

Name: _____

Class: _____

Register No:

Friday

07 May 2021

1 hour

Write your name and register number in the spaces provided.
Write in dark blue or black ink.

For **Section A**, indicate your answers on the separate Answer Sheet provided.

Answer all other questions in the space provided.

All quantitative answers should include appropriate units.

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

The number of marks is given in brackets [] at the end of each question or part question.

You may be penalised for incorrect use of units and/or not giving quantitative answers to an appropriate number of significant figures.

A copy of the Periodic Table is provided on the last page of the Question Paper.

The total number of marks for this paper is **40** and the weighting is **20%**.

Question / Section	Marks Obtained
-----------------------	-------------------

Section A / 10

1-10

Section B / 30

11

/6

12

15

13

17

14

/5

15

17

statement/ units/ sig. fig.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Total

/40

Parent's / Guardian's Name:

Signature:

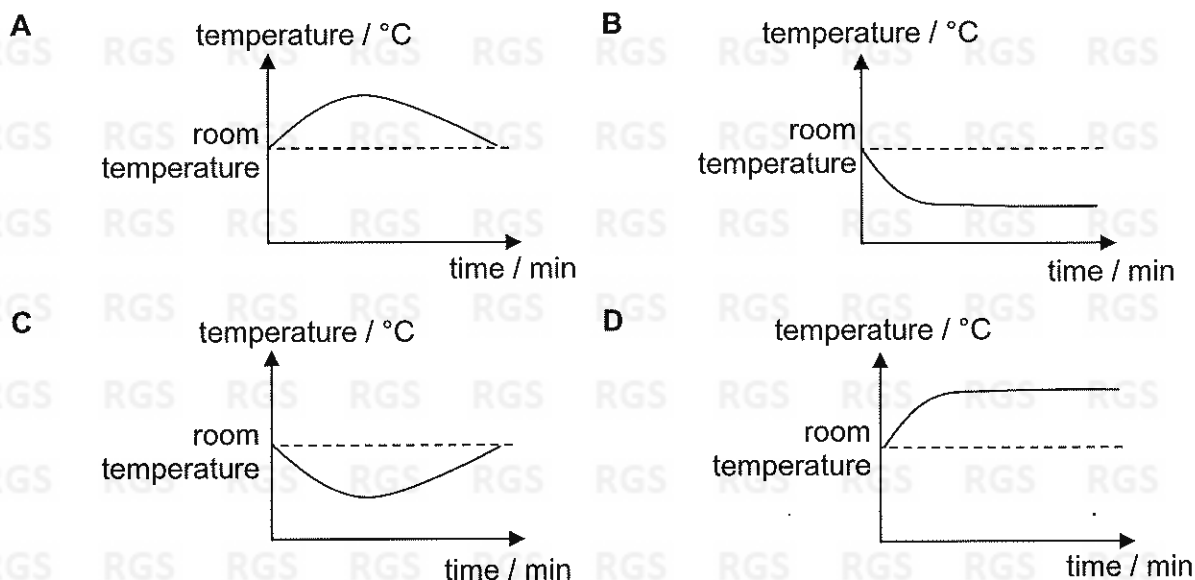
Date:

Section A – Multiple Choice Questions [10 marks]

Answer all questions. For each question, there are four possible answers (A, B, C, and D). Choose the most appropriate answer and record your choice in the separate Answer Sheet provided.

1. Dissolving of ammonium chloride in water is an endothermic process.

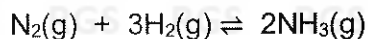
Which graph shows the temperature changes as ammonium chloride is added to water and left to stand?



2. Which metal is the strongest reducing agent?

- A beryllium
- B calcium
- C lithium
- D sodium

3. In Haber process, hydrogen reacts with nitrogen to form ammonia gas.



When 60 dm³ of hydrogen gas is reacted with 28 g of nitrogen gas, 30 dm³ of ammonia gas is produced at room temperature and pressure.

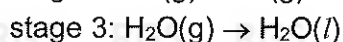
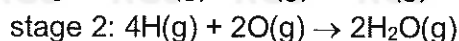
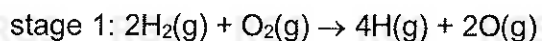
What is the percentage yield of ammonia?

- A 25.0 %
- B 50.0 %
- C 75.0 %
- D 100 %

4 Which of the following does **not** involve the release of energy?

- A neutralisation of acid
- B combustion of methane
- C condensation of iodine vapour
- D decomposition of calcium carbonate

5 Formation of water from its elements occurs in three stages as shown below.



Which of the following is correct?

	ΔH for stage 1	ΔH for stage 2	ΔH for stage 3
A	positive	negative	positive
B	positive	negative	negative
C	negative	positive	positive
D	negative	positive	negative

6 In the manufacture of the iron by the blast furnace, which are the main gases that escape from the top of the blast furnace?

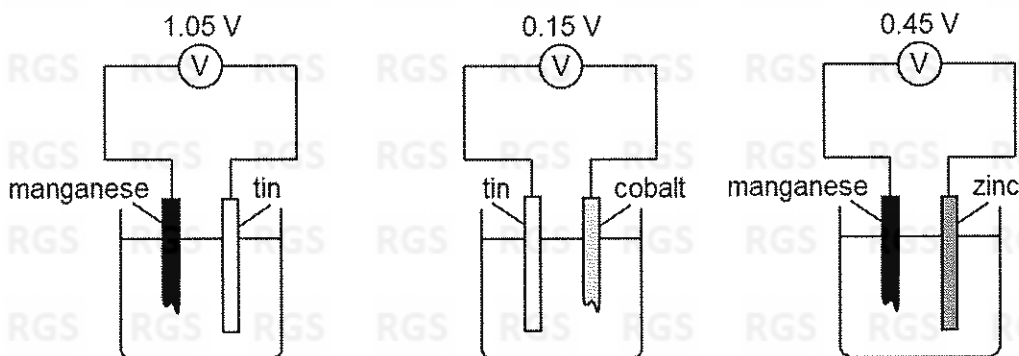
- A carbon dioxide, nitrogen, oxygen
- B carbon dioxide, hydrogen, nitrogen
- C carbon dioxide, carbon monoxide, nitrogen
- D carbon dioxide, carbon monoxide, hydrogen

7 In an experiment, 4.0 cm^3 of 1.0 mol/dm^3 copper(II) nitrate solution is mixed with 8.0 cm^3 of 1.0 mol/dm^3 sodium carbonate solution.

What will be observed at the end of the experiment?

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

- 8 How many moles of iron can be extracted from 40.0 g of Fe_2O_3 ?
- A 0.150 mol
B 0.250 mol
C 0.350 mol
D 0.500 mol
- 9 Which change **always** takes place when aqueous copper(II) sulfate is electrolysed?
- A Oxygen is evolved at the anode.
B The blue solution turns colourless.
C The mass of both the electrodes changes.
D Reddish-brown solid is deposited at the cathode.
- 10 Three simple cells are set up as shown below using different types of metal electrodes.



What is the order of reactivity of the four metals?

	most reactive	→		least reactive
A	manganese	zinc	cobalt	tin
B	tin	cobalt	manganese	zinc
C	tin	cobalt	zinc	manganese
D	manganese	tin	cobalt	zinc

----- End of Section A -----

Section B – Structured Questions [30 Marks]

Answer **ALL** questions and write your answers in the spaces provided.

- 11** A student carried out several tests on a colourless solution, X, which is subsequently found to be calcium chloride.

Record the observations expected for the tests in the table.

Test Number	Test	Observation
1	To 1 cm depth of X in a test tube, add aqueous sodium hydroxide until no further change.	
2	To 1 cm depth of X in a test tube, add aqueous ammonia until no further change.	
3	To 1 cm depth of X in a test tube, add an equal volume of aqueous barium nitrate. Add dilute nitric acid.	
4	To 1 cm depth of X in a test tube, add an equal volume of aqueous silver nitrate. Add dilute nitric acid.	

[6]

- 12 Nickel is manufactured from nickel(II) sulfide, NiS, by heating in air to form nickel(II) oxide and sulfur dioxide. Nickel(II) oxide is then heated with carbon to produce nickel.

(a) (i) Write the chemical equation for the reaction when nickel(II) sulfide is heated in air.

..... [1]

(ii) Calculate the maximum mass of sulfur dioxide that is formed when 182 kg of nickel(II) sulfide is heated in air.

..... [2]

(b) State and explain the role of carbon.

..... [2]

13

Oxyacids are a type of acid that contains oxygen. Bromine forms several types of oxyacids as shown in the table below.

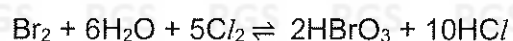
name of oxyacid	chemical formula	oxidation state of bromine
perbromic acid	HBrO_4	
bromic acid	HBrO_3	
hypobromous acid	HBrO	

(a) (i) Complete the table by filling in the oxidation state of bromine. [2]

(ii) Give the chemical formula of the anion present in perbromic acid.

..... [1]

(b) Bromic acid is produced when bromine is mixed with water and chlorine, as shown in the equation below.



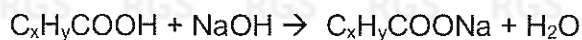
Explain, in terms of oxidation states, why this is a redox reaction.

.....

 [2]

(c) Carboxylic acids are also a type of oxyacid.

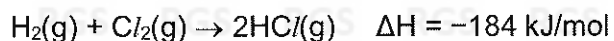
A solution containing 0.172 g of an unknown carboxylic acid, $\text{C}_x\text{H}_y\text{COOH}$, is titrated with 0.100 mol/dm^3 aqueous sodium hydroxide. The volume of sodium hydroxide solution needed to exactly neutralize the acid is 23.20 cm^3 .



Calculate the relative molecular mass of the carboxylic acid.

[2]

14 Hydrogen and chlorine react to form hydrogen chloride as shown in the equation below.



(a) Explain why this is an exothermic reaction.

.....
..... [1]

(b) Complete the energy profile diagram for the reaction between hydrogen and chlorine.

Your diagram should include:

- the identities of the reactants and products of the reaction,
- labels to show the enthalpy change of reaction and the activation energy.

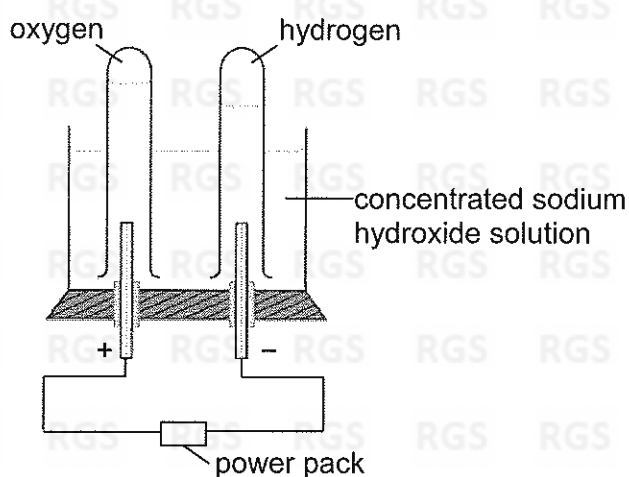


[2]

(c) Calculate the energy released when 800 cm^3 of hydrogen chloride gas is formed at room temperature and pressure.

[2]

- 15 An electrolytic cell is set up as shown below.



- (a) Write the half-equations for the reaction occurring at the anode and cathode.

Anode :

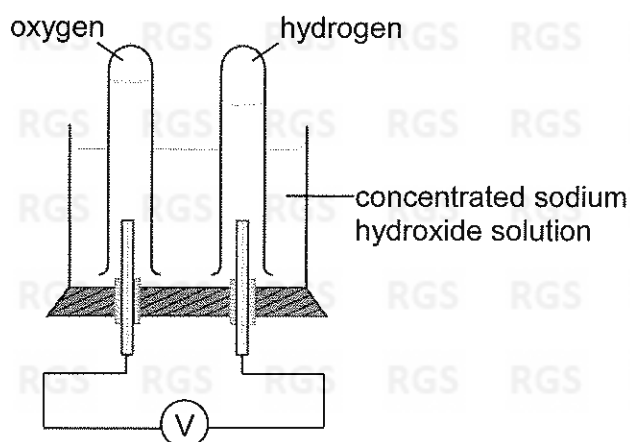
Cathode : [2]

- (b) Platinum metal electrodes are used.

Suggest why platinum is a suitable material for use as an electrode.

..... [1]

- (c) When the power pack is replaced with a voltmeter, the set-up acts like a fuel cell.



- (i) Label the positive and negative electrodes and the direction of the electron flow in the external circuit in the diagram above. [2]

- (ii) Hydrogen gas reacts with aqueous hydroxide ions to form water.

Construct the half-equation for this reaction.

..... [1]

(iii) Suggest one advantage of fuel cells.

[1]

----- End of Section B -----

- BLANK PAGE -

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	2 He helium 4
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	10 Ne neon 20
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 -

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
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 -

lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids	lanthanoids
actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids	actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

Raffles Girls Secondary School

1. Enter your Name (as in NRIC) _____
2. Enter the SUBJECT TITLE _____
3. Date _____
4. Enter your CLASS and REGISTER NUMBER
5. SHADE the corresponding lozenges

USE PENCIL ONLY
FOR ALL ENTRIES ON THIS SHEET
RUB OUT ERRORS THOROUGHLY

CLASS			REGISTER NUMBER	
1	0	0	0	0
2	1	1	1	1
3		2	2	2
4		3	3	3
		4	4	4
		5	5	5
		6	6	6
		7	7	7
		8	8	8
		9	9	9

6. INSTRUCTIONS FOR RECORDING ANSWERS

Suggested answers to each question are given in the question paper. Choose an answer and shade the corresponding lozenge.

- 1 (A) (B) (C) (D)
- 2 (A) (B) (C) (D)
- 3 (A) (B) (C) (D)
- 4 (A) (B) (C) (D)
- 5 (A) (B) (C) (D)
- 6 (A) (B) (C) (D)
- 7 (A) (B) (C) (D)
- 8 (A) (B) (C) (D)
- 9 (A) (B) (C) (D)
- 10 (A) (B) (C) (D)

