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HILTON COLLEGE
GRADE 12 TRIALS EXAMINATIONS
AUGUST 2017

PHYSICAL SCIENCE : PAPER 2

Time: 3 hours

200 marks

Examiner: Mr M Green
Moderator: Mr S van Wyk

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of:
 - A question paper of **21 pages** and **11 questions**.
 - Three pages of data and formulae (Pages 19, 20 and 21) which can be detached.
2. **Please check that your question paper is complete.**
3. Read the questions carefully.
4. It is in your own interest to write legibly and to set your work out neatly.
5. Use the data and formulae whenever necessary.
6. Number your answers in the same way as the questions are numbered.
7. All working must be shown.
8. Units need not be used in the calculations.
They **MUST** be shown in the answers, however.
9. No programmable calculators may be used.

QUESTION 1

Choose the most correct alternative and write down the letter of your choice on the inside cover of your answer book. You may only mark one letter for each question.

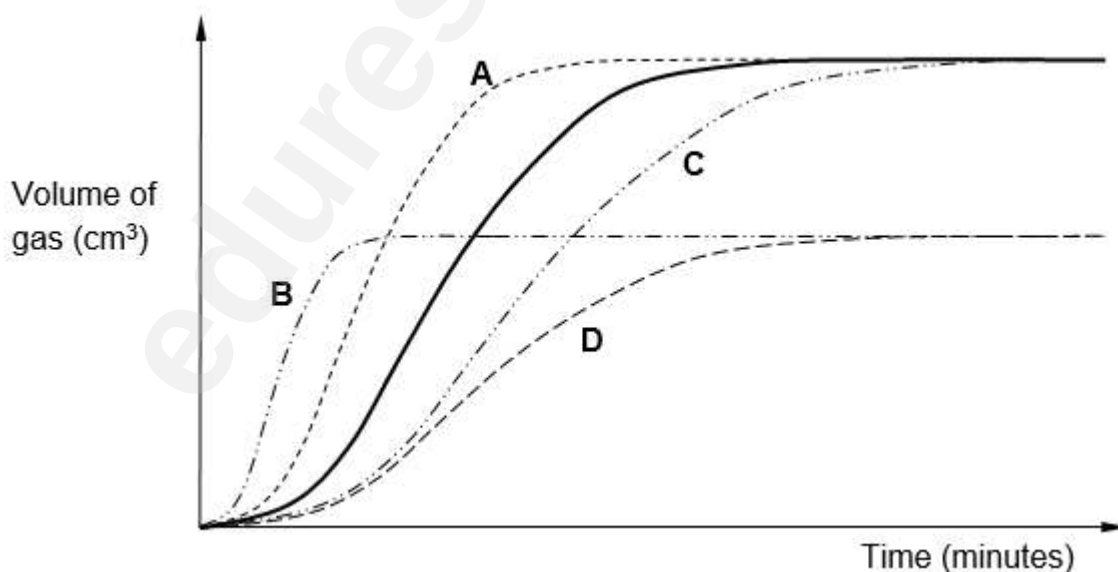
1.1 CCl_4 does not mix with water because CCl_4 has _____ intermolecular forces while water has _____ intermolecular forces, respectively...

- | | | | |
|---|-------------------------|---|---------------------------------|
| A | London; ion-dipole | B | London; hydrogen bonding |
| C | covalent; dipole-dipole | D | dipole-dipole; hydrogen bonding |

1.2 The particles of a diamond crystal are held together by ...

- A ionic bonding
- B Van der Waals forces
- C hydrogen bonding
- D covalent bonding

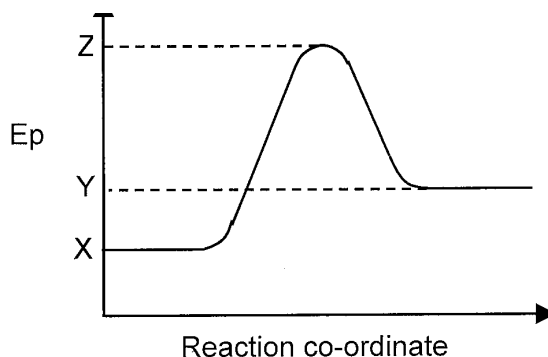
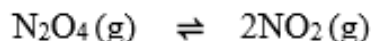
1.3 In an experiment, a 2g lump of zinc and 1g of powdered zinc are added separately to equal volumes of dilute sulphuric acid. The **solid line** in the graph below shows the volume of gas given off when the 2g lump is used.



Which dotted line is obtained when 1 g of powdered zinc is used?

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- 1.4 The graph below represents the change in potential energy against time for the following reaction:



Which **ONE** of the following statements is correct?

- A The heat of reaction for the forward reaction is $Y - X$
- B The forward reaction is exothermic.
- C The activation energy for the forward reaction is $Z - Y$
- D The activation energy for the reverse reaction is $Z - X$

- 1.5 Consider the following equilibrium:

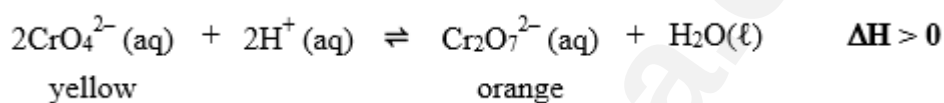


The volume of the equilibrium system is increased and a new equilibrium is established. Compared to the rates of the reactions in the original equilibrium, which of the following describes the rates of the forward and reverse reactions, as well as the K_c in the new equilibrium?

	Forward Rate	Reverse Rate	K_c
A	increased	increased	unchanged
B	decreased	decreased	unchanged
C	decreased	increased	increases
D	unchanged	unchanged	decreases

[20]

1.6 Consider the following equation of a reversible reaction:



Which set of factors below would favour the formation of orange dichromate ions?

	Temperature	pH
A	Decrease	Increase
B	Decrease	Decrease
C	Increase	Increase
D	Increase	Decrease

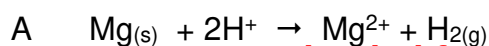
1.7 In the reaction,



X represents the following:

- A The acid SO_4^{2-}
- B The base SO_4^{2-}
- C The acid H_2SO_4
- D The base H_2SO_4

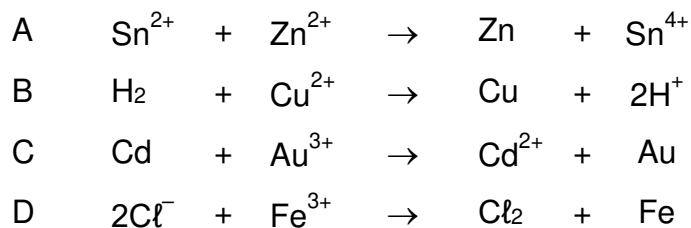
1.8 Which of the following redox reactions will occur spontaneously? Refer to the Table of Reduction Potentials.



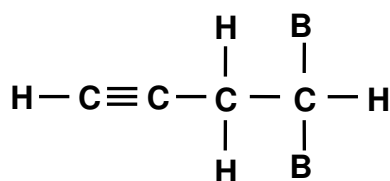
- B $\text{Cu}_{(\text{s})} + 2\text{H}^{+} \rightarrow \text{Cu}^{2+} + \text{H}_{2(\text{g})}$
- C $2\text{Ag}_{(\text{s})} + 2\text{H}^{+} \rightarrow 2\text{Ag}^{+} + \text{H}_{2(\text{g})}$
- D $\text{Hg}_{(\text{l})} + 2\text{H}^{+} \rightarrow \text{Hg}^{2+} + \text{H}_{2(\text{g})}$

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- 1.9 A learner has a light bulb which only lights up when a voltage (potential difference) of 1,5 V is applied across its filament. Which one of the following standard cells will cause the bulb to light up? Refer to the Table of Standard Electrode Potentials.



- 1.10 What is the IUPAC name of the following compound?

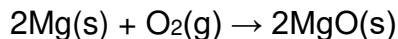


- A 1,1- dibromo-3-butyne.
- B 4,4-dibromo-1-butyne.
- C 2,4-dibromo-1-butyne.
- D 4,4-dibromo-1-propyne.

[10 x 2 = 20]

QUESTION 2

- 2.1 Magnesium burns in air to form magnesium oxide according to the following balanced equation:

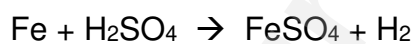


If 2,4g of magnesium combines with 0,8g of oxygen, which is at STP:

- 2.1.1 What does STP stand for? (1)
- 2.1.2 Calculate how many moles of magnesium **and** how many moles of oxygen is present. (2)
- 2.1.3 Which of the two substances will be used up completely? (1)
- 2.1.4 Determine how many moles of the other substance is in excess. (3)

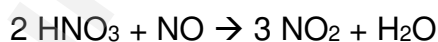


- 2.2 20 g of impure iron reacts with excess sulphuric acid, releasing 5 dm³ of hydrogen gas. The reaction is presented below:



- 2.2.1 Calculate the number of moles of hydrogen gas released. (2)
- 2.2.2 Write down the number of moles of pure Fe which reacted. (1)
- 2.2.3 Calculate the percentage purity of the iron. (3)

- 2.3 Consider the balanced equation shown below. The yield for the production of water is 68,7%.



- 2.3.1 If 44,1 g of HNO₃ reacts completely with nitrogen monoxide, calculate the theoretical mass of water which is produced. (4)
- 2.3.2 Considering the yield for this reaction (68,7%), now calculate the actual mass of water which is produced. (2)

[19]

QUESTION 3

Both aluminium fluoride (AlF_3) and phosphorous trifluoride (PF_3) contain fluorine. Aluminium fluoride is a colourless solid used in the production of aluminium, whilst phosphorous trifluoride is a poisonous, colourless gas.

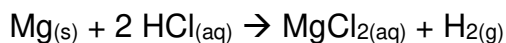
- 3.1 Define *intermolecular force*. (2)
- 3.2 Explain the difference between a *covalent bond* and an *ionic bond*. (2)
- 3.3 Name the type of chemical bond between particles in:
- 3.3.1 AlF_3 (1)
- 3.3.2 PF_3 (1)
- 3.4 Draw the Lewis structures for
- 3.4.1 AlF_3 (2)
- 3.4.2 PF_3 (2)

The boiling points of four compounds of hydrogen, are given in the table below. The questions which follow refer to this table.

Formula	Boiling point ($^{\circ}\text{C}$)
CH_4	-164
NH_3	-33
H_2O	100
SiH_4	-112

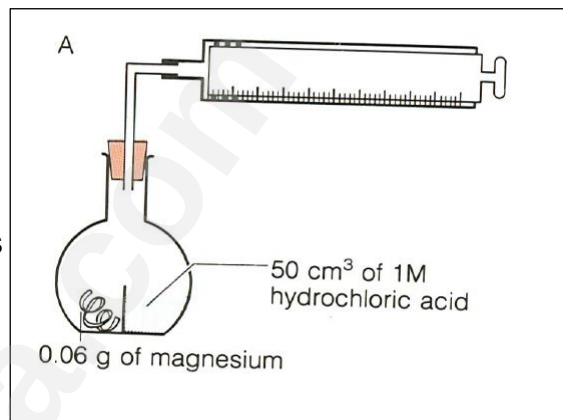
- 3.5 Fully explain the difference in boiling points between:
- 3.5.1 CH_4 and NH_3 by referring to their type of intermolecular forces. (3)
- 3.5.2 CH_4 and SiH_4 by referring to their molecular sizes. (3)
- 3.6 Write down the formula from the table that represents the following
- 3.6.1 ONE polar compound (1)
- 3.6.2 ONE non-polar compound (1)

[18]

QUESTION 4

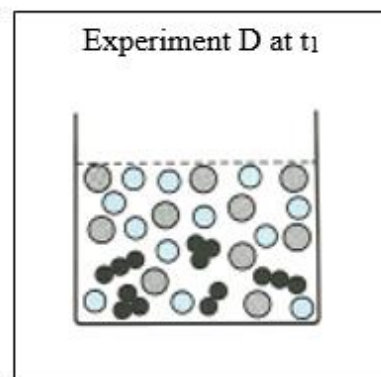
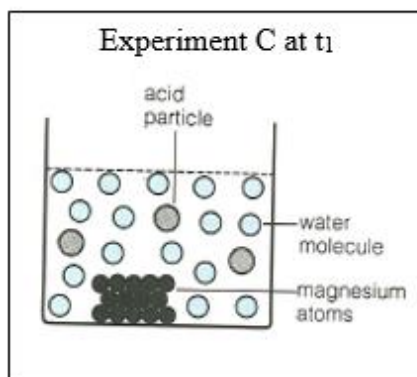
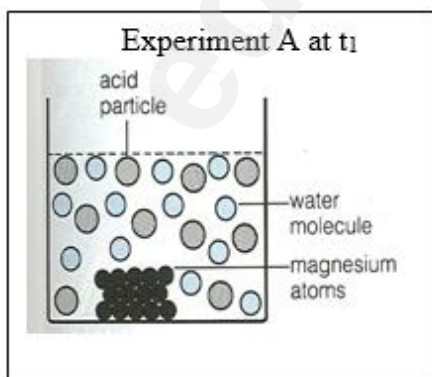
An experiment to investigate the rate of the above reaction was carried out as shown in the diagram below.

- A divided flask was used to keep the reactants apart initially.
- The stop-watch was started once the flask was tipped up to mix the chemicals.
- The volume of $\text{H}_2\text{(g)}$ collected was measured as a function of time.
- The temperature was kept constant for all experiments.
- The molar gas volume at the temperature used is $24 \text{ dm}^3 \cdot \text{mol}^{-1}$.



Experiment	Mass Mg (g)	Volume HCl (cm ³)	[HCl] (mol.dm ⁻³)
A	0.06	50	1
B	0.03	50	1
C	See diagram		
D	See diagram		

Molecular diagrams of the initial reaction mixture for Experiments A, C and D are shown below.



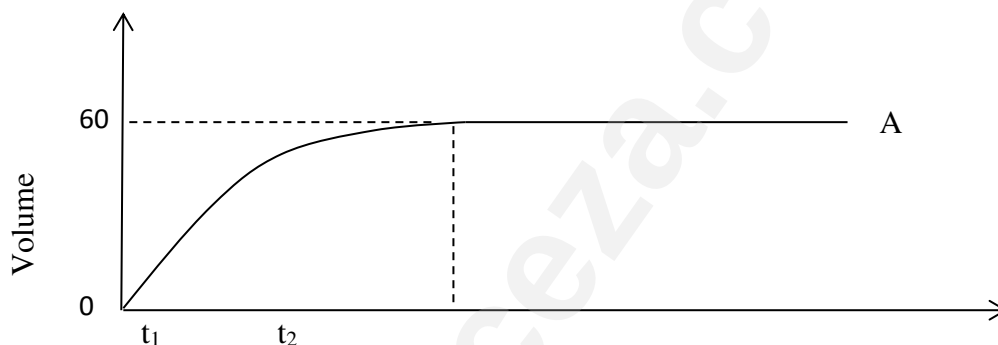
4.1 Using the diagram of Experiment A as a reference, deduce what factor is being investigated in...

4.1.1 Experiment C; and

4.1.2 Experiment D? (2)

4.2 Use the data provided for Experiment A to determine which reactant was in excess and hence prove that 60 cm^3 of $\text{H}_2(\text{g})$ would be collected at this temperature as shown in the graph below. (5)

Refer to the graph below and answer the questions which follow.



4.3 What does the gradient of this graph represent? (1)

4.4 Name and explain two possible reasons why the gradient of the graph is less steep at t_2 compared to t_1 . You should refer to the collision theory in your answer. (4)

The rate of this reaction could also be investigated by measuring the mass loss of an open flask as a function of time.

4.5 It is a law of nature that "matter is conserved" i.e. mass cannot be lost in a chemical reaction. Why would the mass of an open flask decrease as this reaction proceeds? (1)

4.6 Calculate the mass of $\text{H}_2(\text{g})$ that would be produced in Experiment A. (2)

4.7 Comment on which of the two experimental techniques is preferable in this case (measuring volume produced or measuring mass loss). Justify your answer. (2)

[17]

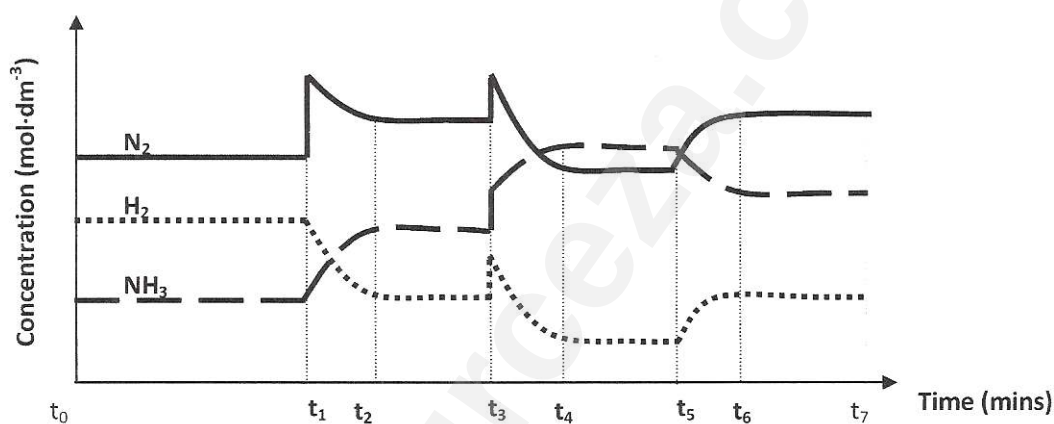
QUESTION 5

A fertiliser company produces ammonia on a large scale at a temperature of 450°C. The balanced equation below represents the reaction that takes place in a sealed 2 dm³ container.



To meet an increased demand for fertiliser, the management of the company instructs their engineers to make the necessary adjustments to the dynamic chemical equilibrium of the reaction to increase the yield of ammonia.

In a trial run on a small scale in the laboratory, an engineer makes adjustments to the equilibrium mixture. The graphs below represent the results obtained.



- 5.1 Explain what is meant by the term “dynamic chemical equilibrium”. (2)
- 5.2 Give one time interval during which the reaction would have been in dynamic chemical equilibrium. (1)
- 5.3 Using Le Chatelier’s Principle, identify and explain the changes made to the equilibrium mixture between each of the following times:
 - 5.3.1 t_1 and t_2 (3)
 - 5.3.2 t_5 and t_6 (3)
- 5.4 At t_3 , both the reactants and product showed a sudden increase in concentration.
 - 5.4.1 What do you think happened at this point to cause the increase in concentration? (1)
 - 5.4.2 Using Le Chatelier’s Principle, explain how the equilibrium now re-establishes itself between t_3 and t_4 . (3)

5.5 At t_7 , the following amounts of reactant and product were present at equilibrium at a temperature of 450°C :

- 1,28 mol of H_2 ,
- 49,6 g of N_2
- $12,31 \text{ dm}^3$ of NH_3 gas at STP

The volume of the reaction container is 2 dm^3

5.5.1 Write down an expression for the equilibrium constant (K_c) for this reaction. (2)

5.5.2 Calculate the value of K_c for this reaction at 450°C . (7)

5.5.3 What would happen to the value of the equilibrium constant (K_c) calculated above, under the following conditions ?

(Simply answer INCREASE, DECREASE or STAY THE SAME)

5.5.3.1 $\text{N}_2 (\text{g})$ is removed from the system.

5.5.3.2 The temperature is decreased to 350°C .

5.5.3.3 The size of the reaction vessel is increased. (3)

[25]

QUESTION 6

The acid ionisation constants, K_a , for the hypothetical acids H_2X , HY and HZ , in water at $25^\circ C$, are given in the table below.

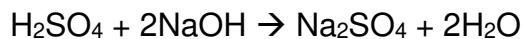
Acid	K_a
H_2X	$2,8 \times 10^{-3}$
HY	$1,2 \times 10^{-6}$
HZ	6×10^{-4}

- 6.1 Define the term *acid* (in terms of Lowrey-Bronsted model). (1)
- 6.2 Explain the difference between a strong acid and a weak one. Give an example of a weak acid from the table above. (3)
- 6.3 From the table above, give an example of a polyprotic acid. (1)
- 6.4 Which acid, H_2X , HY or HZ , will have the lowest pH. Justify your choice. Assume that the concentrations of the acids are the same. (2)
- 6.5 HY is added to ammonia to make a salt. Give the formula of the salt. (1)

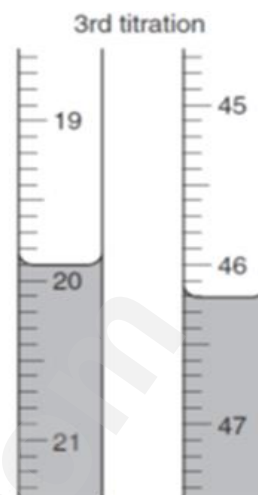
[8]

QUESTION 7

A pupil titrates a strong acid, sulphuric acid, with sodium hydroxide to produce sodium sulphate and water.



Three readings are taken so that on average 27cm^3 of acid is required to neutralize 25cm^3 of a standardized solution of sodium hydroxide of concentration $0,2\text{mol}\cdot\text{dm}^{-3}$

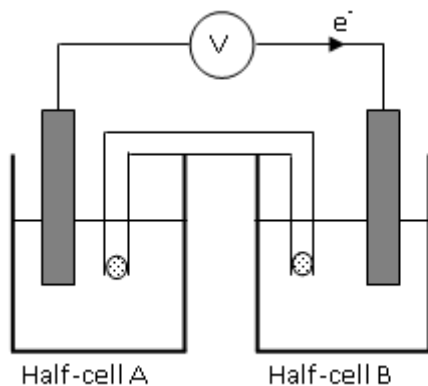


- 7.1 Calculate the volume for the 3rd titration as shown in the diagram. The diagram shows the start and end reading on the burette. (2)
- 7.2 Bromothymol blue changes colour around pH 7. Explain why it is a suitable indicator for this titration. (2)
- 7.3 Write down an equation for the ionization of sulphuric acid in water. (2)
- 7.4 Strong acids are known to conduct electricity. Compare the conductivity of the acid solution to that of the solution where the bromothymol blue changes colour. (2)
- 7.5 Define the term *neutralisation* in a titration? (2)
- 7.6 Consider a solution of the salt ammonium sulphate [$(\text{NH}_4)_2\text{SO}_4$]
- 7.6.1 Define a *salt*. (2)
- 7.6.2 Use an equation to show the hydrolysis of ammonium sulphate. (3)
- 7.6.3 Name the compounds that need to react to produce ammonium sulphate. (2)
- 7.6.4 Predict the pH of this solution. (1)

[18]

QUESTION 8

The galvanic cell represented in the diagram below consists of a Mg electrode dipped into a $\text{Mg}(\text{NO}_3)_2$ solution, and a Pb electrode dipped into a $\text{Pb}(\text{NO}_3)_2$ solution. Assume that the cell operates under standard conditions.

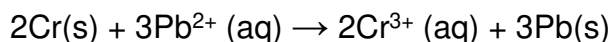


- 8.1 What energy conversions take place in this cell? (2)
- 8.2 State TWO standard conditions under which this cell operates. (2)
- 8.3 Write down the half-reaction that takes place in half-cell A. (2)
- 8.4 Write down the cell notation for this cell. (2)
- 8.5 Calculate the emf of this cell. (3)
- 8.6 How will each of the following changes influence the value of the cell's emf calculated in QUESTION 8.5? Write down only INCREASES, DECREASES or REMAINS THE SAME.
- 8.6.1 An increase in $[\text{Mg}^{2+}(\text{aq})]$ (1)
- 8.6.2 An increase in $[\text{Pb}^{2+}(\text{aq})]$ (1)
- 8.7 In which direction, from half-cell A to B or from half-cell B to A, do cations move within the salt bridge to maintain electrical neutrality? Explain how you arrived at your answer. (3)

[16]

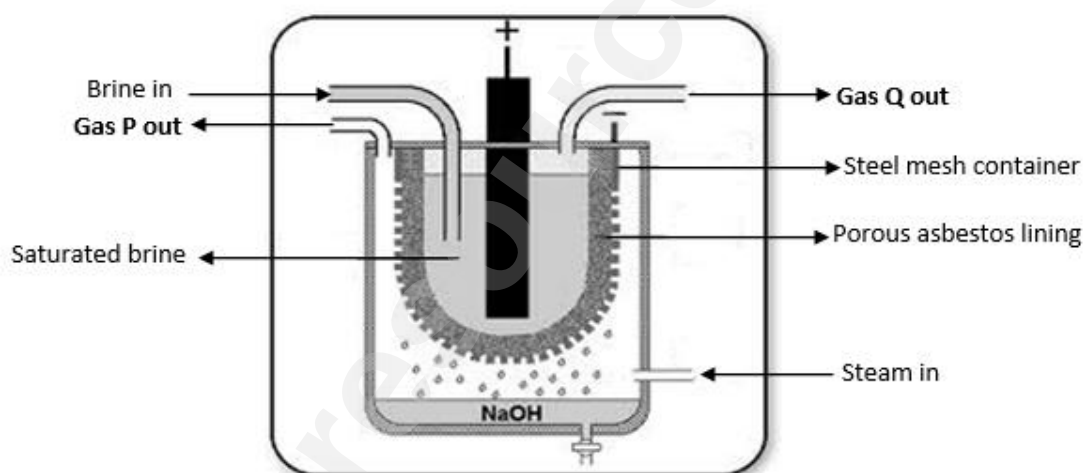
QUESTION 9

Consider the following balanced chemical equation for the reaction taking place in a galvanic cell under standard conditions:



- 9.1 Write down the symbol of the oxidising agent in this reaction. (1)
- 9.2 The cell delivers a current of 0,2 A for 50 minutes. Using the formula $Q = It$ calculate the charge delivered by the cell **and** hence the number of electrons that are transferred. (Note: charge on an electron = $1,6 \times 10^{-19}\text{C}$) (4)
- 9.3 Calculate the loss in mass of the anode? (Take your answer to 4 decimal places or 3 significant figures.) (4)

The diagram below is a simplified representation of one of the electrolytic cells used in the chlor-alkali industry. The letters **P** and **Q** represent the two gases formed during this process.



- 9.4 What is "brine"? (1)
- 9.5 Write down the **chemical formulae** of the gases **P** and **Q**. (2)
- 9.6 Use the Redox Table to explain why sodium metal is NOT one of the products of this process. (2)
- 9.7 Write down the complete balanced equation for the reaction taking place in this cell. (2)
- 9.8 Do a calculation to explain why this reaction is not spontaneous. (3)
- 9.9 What is the name of the cell type depicted in the diagram and give a reason as to why it is getting phased out. (2)

QUESTION 10

Consider the following organic compounds below, represented by their condensed or molecular formula:

A	C_3H_8	B	$\text{CH}_3\text{CH}_2\text{CHCH}_2$	C	$\text{CH}_3\text{CH}_2\text{CHO}$
D	$\text{CH}_3\text{CH}_2\text{COOCH}_3$	E	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$	F	CH_3OH
G	$\text{CH}_3\text{CH}_2\text{COOH}$	H	$\text{CH}_3\text{C}(\text{CH}_3)\text{CH}_2$	I	C_3H_4

- 10.1 Write a balanced equation for the combustion of the alkane shown above. (3)
- 10.2 To which homologous series does compound **F** belong? (1)
- 10.3 Compound **D** is formed by a process called esterification. Using structural formulae, show how this ester is formed. Name all the reactants and products in this reaction. (7)
- 10.4 Compound **E** is formed from compound **B**.
- 10.4.1 Name this type of reaction. (1)
- 10.4.2 Name the other compound that reacted with compound **B**. (1)
- 10.5 Name the functional group in compound **G**. (1)
- 10.6 Give the IUPAC name of compound **H**. (2)
- 10.7 What type of intermolecular force exists between the molecules of compound **F**? (1)
- 10.8 State one physical property of compound **F** as a result of the intermolecular force mentioned in 10.7. (1)

[18]

QUESTION 11

11.1 Define each of the following terms:

11.1.1 *Functional group* (2)

11.1.2 *Isomer* (2)

11.2 Draw the following molecules using the formula shown in brackets:

11.2.1 2,4-di-bromo-hex-2-ene (**semi structural formula**) (2)

11.2.2 3-ethyl-2-methyl-pentane (**condensed formula**) (2)

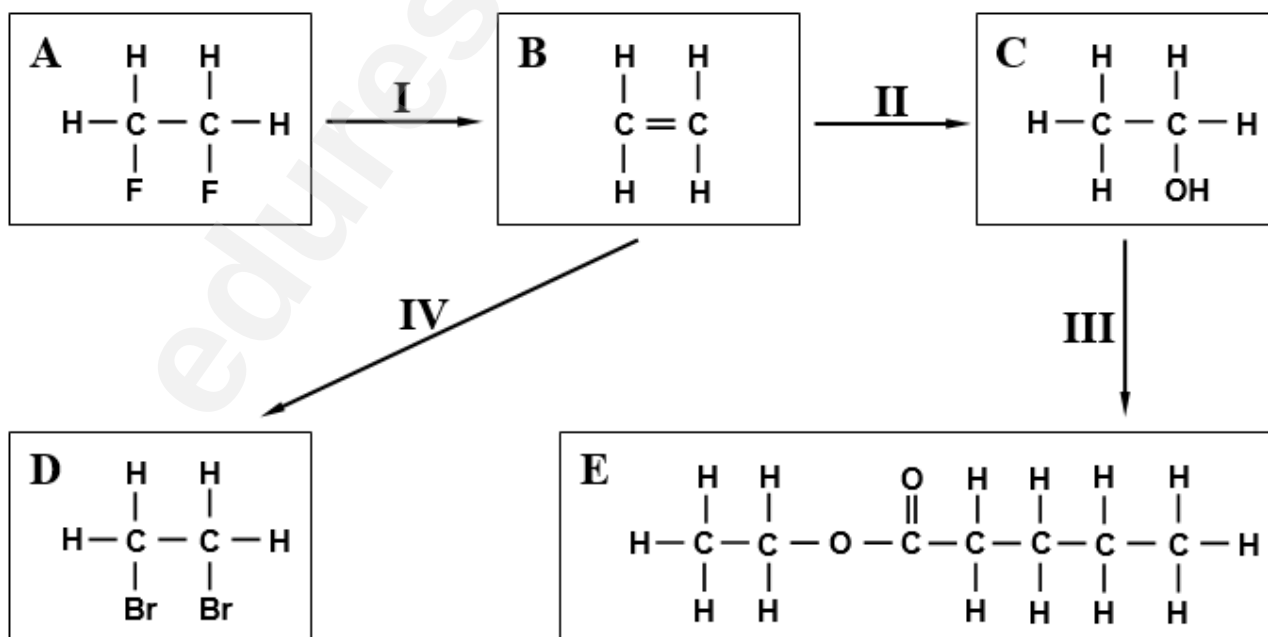
11.3 The table below shows the boiling points of five alkanes.

Alkane	Boiling point (°C)
Methane	-162
Ethane	-89
Propane	-42
Butane	0
Pentane	36

11.3.1 Name the intermolecular force that exists between alkane molecules. (1)

11.3.2 Briefly explain why methane has a much lower boiling point compared to pentane. (2)

11.4 Study the various reaction pathways shown below and answer the questions that follow:



- 11.4.1 To which homologous series does organic compound **A** belong? (1)
- 11.4.2 What type of reaction is represented by reaction **I**? (1)
- 11.4.3 Name the reactant that needs to be added to **B** to complete reaction **II**. (1)
- 11.4.4 Name TWO substances that must be added to **C** in order to produce The product in reaction **III**. (2)
- 11.4.5 Draw and name a structural isomer of organic molecule **E** that is found in a different homologous series. (3)
- 11.4.6 What would you observe when bromine liquid (Br_2) liquid is added to **B** in reaction **IV**. (1)

[20]**TOTAL: 200 MARKS**

EXAMINATION DATA SHEET FOR THE PHYSICAL SCIENCES (CHEMISTRY)

TABLE 1 PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Magnitude of charge on electron	e	$1,6 \times 10^{-19} \text{ C}$
Mass of an electron	m_e	$9,1 \times 10^{-31} \text{ kg}$
Standard pressure	p^θ	$1,01 \times 10^5 \text{ Pa}$
Molar gas volume at STP	V_m	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$
Standard temperature	T^θ	273 K
Avogadro's constant	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
Faraday's constant	F	$96\,500 \text{ C} \cdot \text{mol}^{-1}$

TABLE 2 CHEMISTRY FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$	$n = \frac{V}{V_m}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14} \text{ at } 298 \text{ K}$	
$Q = It$	$E_{\text{cell}}^\theta = E_{\text{cathode}}^\theta - E_{\text{anode}}^\theta$ $E_{\text{cell}}^\theta = E_{\text{oxidising agent}}^\theta - E_{\text{reducing agent}}^\theta$	

PERIODIC TABLE

		Key																							
		I	II																	III	IV	V	VI	VII	0
		Atomic number (Z)																							

TABLE 4B STANDARD ELECTRODE POTENTIALS

Increasing oxidising ability	Half –reaction		E°/ volt	Increasing reducing ability
	$\text{Li}^+ + \text{e}^-$	$\rightleftharpoons$	Li	-3.05
	$\text{K}^+ + \text{e}^-$	$\rightleftharpoons$	K	-2.93
	$\text{Cs}^+ + \text{e}^-$	$\rightleftharpoons$	Cs	-2.92
	$\text{Ba}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Ba	-2.90
	$\text{Sr}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Sr	-2.89
	$\text{Ca}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Ca	-2.87
	$\text{Na}^+ + \text{e}^-$	$\rightleftharpoons$	Na	-2.71
	$\text{Mg}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Mg	-2.37
	$\text{Al}^{3+} + 3\text{e}^-$	$\rightleftharpoons$	Al	-1.66
	$\text{Mn}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Mn	-1.18
	$2\text{H}_2\text{O} + 2\text{e}^-$	$\rightleftharpoons$	$\text{H}_2(\text{g}) + 2\text{OH}^-$	-0.83
	$\text{Zn}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Zn	-0.76
	$\text{Cr}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Cr	-0.74
	$\text{Fe}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Fe	-0.44
	$\text{Cd}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Cd	-0.40
	$\text{Co}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Co	-0.28
	$\text{Ni}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Ni	-0.25
	$\text{Sn}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Sn	-0.14
	$\text{Pb}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Pb	-0.13
	$\text{Fe}^{3+} + 3\text{e}^-$	$\rightleftharpoons$	Fe	-0.04
	$2\text{H}^+ + 2\text{e}^-$	$\rightleftharpoons$	$\text{H}_2(\text{g})$	0.00
	$\text{S} + 2\text{H}^+ + 2\text{e}^-$	$\rightleftharpoons$	$\text{H}_2\text{S}(\text{g})$	+0.14
	$\text{Sn}^{4+} + 2\text{e}^-$	$\rightleftharpoons$	Sn^{2+}	+0.15
	$\text{Cu}^{2+} + \text{e}^-$	$\rightleftharpoons$	Cu^+	+0.16
	$\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^-$	$\rightleftharpoons$	$\text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$	+0.17
	$\text{Cu}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Cu	+0.34
	$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$	$\rightleftharpoons$	4OH^-	+0.40
	$\text{SO}_2 + 4\text{H}^+ + 4\text{e}^-$	$\rightleftharpoons$	$\text{S} + 2\text{H}_2\text{O}$	+0.45
	$\text{I}_2 + 2\text{e}^-$	$\rightleftharpoons$	2I^-	+0.54
	$\text{O}_2(\text{g}) + 2\text{H}^+ + \text{e}^-$	$\rightleftharpoons$	H_2O_2	+0.68
	$\text{Fe}^{3+} + \text{e}^-$	$\rightleftharpoons$	Fe^{2+}	+0.77
	$\text{Hg}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Hg	+0.79
	$\text{NO}_3^- + 2\text{H}^+ + \text{e}^-$	$\rightleftharpoons$	$\text{NO}_2(\text{g}) + \text{H}_2\text{O}$	+0.80
	$\text{Ag}^+ + \text{e}^-$	$\rightleftharpoons$	Ag	+0.80
	$\text{NO}_3^- + 4\text{H}^+ + 3\text{e}^-$	$\rightleftharpoons$	$\text{NO}(\text{g}) + 2\text{H}_2\text{O}$	+0.96
	$\text{Br}_2 + 2\text{e}^-$	$\rightleftharpoons$	2Br^-	+1.09
	$\text{Pt}^{2+} + 2\text{e}^-$	$\rightleftharpoons$	Pt	+1.20
	$\text{MnO}_2 + 4\text{H}^+ + 2\text{e}^-$	$\rightleftharpoons$	$\text{Mn}^{2+} + 2\text{H}_2\text{O}$	+1.21
	$\text{O}_2 + 4\text{H}^+ + 4\text{e}^-$	$\rightleftharpoons$	$2\text{H}_2\text{O}$	+1.23
	$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^-$	$\rightleftharpoons$	$2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+1.33
	$\text{Cl}_2 + 2\text{e}^-$	$\rightleftharpoons$	2Cl^-	+1.36
	$\text{Au}^{3+} + 3\text{e}^-$	$\rightleftharpoons$	Au	+1.42
	$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^-$	$\rightleftharpoons$	$\text{Mn}^{2+} + 4\text{H}_2\text{O}$	+1.51
	$\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^-$	$\rightleftharpoons$	$2\text{H}_2\text{O}$	+1.77
	$\text{F}_2(\text{g}) + 2\text{e}^-$	$\rightleftharpoons$	2F^-	+2.87