used as a catalyst with an initial temperature of 19 °C.

..... [1]

[Total: 10]

End of Paper

Form Class	Teaching Group	Name and Index Number

PEI HWA SECONDARY SCHOOL

MID-YEAR EXAMINATION 2021

Secondary Four Express

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **17 May 2021**

1 hr

Additional Materials : Optical Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

This booklet consists of only questions for MCQs.

1. Write your name, class and index number in the spaces above and on the OTAS. Shade your index number in the boxes provided.
2. There are **40** questions in 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 OTAS provided.
3. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done on this booklet
4. **Hand in the OTAS separately from the question booklet.**
5. A copy of the Periodic Table is printed on page **19**.

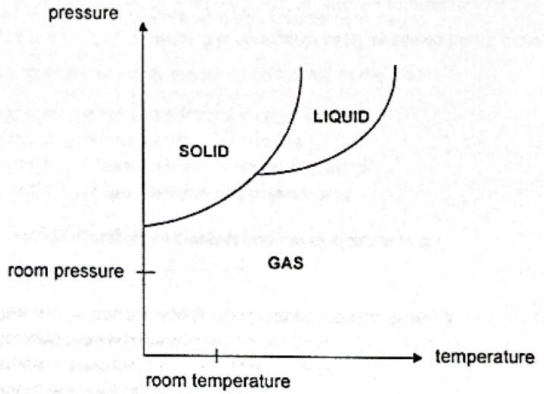
This question paper consists of **19** printed pages, inclusive of this cover page.

1 When a few grams of calcium carbonate is suspended in water and viewed through a microscope, the particles appear to move in a random fashion.

The movement is the result of .....

A bombardment of calcium carbonate particles by water molecules.
B bombardment of water molecules by the calcium carbonate particles.
C chemical reaction between calcium carbonate and water.
D the different boiling points of water and calcium carbonate.

2 The graph below shows a phase diagram, which describes how the physical state of an unknown pure substance can be determined, given the pressure and temperature.



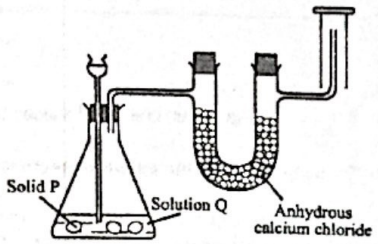
Which of the following statements can be deduced from the phase diagram?

A The identity of the unknown substance could be water.
B It is possible for the unknown pure substance to exist as a liquid under all pressures.
C The higher the pressure, the lower the boiling point of the unknown pure substance.
D At a specific condition, all 3 states of the unknown substance can coexist together.

3 Compound X melts at -101 °C and boils at 60 °C. It is soluble in water.
Which method can be used to obtain a pure sample of X from a mixture of X and water?

A chromatography
B filtration
C evaporation to dryness
D fractional distillation

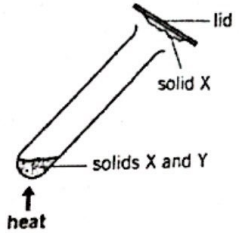
4 The diagram shows a simple laboratory apparatus used to prepare and collect a dry gas.



Suggest the identities of solid P and solution Q.

	solid P	solution Q
A	calcium carbonate	hydrochloric acid
B	lithium	water
C	silver	nitric acid
D	lead(II) oxide	nitric acid

5 The diagram below shows a mixture of solids X and Y being heated. Solid X turns into a vapour and changes back into a solid on the cold surface of the lid. Solid Y remains in the test tube.



What could solids X and Y be?

	solid X	solid Y
A	iodine crystals	sodium chloride
B	sodium nitrate	ammonium chloride
C	iodine crystals	dry ice
D	napthalene	iodine crystals

6 The proton numbers and mass numbers of elements P and Q are given in the table below.

element	proton number	mass number
P	7	14
Q	8	16

What is the relative molecular mass of the compound formed between **P** and **Q**?

A 28
B 30
C 42
D 58

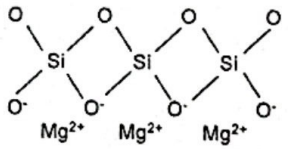
7 A sample of 100 bromine atoms is made up of 51 bromine-79 atoms and 49 bromine-81 atoms.
What can you infer from the information above?

A Some bromine atoms are unstable.
B Bromine has two different nucleon numbers.
C Bromine has two different proton numbers.
D Bromine-81 has two additional electrons than bromine-79.

8 Which solution contains the greatest number of chloride ions?

A 1 dm^3 of 2 mol/dm^3 of dilute hydrochloric acid
B 1 dm^3 of 1 mol/dm^3 of aqueous calcium chloride
C 1 dm^3 of 5 mol/dm^3 of aqueous chlorine
D 1 dm^3 of 1 mol/dm^3 of aqueous iron(III) chloride

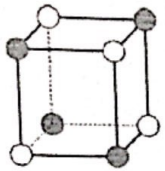
9 Asbestos is a building material. It is commonly used as ceiling board materials.
The diagram below shows a simplified structure of asbestos.



Which of the following is likely to be a property of asbestos?

A It has a high melting point.
B It has a low melting point.
C It is soluble in water.
D It can conduct electricity in the solid state.

10 The diagram shows the arrangement of the ions in an ionic crystal.



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

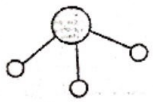
A calcium hydroxide
B copper(II) sulfate
C sodium chloride
D magnesium oxide

11 Fibreglass is used as a reinforcing agent in many products. It contains a mixture of ionic oxides and giant covalent oxides.

Which of the following is **not** a possible constituent of fibreglass?

A CaO
B Cr_2O_3
C P_4O_9
D SiO_2

12 The models and formulae for some molecules are shown below.

XY_3 

ZX 

Which of the following is the correct model for a molecule of the compound that can be formed from the reaction between Y and Z?

A **B** **C** **D**

13 Which of the following is the same as the Avogrado's Constant?

A The number of molecules in 16.0 g of oxygen.
B The number of atoms in 20.0 g of neon.
C The number of sodium ions in 20.0 g of sodium hydroxide.
D The number of ions in 58.5 g of sodium chloride.

14 A household bleach contains sodium chlorate(I) as its active ingredient. The concentration of the ingredient can be determined by reacting a known amount of aqueous hydrogen peroxide.

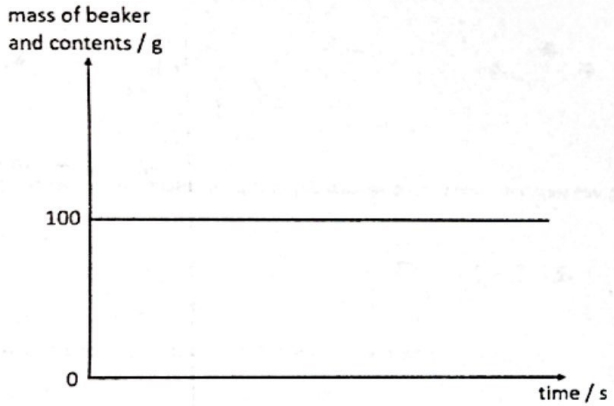
$NaClO\ (aq) + H_2O_2\ (aq) \rightarrow NaCl\ (aq) + O_2\ (g) + H_2O\ (l)$

When 25.0 cm^3 of bleach is treated with an excess of aqueous hydrogen peroxide, 0.0350 mol of oxygen is produced.

What is the concentration of sodium chlorate(I) in the bleach?

A 0.0875 mol/dm^3
B 0.700 mol/dm^3
C 0.714 mol/dm^3
D 1.400 mol/dm^3

15 Two substances P and Q are mixed in a beaker and the initial mass is 100 g. The mass of the beaker and its content are recorded at regular interval and the results obtained are shown in the graph below.
What could substances P and Q be?



A copper(II) carbonate and hydrochloric acid
B calcium oxide and hydrochloric acid
C copper(II) carbonate and nitric acid
D calcium and hydrochloric acid

16 Different volumes of 2.0 mol/dm^3 potassium hydroxide solution and 2.0 mol/dm^3 sulfuric acid are mixed in a polystyrene cup.
Which combination would result in the greatest rise in temperature?

	volume of KOH (aq) / cm^3	volume of H_2SO_4 (aq) / cm^3
A	20.0	40.0
B	30.0	30.0
C	40.0	20.0
D	45.0	15.0

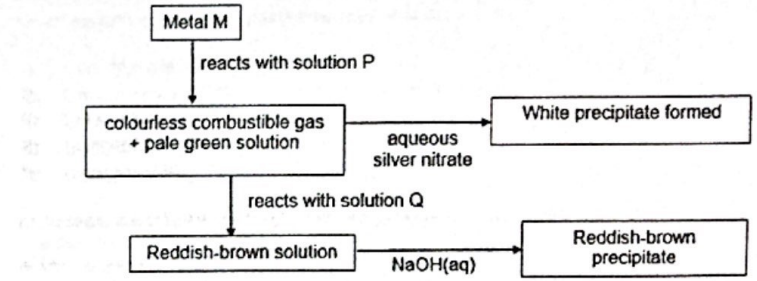
17 The table below gives information about three indicators.

indicator	colour in strongly acidic solution	pH at which colour changes	colour in strongly alkaline solution
methyl orange	red	4.5	yellow
bromothymol blue	yellow	6.5	blue
phenolphthalein	colourless	9.0	pink

If equal amounts of the indicators were added to pure water, what would be the resulting colour of the mixture?

A red
B orange
C yellow
D green

18 In the reaction scheme below, solutions P and Q are involved in some reactions.
Identify P and Q.



	P	Q
A	dilute hydrochloric acid	potassium iodide
B	dilute hydrochloric acid	potassium manganate(VII)
C	dilute nitric acid	potassium iodide
D	dilute nitric acid	potassium manganate(VII)

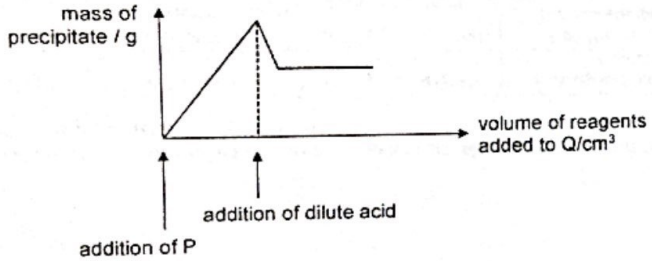
19 The table shows the observations made when an aqueous solution X was tested.

reagent added	colour of precipitate
acidified aqueous silver nitrate	yellow
aqueous sodium hydroxide	green

Which ions were present in solution X?

A Cu^{2+} and Cl^-
B Cu^{2+} and I^-
C Fe^{2+} and Cl^-
D Fe^{2+} and I^-

20 In a qualitative analysis, reagent P is gradually added to a salt solution Q followed by the addition of a dilute acid. The graph below shows how the mass of the precipitate formed changes with the reagents added.



Which of the following set of reactants and anions would produce the given results?

	reagents (P and acid) added	anion(s) in Q
A	add aqueous silver nitrate, followed by dilute nitric acid	Cl^-, CO_3^{2-}
B	add aqueous barium chloride, followed by dilute hydrochloric acid	CO_3^{2-}
C	add aqueous barium chloride, followed by dilute hydrochloric acid	Cl^-, CO_3^{2-}
D	add aqueous silver nitrate, followed by dilute nitric acid	I^-

21 In an experiment, 10.0 cm^3 of 0.01 mol/dm^3 copper(II) sulfate solution was mixed with 5.0 cm^3 of 0.01 mol/dm^3 sodium carbonate solution according to the equation:

$$CuSO_4 + Na_2CO_3 \rightarrow Na_2SO_4 + CuCO_3$$

What does the reaction vessel contain at the end of the experiment?

A a colourless solution only
B a green precipitate and a blue solution
C a green precipitate and a colourless solution
D a white precipitate and a colourless solution

22 Epsom salts contain magnesium sulfate and are used for treating upset stomachs.

Which of the following reagents can be used to prepare magnesium sulfate?

A magnesium nitrate and sulfuric acid
B magnesium chloride and sulfuric acid
C magnesium oxide and sulfuric acid
D magnesium and copper(II) sulfate

23 In which pair is the underlined element has the same oxidation state in both compounds?

A $Cu\underline{Cl}_2$ and $Na\underline{Cl}$
B $\underline{Fe}_2O_3$ and $\underline{Fe}SO_4$
C $H_2\underline{S}$ and $\underline{S}O_2$
D $H_2\underline{O}_2$ and $H_2\underline{O}$

24 Which of the following equations represents a redox reaction?

A $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$
C $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
D $Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

25 Which one of the following could be used to change MnO_4^- to MnO_2 ?

A chlorine
B acidified aqueous potassium manganate(VII)
C iron(III) chloride solution
D aqueous potassium iodide

26 The flow chart below shows the conversion of sulfur to sulfuric acid via the Contact Process.

Stage 1 Stage 2 Stage 3 Stage 4

$S \longrightarrow SO_2 \longrightarrow SO_3 \longrightarrow H_2S_2O_7 \longrightarrow H_2SO_4$

Which of the steps involve an increase in the oxidation state of sulfur?

A 1 and 2 only
B 2 and 3 only
C 1, 2 and 3 only
D 1, 2, 3 and 4

27 A chemical analysis is carried out on a sample of an alloy containing two metals. The results are shown in the table below.

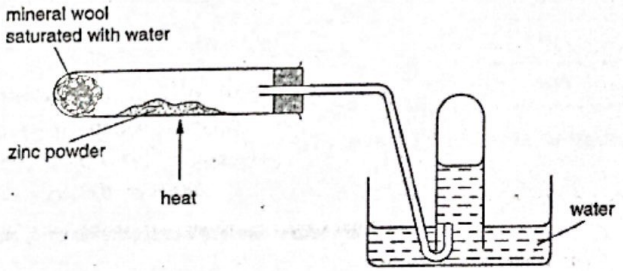
test	adding HCl (aq)	adding NaOH solution	adding excess NaOH solution
observation	alloy dissolved completely to form a colourless solution	precipitate formed	half the amount of precipitate dissolved

What are the two possible metals present in the alloy?

A aluminium and zinc
B calcium and copper
C calcium and zinc
D copper and aluminium

28 The apparatus is used to show the reaction between zinc and steam.

Which equation represents the reaction taking place?



A $Zn + H_2O \rightarrow ZnO + H_2$
B $Zn + 2H_2O \rightarrow Zn(OH)_2 + H_2$
C $Zn + 4H_2O \rightarrow Zn(OH)_2 + 3H_2 + O_2$
D $2Zn + 3H_2O \rightarrow ZnO + Zn(OH)_2 + 2H_2$

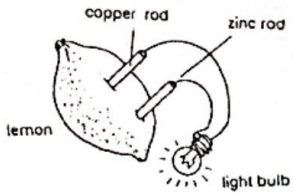
29 Which of the following correctly shows the ease of decomposition of the metal carbonates, from the most easily decomposed to the least easily decomposed?

A $Ag_2CO_3 \rightarrow FeCO_3 \rightarrow Na_2CO_3 \rightarrow PbCO_3$
B $Ag_2CO_3 \rightarrow PbCO_3 \rightarrow FeCO_3 \rightarrow Na_2CO_3$
C $Na_2CO_3 \rightarrow FeCO_3 \rightarrow PbCO_3 \rightarrow Ag_2CO_3$
D $PbCO_3 \rightarrow Na_2CO_3 \rightarrow FeCO_3 \rightarrow Ag_2CO_3$

30 Which of the following is a constituent element of brass?

A zinc
B nickel
C chromium
D tin

31 The diagram below shows a 'lemon cell'.



Which of the following statements concerning the lemon cell is **not** correct?

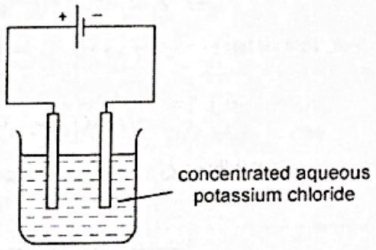
A Electrons flow from zinc rod to copper rod.
B The light bulb will not light if the copper rod is replaced by a magnesium rod.
C The electrolyte in a lemon cell is the organic acid and mineral salts in the lemon.
D The light bulb will also light if the lemon is replaced by an orange.

32 216 g of silver is deposited when an electric current is passed through a solution of silver nitrate.

What is the mass of magnesium formed when the same current is passed through molten magnesium chloride?

A 24 g
B 48 g
C 72 g
D 96 g

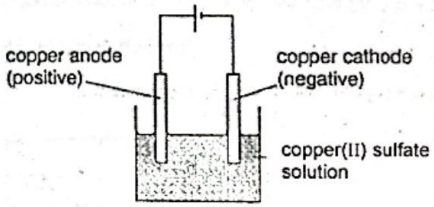
33 A current was passed through concentrated aqueous potassium chloride, KC*l*, as shown.



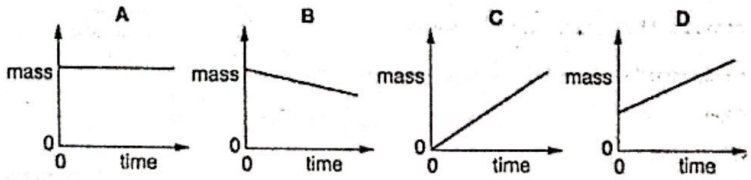
Which entry in the table is correct?

	ions move towards	
	cathode	anode
A	K^+ only	Cl^- and OH^-
B	K^+ only	Cl^- only
C	K^+ and H^+	Cl^- only
D	K^+ and H^+	Cl^- and OH^-

34 The diagram shows the electrolysis of aqueous copper(II) sulfate using copper electrodes.



Which graph shows how the mass of the cathode changes during electrolysis?



35 Four halogens, R, undergo reactions with potassium as follows.

$2\,K + R_2 \rightarrow 2\,KR \qquad \Delta H = -y\ kJ / mol$

For which of the following halogen will y have the **smallest** value?

A chlorine
B astatine
C iodine
D bromine

36 The scheme shows four stages I to IV in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.

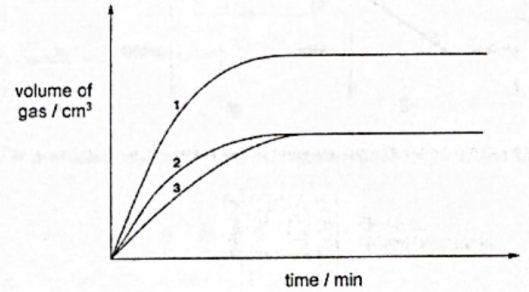
$$C_{30}H_{62}\,(s) \xrightarrow{I} C_{30}H_{62}\,(l) \xrightarrow{II} C_{30}H_{62}\,(g) \xrightarrow{III} 30\,CO_2\,(g) + 31\,H_2O\,(l) \xrightarrow{IV} 30\,CO_2\,(g) + 31\,H_2O\,(g)$$

Which stages are endothermic?

A I and II only
B III and IV only
C I, II and IV only
D II, III and IV only

37 A student did three experiments in which equal volumes of hydrochloric acid were added to equal masses of excess calcium carbonate. The gas produced was collected in a syringe and the volume of gas recorded at one minute intervals.

The results of the three experiments were used to plot the graphs shown below, labelled 1, 2 and 3 respectively.



Which of the following statement is correct?

A In experiment 1, the number of moles of acid were less than in experiment 2.
B In experiments 2 and 3, the number of moles of acid were the same.
C In experiment 3, the concentration of acid was higher than in experiment 2.
D In experiment 3, the calcium carbonate was more finely powdered than in experiment 1.

38 In which reaction will there be **no** change in the speed when there is a reduction in pressure used for the reaction?

A oxidation of sulfur dioxide in air
B reaction of iron and steam
C reduction of copper(II) oxide by hydrogen
D reaction of zinc and aqueous copper(II) sulfate

39 Different types of steel differ in the percentage of carbon present.

What are the properties of high carbon steel?

A soft and brittle
B soft and easily shaped
C strong and brittle
D strong and easily shaped

40 Which of the following is one of the chemicals responsible for the depletion of the ozone layer?

A HCl
B $HClO_4$
C $CFCl_3$
D $C_{14}H_9Cl_5$