PART 2 (60 marks = % of paper)

Answer ALL questions in Part 2 in the spaces provided below.

---

1. Write equations for any reactions that occur in the following procedures. If no reaction occurs write 'no reaction'.

   In each case describe **in full** what you would observe, including any
   - colours
   - odours
   - precipitates (give the colour)
   - gases evolved (give the colour or describe as colourless).

   If no change is observed, you should state this.

(a)

Equation _____

Observation

_____

_____

_____

[3 marks]

(b)

Equation _____

Observation

_____

_____

_____

[3 marks]

(c)

Equation _____

Observation

_____

_____

_____

[3 marks]

2. For each species listed in the table below draw the structural formula, represent all valence electrons using an appropriate symbol, and indicate the shape of the species by either a sketch or a name.

Species	**Structural formula** (showing all valance electrons)	**Shape** (sketch or name)

[6 marks]

3. The electron configuration of a lithium atom is $1s^2\ 2s^1$. Using the same notation, give the electron configuration of

a) _____

b) _____

[2 marks]

[6 marks]

10. Using carefully drawn diagrams, thoroughly explain the difference in shape and polarity between BF_3 molecules and PF_3 molecules.

.....
.....

.....
.....

.....
.....

.....
.....

12. Explain the difference between the terms "electronegativity" and "ionisation energy".

.....
...

.....
....

.....
...
.
.....
....

.....
....

……
……

Species	Electron dot diagram	Shape (sketch or name)
BF_3		
CS_2		

PCl_4^+		

How would you conduct a chemical test to distinguish between

sodium hydroxide and barium hydroxide
iron oxide and aluminium oxide
sodium oxide and sodium sulfide

Use the information given below to identify the elements X and Y. Justify your choices.

The oxides have formulae of XO and YO_2.
XO is a solid which dissolves in water producing a basic solution.
YO_2 is a colourless, odourless gas which dissolves in water producing an acidic solution.
The element X is the third member of its group in the periodic table.

[3 marks]

_____

_____

(d) A solution of ammonium nitrate is added to a solution of potassium hydroxide.

Equation : .....

Observation : .....

.....
.....

9. Both aluminium metal and aluminium hydroxide are amphoteric.
Explain what is meant by the term “amphoteric” and write balanced equations which illustrate the amphoteric nature of either one.

.....
.....

.....
.....

.....

.....
..

SHORT ANSWER

Question 5

(a) Consider the following reaction:

$$3Cl_{2(g)} + 6NaOH_{(aq)} \rightarrow 5NaCl_{(aq)} + NaClO_{3(aq)} + 3H_2O$$

[4 marks]

What is the oxidation state of

(i) Cl in $Cl_{2(g)}$ .....

(ii) Cl in $NaCl_{(aq)}$ .....

(iii) Cl in $NaClO_{3(aq)}$ .....

(iv) Explain why the above reaction is classified as a disproportionation reaction.

_____

_____

_____

_____

_____

_____

_____

_____

(b) $SO_{2(g)}$ is bubbled into an aqueous solution containing $Fe^{3+}_{(aq)}$ ions. Write half-equations and a balanced overall equation for the chemical changes occurring.

Name the oxidising agent and the reducing agent. **[4 marks]**

_____

_____

_____

_____

_____

_____

(c) Copper metal is placed in a solution of lead nitrate.

Equation : .....

Observation : .....

.....
..

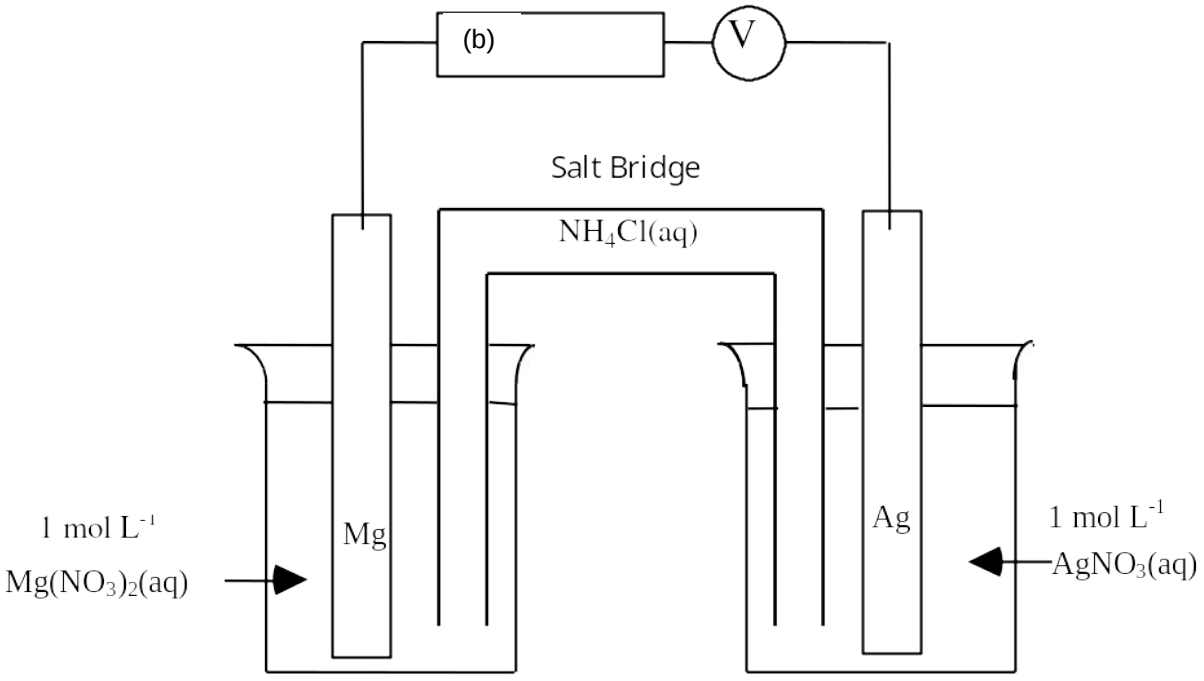
[3 marks]

4. Write an equation for the reaction which occurs at the cathode of a lead-acid accumulator when it is supplying an electric current.

Equation : .....

[2 marks]

5. Below is a diagram of an electrochemical cell.



(a) Write a half equation to show the reaction at the **anode** of the cell.

.....

[2 marks]

(b) Draw an arrow **in the box** provided on the diagram to indicate the flow of electrons in the external circuit. [1 mark]

(c) Give the formula of one ion that will move from the Mg/Mg^{2+} half cell towards the Ag/Ag^{+} half cell through the salt bridge.

..... [1 mark]

(d) Under standard conditions, what would be the maximum reading on the voltmeter in the external circuit?

.....volts [2 marks]

(e) Several connected strips of magnesium and silver are used in the half-cells instead of just one strip. What would be the specific advantage of this cell over the one shown above?

Answer : .....

..... [2 marks]

[6 marks]

11. Consider the electrolysis of molten potassium iodide and 1.0 mol L^{-1} potassium iodide solution. Write the equations for the anode and cathode reactions in each case.

(a)

KI(l)

Anode:

Cathode:

(b)

KI(aq)

Anode:

Cathode:

[4 marks]

(d) Nickel pellets are dropped into a warm solution of chromium(III) nitrate.

EQUATION:

_____

OBSERVATION:

_____

[2 marks]

1. Three experiments were performed by passing electricity through different electrolytes using different electrodes. The electrolytes and electrodes used are shown in the table below. Complete the table by writing the **oxidation and reduction half equations** which are most likely to occur at the anode and cathode.

Expt No.	Electrolyte	Electrodes	Half-reactions at:	
			cathode	**anode**
1	1 mol L^{-1} $CuSO_4(aq)$	carbon		
2	KBr(l)	platinum		
3	A mixture of 1 mol L^{-1} $AgNO_3(aq)$ and 1 mol L^{-1} $Cd(NO_3)_2(aq)$	platinum		

4.

5.

6.

[4 marks]

7.

[4 marks]

[4 marks]

[4 marks]

8.

[2 marks]

9.

[4 marks]

[3 marks]

11.

12.

13.

[6 marks]