HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE

GRADE 11

PAPER 2- Chemistry

JUNE 2019

TIME: 3 HRS

Total 150

Instructions

1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (14)
   SECTION B (136)

   Answer SECTIONS A and B in the ANSWER BOOK.
4. Non-programmable calculators may be used.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Data sheets and a periodic table are attached for your use.
8. Give brief motivations, discussions, et cetera where required.
9. Numbers must be rounded off to **two decimal** places.

SECTION A

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 Consider the reaction represented below:

$$HC\ell O_2 + H_2O \rightleftharpoons H_3O^+ + C\ell O_2^-$$

Which **ONE** of the following is a conjugate acid-base pair in the above reaction?

A $HC\ell O_2$ and $C\ell O_2^-$

B $HC\ell O_2$ and H_2O

C $C\ell O_2^-$ and H_3O^+

D $HC\ell O_2$ and H_3O^+

1.2 A learner leaves a coil of copper wire overnight in a clear solution of silver nitrate. The next morning the learner observes that the solution turned blue. Which **ONE** of the equations below represents the reaction that takes place?

A $Cu + Ag \rightarrow Cu^+ + Ag^+$

B $2Ag + Cu^{2+} \rightarrow Cu + 2Ag^+$

C $2Ag^+ + Cu^+ \rightarrow 2Ag + Cu^{2+}$

D $Cu + 2Ag^+ \rightarrow Cu^{2+} + 2Ag$

1.3 The half-reactions below take place in an electrochemical cell.

$$Pt^{2+} + 2e^- \rightarrow Pt$$

$$Cs^+ + e^- \rightarrow Cs$$

Which **ONE** of the statements below is **TRUE** for this cell when it delivers current?

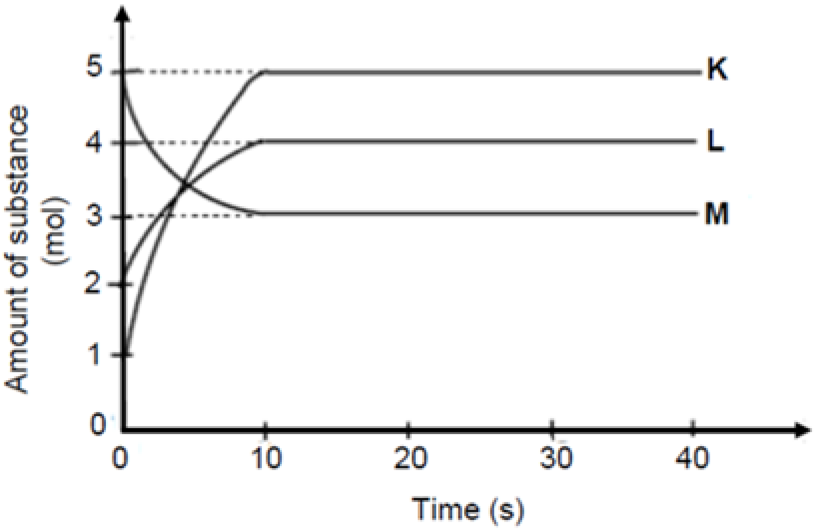
A The mass of the Cs electrode increases.

B Pt^{2+} undergoes oxidation more easily than Cs.

C Pt^{2+} undergoes reduction more easily than Cs^+.

D Electrons will flow from the Pt electrode to the Cs electrode in the external circuit.

1.4 The graph below shows the relationship between the amount of substance and time in a chemical reaction involving substances K, L and M.

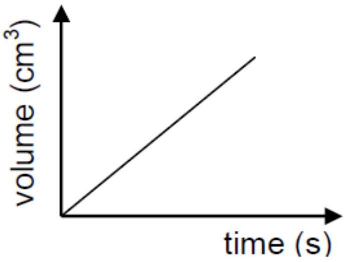


The equation for the reaction can be represented as:

A $3M \rightarrow 4K + 5L$
B $5M \rightarrow 2K + L$
C $M \rightarrow 2K + L$
D $M \rightarrow K + 2L$

1.5 Hydrogen gas is produced in the reaction between hydrochloric acid and magnesium. Which ONE of the following graphs of volume versus time best represents the formation of hydrogen gas until the reactants are used up?

A



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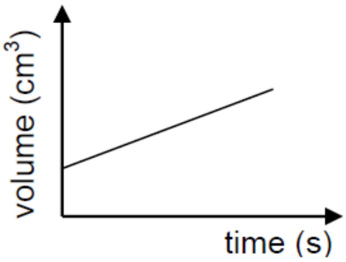

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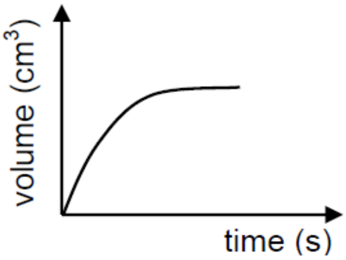

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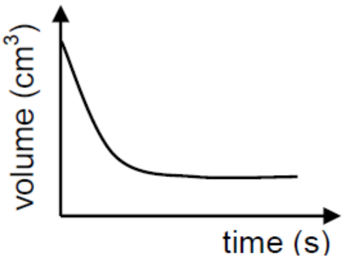
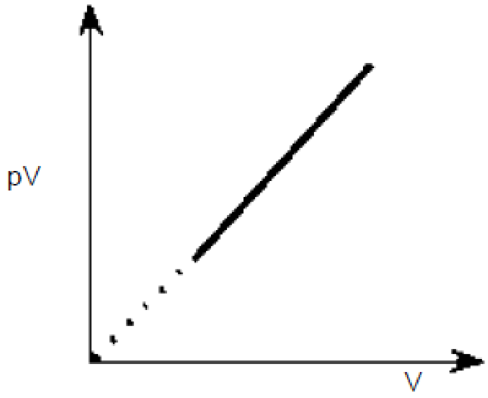
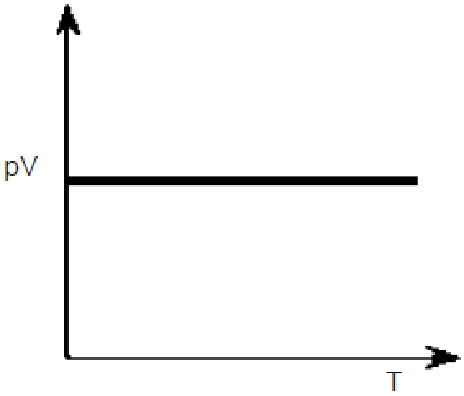


1.6 The relationship between p, V and T, for 1 mol of an enclosed gas was investigated and the results are plotted below. In which ONE of the graphs does the gradient of the line represent the universal gas constant (R)?

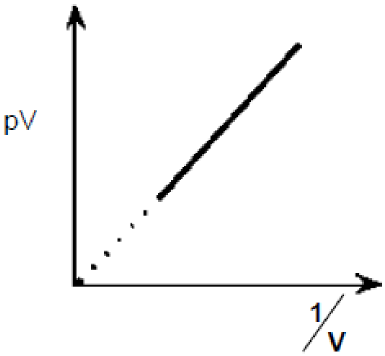
A



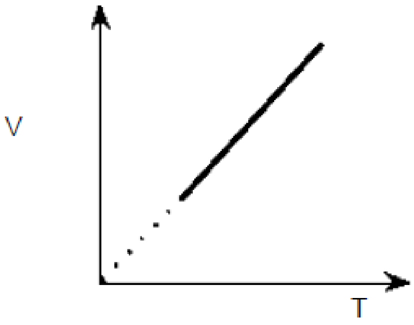
B



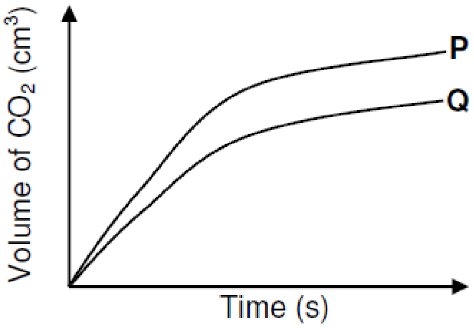
C



D



1.7 When copper(II) carbonate reacts with excess acid, carbon dioxide is produced. The graphs below were obtained under two different reaction conditions.



The change from **P** to **Q** could be brought about by …

A increasing the concentration of the acid.

B decreasing the mass of the copper(II) carbonate.

C decreasing the particle size of the copper(II) carbonate.

D adding a catalyst.

[2 X 7 = 14]

Question 2

2.1 14,5 g of iron reacts with 12 g of water during a corrosion reaction to form Fe_3O_4 and H_2, according to the following equation.

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

2.1.1 Find the substance which is the limiting reactant. Show your calculations. (5)

2.1.2 Using the calculations in your answer to Question 2.1.1, determine the mass of Fe_3O_4 that will be formed. (4)

2.2 Chalk is almost pure calcium carbonate. If 10 g of chalk was reacted with an excess of dilute hydrochloric acid, 2.128 litres of carbon dioxide gas is collected at STP.

$$CaCO_3 (s) + 2HCl (aq) \rightarrow CaCl_2 (aq) + H_2O (l) + CO_2 (g)$$

Determine the purity of calcium carbonate. (Tip: Start by measuring how much carbon dioxide is given off.) (5)

[14]

Question 3

3.1 A sample of IMPURE calcium carbonate (limestone) of unknown mass required a continuous supply of strong heat to decompose according to the following equation:

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$$

After the completion of reaction, 11,76 g CaO was produced.
The percentage purity of calcium carbonate is found to be 80%.

3.1.1 Calculate the mass of the impure calcium carbonate. (6)

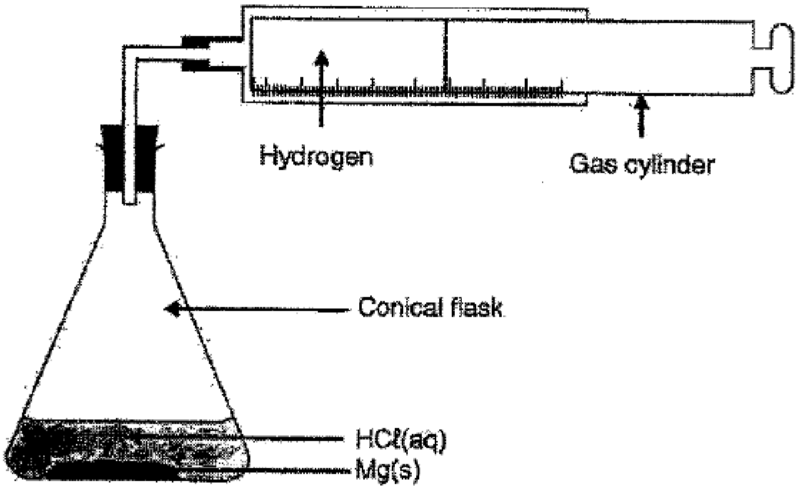
3.2. Sketch a potential energy diagram for the above reaction. Clearly indicate the axes and indicate the following on the graph: (No values are required.)

- ΔH
- Reactants(R) and Products (P)
- Activation energy (EA)
- Activated complex (X) (5)

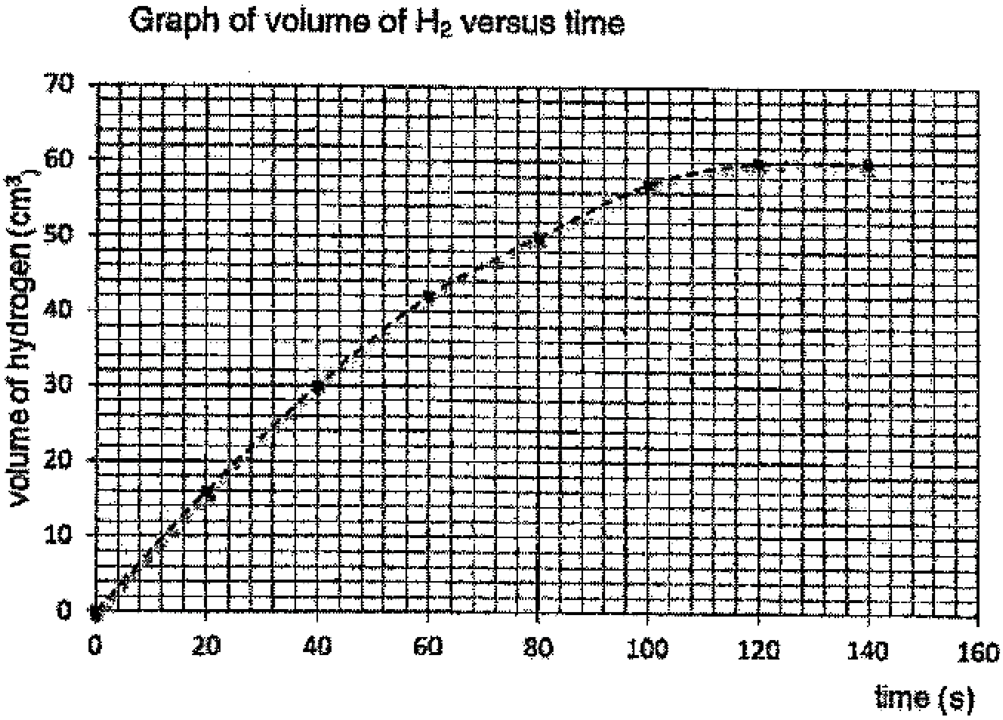
[11]

Question 4

Learners use the reaction between magnesium powder and dilute hydrochloric acid to investigate some of the factors that affect the rate of a reaction. They use the apparatus shown below.



After the investigation, learners displayed their results graphically as shown below:



4.1 Write down the balanced equation for the reaction of magnesium with hydrochloric acid. (3)

4.2 For the investigation's **graph** identify the:

4.2.1 Dependent variable (1)

4.2.2 Independent variable (1)

4.3 Use the graph to determine the volume of gas produced at t = 80 s. (1)

4.4 What will be the average rate for this reaction for the first 60 seconds? (2)

4.5 Redraw (not to scale) the basic outline of the graph above in your answer book (on graph paper required).
Label the graph as Q.
On the same set of axes, draw **sketch graphs** to represent how the following changes in the conditions would affect the shape of the graph Q.
Label the new graphs 'A' and 'B'.

4.5.1 The temperature of the reaction mixture is decreased. (Graph A) (2)

4.5.2 Half the amount of the powdered magnesium is now used with the same amount of dilute acid. (Graph B) (2)

4.6 What else could be added to the reaction mixture to make the reaction go faster? (1)

4.7 In each of the experiments learners use an excess of $HCl_{(aq).}$ Give a reason why the excess $HCl_{(aq)}$ will not influence the result. (2)

4.8 Calculate the mass of Mg put into the container to obtain the volume of hydrogen gas (at STP) that is seen at 120s. (5)

[20]

Question 5

5.1 The hydrogen phosphate ion (HPO_4^{2-}) can act as an ampholyte.

5.1.1 Define the term ampholyte. (2)

5.1.2 Consider the following reaction:

$$HPO_4^{2-}{}_{(aq)} + H_2O_{(l)} \rightarrow PO_4^{3-}{}_{(aq)} + H_3O^+{}_{(aq)}$$

Is the HPO_4^{2-} ion in this reaction acting as a Bronsted-Lowry acid or a base? Give a reason for the answer. (2)

5.1.3 Write down the FORMULA of the substance which forms a conjugate acid-base pair with the HPO_4^{2-} ion. (1)

5.2 A container holds an unknown solution. On the label is written: pH = 13,3

5.2.1 Is the solution acidic, basic or neutral? (1)

5.2.2 Determine the concentration of the hydroxide ions (OH^-) in the solution. (5)

5.2.3 Exactly 25cm^3 of the solution in QUESTION 5.2.2 is titrated with a sulphuric acid solution of unknown concentration. At the end point it is found that 17.85 cm^3 of the sulphuric acid was used. The balanced equation for the reaction is.

$$H_2SO_{4(aq)} + 2XOH_{(aq)} \rightarrow X_2SO_{4(aq)} + 2H_2O_{(l)}$$

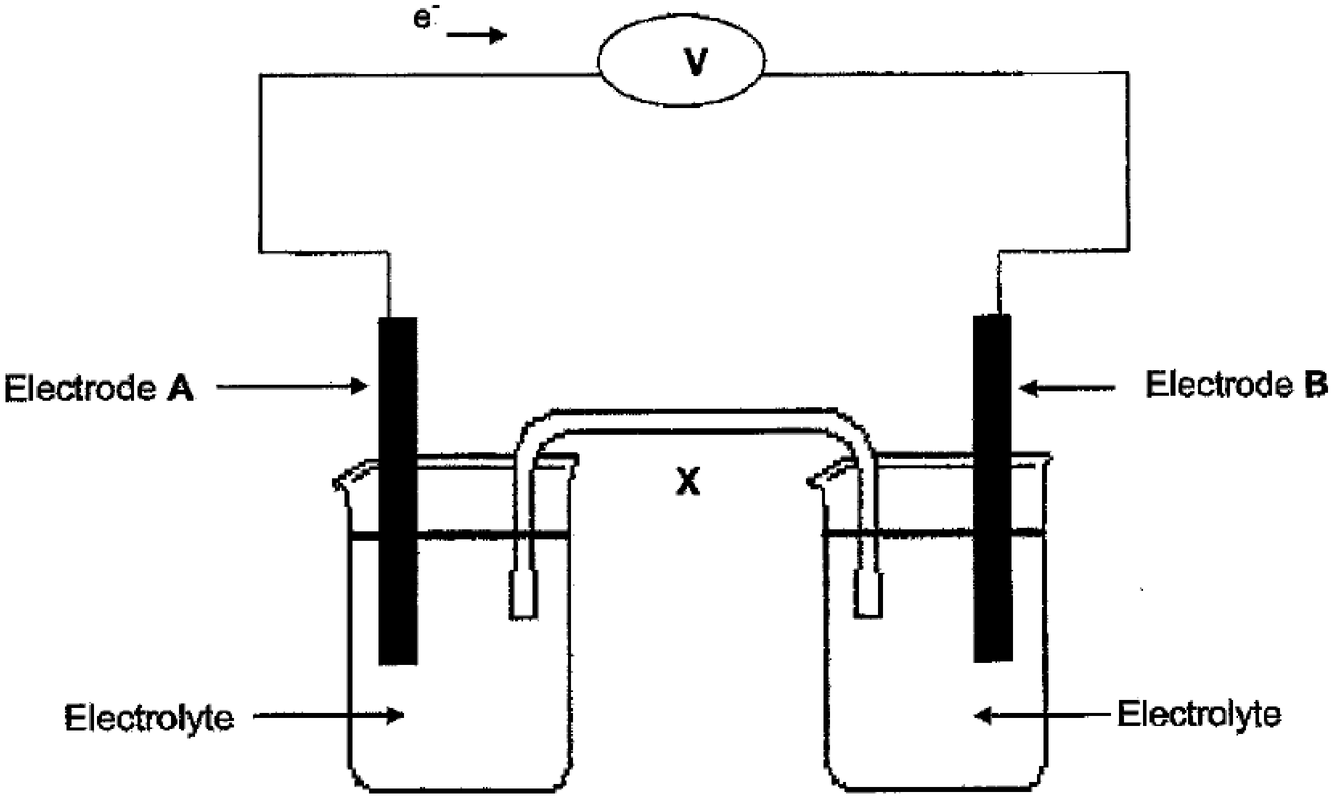
Calculate the concentration of the sulphuric acid solution (5)

5.2.4 Use a calculation to identify element X if the molar mass of compound XOH is 56 g.mol^{-1} (2)

[18]

Question 6

The diagram below represents a galvanic (voltaic) cell functioning under standard conditions using magnesium (Mg) and Lead (Pb) electrodes.



6.1 Define the term electrolyte. (2)

6.2 Write down the NAME of apparatus X and give its function. (2)

6.3 Which electrode, A or B is lead? Refer to the relative strengths of reducing agents to explain your answer. (3)

6.4 Write down the NAME or FORMULA of a suitable electrolyte that can be used in the lead half-cell. (2)

6.5 Electrode B is now replaced by a hydrogen half-cell.

Write down the:

6.5.1 Half-reaction that takes place at the ANODE. (2)

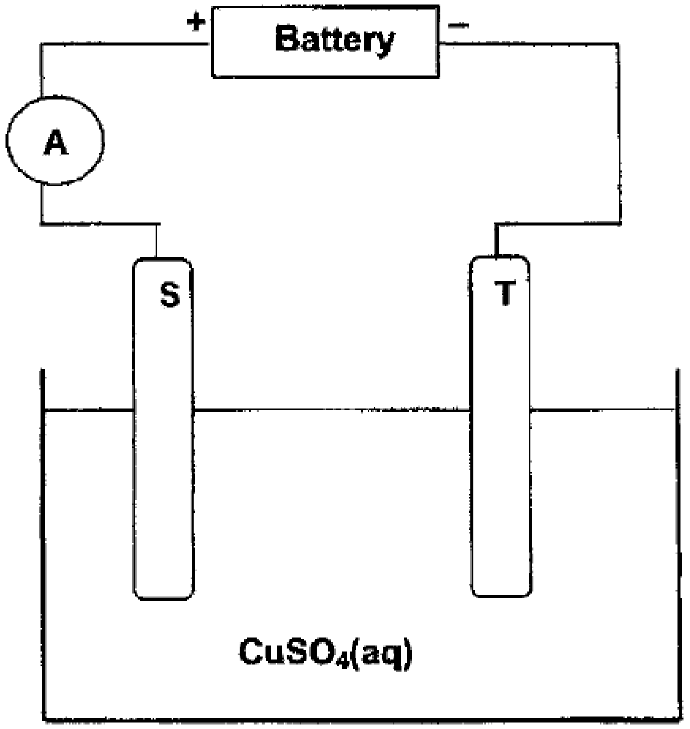
6.5.2 Cell notation for this cell. (3)

6.5.3 Give a reason why Pt is suitable to be used as electrode B. (1)

[15]

Question 7

The simplified diagram below represents the electrolytic cell used to purify copper.



7.1 Define cathode. (2)

7.2 Which electrode, S or T, consists of pure copper? Give a reason for your answer. (2)

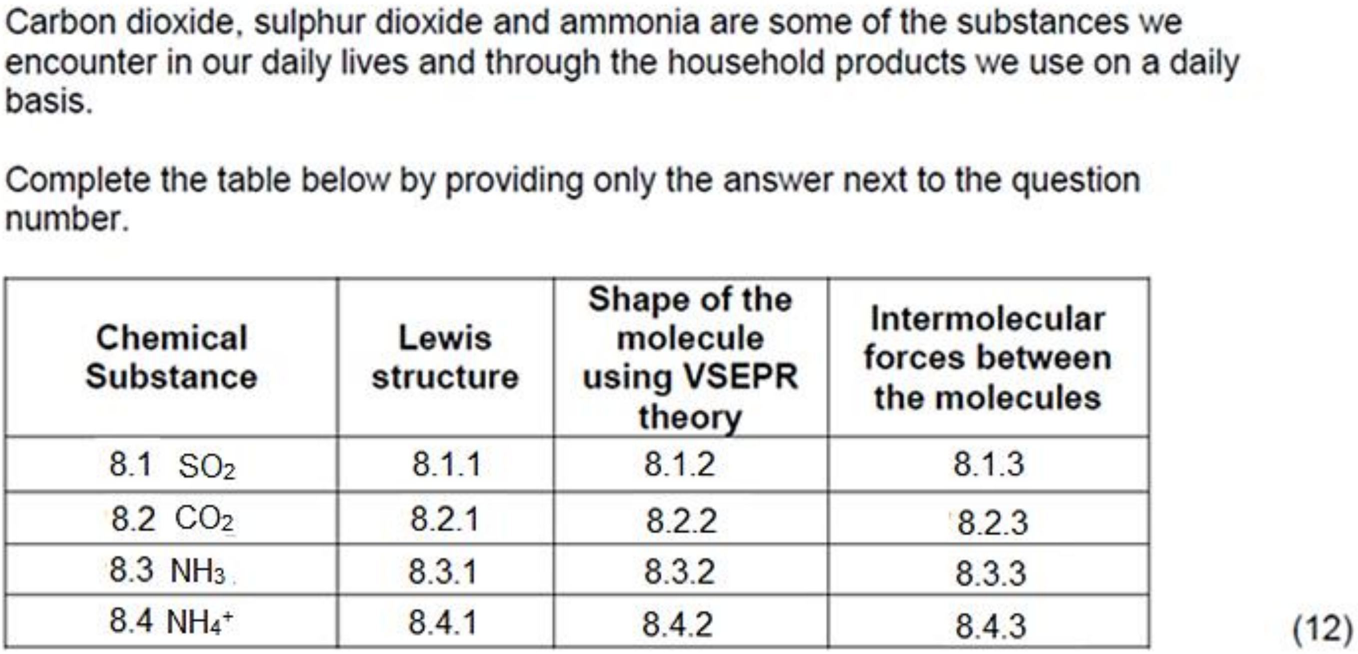
7.3 Write down the half-reaction that takes place at electrode S. (2)

7.4 During purification, metals such as silver and platinum form sludge at the bottom of the container. Refer to relative strength of reducing agents to explain why these two metals do not form ions during the purification process. (2)

7.5 Explain why the concentration of the copper (II) sulphate solution remains constant. Assume that the only impurities in the copper are silver and platinum. (2)

[10]

Question 8



Carbon dioxide, sulphur dioxide and ammonia are some of the substances we encounter in our daily lives and through the household products we use on a daily basis.

Complete the table below by providing only the answer next to the question number.

Chemical Substance	Lewis structure	Shape of the molecule using VSEPR theory	Intermolecular forces between the molecules
8.1 SO_2	8.1.1	8.1.2	8.1.3
8.2 CO_2	8.2.1	8.2.2	8.2.3
8.3 NH_3	8.3.1	8.3.2	8.3.3
8.4 NH_4^+	8.4.1	8.4.2	8.4.3

(12)

8.5 Define the term electronegativity. (2)

8.6 Draw the Lewis diagram for PCl_3. Identify the shape of the PCl_3 molecule and explain whether it will be a polar or non-polar molecule, with reference to the bonds and molecular shape. (3)

8.7 Explain the difference between a polar bond and a polar molecule, using the compounds $CHCl_3$ and CCl_4 as examples. (4)

[21]

Question 9

9.1 Name THREE properties of an ideal gas. (3)

9.2 Under which circumstances do real gases behave like an ideal gas? (2)

9.3 A diver dives down into the sea, to where the temperature is 10°C and the pressure is 150 kPa. He releases a bubble of air from his lungs. The volume of the bubble, when released is 5cm^3. Calculate the volume of the bubble when it reaches the surface of the sea, where the temperature is 25°C. (4)

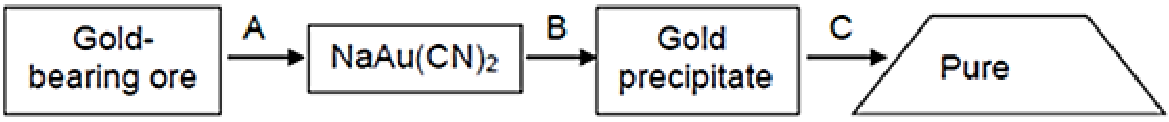
9.4 When 35g of an unknown gas is pumped into a closed, empty 12 dm^3 container at a constant temperature of 55°C, the pressure inside the container is 285 x 10^3 Pa.

9.4.1 Identify the gas. (7)

[16]

Question 10

10.1 Gold was mined as early as 1200 AD in South Africa. Today, South Africa is a world leader in the mining and processing of gold. The following flow diagram illustrates some of the most important steps in the mining and processing of gold:



10.1.1 Identify the process which takes place at C. (1)

10.1.2 Give the NAME of FORMULA of the chemical substances that was used at B originally. (1)

10.1.3 Which chemical substance is now preferred at B and why is this substance preferred? (2)

10.1.4 The recovery of gold through the cyanidation process has positive and negative effects. Give ONE negative effect of the use of cyanide. (2)

10.2 Various fossil fuels are the main sources of energy on Earth.

10.2.1 Name the fossil fuel which is used as the main source of energy in South Africa. (1)

10.2.2 Give TWO reasons why South Africa uses the energy source mentioned in QUESTION 10.2.1 (2)

10.2.3 Give ONE reason why it is necessary to introduce renewable energy resources. (2)

[11]

Total 150

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Avogadro's constant *Avogadro-konstante*	N_A	$6,02 \times 10^{23}$ mol^{-1}
Molar gas constant *Molêre gaskonstante*	R	$8,31$ J·K^{-1}·mol^{-1}
Standard pressure Standaarddruk	p^θ	$1,013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22,4$ dm^3·mol^{-1}
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$n = \frac{V}{V_m}$	$c = \frac{n}{V}$ OR/*OF* $c = \frac{m}{MV}$
$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$

$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K

$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$

or/*of*

$E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$

or/*of*

$E^\theta_{cell} = E^\theta_{oxidising\,agent} - E^\theta_{reducing\,agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29

Electronegativity / *Elektronegatiwiteit*: 1,9

Symbol / *Simbool*: Cu

Approximate relative atomic mass / *Benaderde relatiewe atoommassa*: 63,5

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 2,1 **H** 1																	2 **He** 4
3 1,0 **Li** 7	4 1,5 **Be** 9											5 2,0 **B** 11	6 2,5 **C** 12	7 3,0 **N** 14	8 3,5 **O** 16	9 4,0 **F** 19	10 **Ne** 20
11 0,9 **Na** 23	12 1,2 **Mg** 24											13 1,5 **Aℓ** 27	14 1,8 **Si** 28	15 2,1 **P** 31	16 2,5 **S** 32	17 3,0 **Cℓ** 35,5	18 **Ar** 40
19 0,8 **K** 39	20 1,0 **Ca** 40	21 1,3 **Sc** 45	22 1,5 **Ti** 48	23 1,6 **V** 51	24 1,6 **Cr** 52	25 1,5 **Mn** 55	26 1,8 **Fe** 56	27 1,8 **Co** 59	28 1,8 **Ni** 59	29 1,9 **Cu** 63,5	30 1,6 **Zn** 65	31 1,6 **Ga** 70	32 1,8 **Ge** 73	33 2,0 **As** 75	34 2,4 **Se** 79	35 2,8 **Br** 80	36 **Kr** 84
37 0,8 **Rb** 86	38 1,0 **Sr** 88	39 1,2 **Y** 89	40 1,4 **Zr** 91	41 **Nb** 92	42 1,8 **Mo** 96	43 1,9 **Tc**	44 2,2 **Ru** 101	45 2,2 **Rh** 103	46 2,2 **Pd** 106	47 1,9 **Ag** 108	48 1,7 **Cd** 112	49 1,7 **In** 115	50 1,8 **Sn** 119	51 1,9 **Sb** 122	52 2,1 **Te** 128	53 2,5 **I** 127	54 **Xe** 131
55 0,7 **Cs** 133	56 0,9 **Ba** 137	57 **La** 139	72 1,6 **Hf** 179	73 **Ta** 181	74 **W** 184	75 **Re** 186	76 **Os** 190	77 **Ir** 192	78 **Pt** 195	79 **Au** 197	80 **Hg** 201	81 1,8 **Tℓ** 204	82 1,8 **Pb** 207	83 1,9 **Bi** 209	84 2,0 **Po**	85 2,5 **At**	86 **Rn**
87 0,7 **Fr**	88 0,9 **Ra** 226	89 **Ac**															

58 **Ce** 140	59 **Pr** 141	60 **Nd** 144	61 **Pm**	62 **Sm** 150	63 **Eu** 152	64 **Gd** 157	65 **Tb** 159	66 **Dy** 163	67 **Ho** 165	68 **Er** 167	69 **Tm** 169	70 **Yb** 173	71 **Lu** 175
90 **Th** 232	91 **Pa**	92 **U** 238	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**

TABLE 4A: STANDARD REDUCTION POTENTIALS

Half-reactions			E^{θ} (V)
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$H_2O_2 + 2H^+ + 2e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^-$	$\rightleftharpoons$	$2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	$\rightleftharpoons$	Pt	+ 1,20
$Br_2(\ell) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(\ell)$	+ 0,85
$Ag^+ + e^-$	$\rightleftharpoons$	Ag	+ 0,80
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O_2	+ 0,68
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$Cu^+ + e^-$	$\rightleftharpoons$	Cu	+ 0,52
$SO_2 + 4H^+ + 4e^-$	$\rightleftharpoons$	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	$\rightleftharpoons$	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	Cu	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	$\rightleftharpoons$	Cu^+	+ 0,16
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	Sn^{2+}	+ 0,15
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	$\rightleftharpoons$	**$H_2(g)$**	**0,00**
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	Fe	− 0,06
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	Pb	− 0,13
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	Sn	− 0,14
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	Ni	− 0,27
$Co^{2+} + 2e^-$	$\rightleftharpoons$	Co	− 0,28
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	Cd	− 0,40
$Cr^{3+} + e^-$	$\rightleftharpoons$	Cr^{2+}	− 0,41
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	Fe	− 0,44
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	Cr	− 0,74
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	Zn	− 0,76
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	− 0,83
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	Cr	− 0,91
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	Mn	− 1,18
$A\ell^{3+} + 3e^-$	$\rightleftharpoons$	$A\ell$	− 1,66
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	Mg	− 2,36
$Na^+ + e^-$	$\rightleftharpoons$	Na	− 2,71
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	Ca	− 2,87
$Sr^{2+} + 2e^-$	$\rightleftharpoons$	Sr	− 2,89
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	Ba	− 2,90
$Cs^+ + e^-$	$\rightleftharpoons$	Cs	- 2,92
$K^+ + e^-$	$\rightleftharpoons$	K	− 2,93
$Li^+ + e^-$	$\rightleftharpoons$	Li	− 3,05

Increasing oxidising ability

Increasing reducing ability/

TABLE 4B: STANDARD REDUCTION POTENTIALS

Increasing oxidising ability

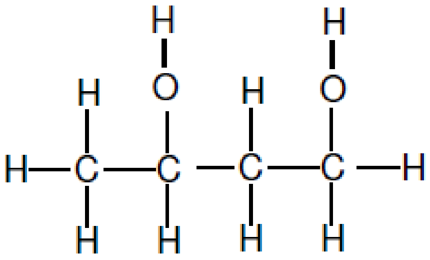
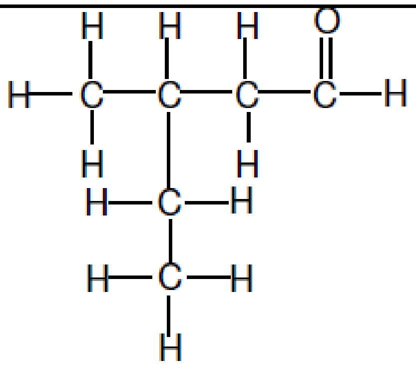
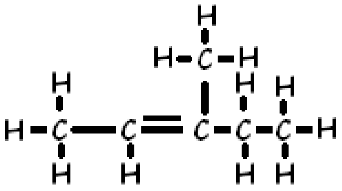
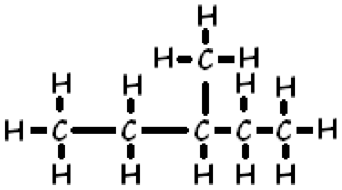
Half-reactions			E^{θ} (V)
$Li^+ + e^-$	$\rightleftharpoons$	Li	− 3,05
$K^+ + e^-$	$\rightleftharpoons$	K	− 2,93
$Cs^+ + e^-$	$\rightleftharpoons$	Cs	− 2,92
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	Ba	− 2,90
$Sr^{2+} + 2e^-$	$\rightleftharpoons$	Sr	− 2,89
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	Ca	− 2,87
$Na^+ + e^-$	$\rightleftharpoons$	Na	− 2,71
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	Mg	− 2,36
$A\ell^{3+} + 3e^-$	$\rightleftharpoons$	$A\ell$	− 1,66
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	Mn	− 1,18
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	Cr	− 0,91
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	− 0,83
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	Zn	− 0,76
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	Cr	− 0,74
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	Fe	− 0,44
$Cr^{3+} + e^-$	$\rightleftharpoons$	Cr^{2+}	− 0,41
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	Cd	− 0,40
$Co^{2+} + 2e^-$	$\rightleftharpoons$	Co	− 0,28
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	Ni	− 0,27
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	Sn	− 0,14
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	Pb	− 0,13
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	Fe	− 0,06
$2H^+ + 2e^-$	$\rightleftharpoons$	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	$\rightleftharpoons$	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	Cu	+ 0,34
$2H_2O + O_2 + 4e^-$	$\rightleftharpoons$	$4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^-$	$\rightleftharpoons$	$S + 2H_2O$	+ 0,45
$Cu^+ + e^-$	$\rightleftharpoons$	Cu	+ 0,52
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	$\rightleftharpoons$	Ag	+ 0,80
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$Pt^{2+} + 2\,e^-$	$\rightleftharpoons$	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	$\rightleftharpoons$	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2\,e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87

Increasing reducing ability

Extension question – only complete once the rest of the exam is finished

Question 11

The letters **A** to **H** in the table below represent eight organic compounds.

A		**B**	
C	ethyl butanoate	**D**	1,2-dibromo-3-methylbutane
E	Propanoic acid	**F**	
G		**H**	4-methylpentan-2-one

Write down the letter(s) that represent(s):

(Letters can be used more than once)

11.1.1 A compound with a carboxyl group as a functional group

11.1.2 An alkene

11.1.3 An aldehyde

11.1.4 A saturated **hydrocarbon**

11.1.5 A compound with a formyl group as a functional group

11.1.6 A compound with a hydroxyl group as a functional group (6 x 1 = 6)

11.2 Write down the IUPAC name of:

11.2.1 Compound B

11.2.2 Compound F

11.2.3 Compound G

11.2.4 Compound A (4 x 1 = 4)

11.3 Write down the structural formula of:

11.3.1 Compound C (2)

11.3.2 Compound D (1)

11.3.3 Compound E (2)

11.3.4 Compound H (2)

11.4 Write down the general formula of:

11.4.1 Compound B

11.4.2 Compound E

11.4.3 Compound C

(3 X 1 = 3)

[20]