

UNIT 2 — NOVEMBER EXAM

CHEMISTRY

Written test 2

ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks	Suggested times (minutes)
A	20	20	20	20
B	10	10	64	70
			Total 84	90

Section A

- | | | | | |
|------|------|-------|-------|-------|
| 1. B | 5. C | 9. B | 13. D | 17. A |
| 2. A | 6. A | 10. A | 14. B | 18. C |
| 3. A | 7. B | 11. B | 15. B | 19. C |
| 4. D | 8. C | 12. A | 16. C | 20. D |

Section B

Question 1.

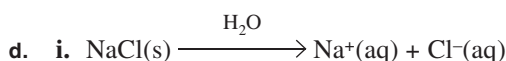
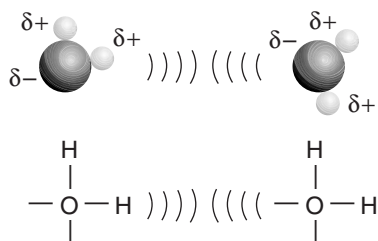
- $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^{-}(\text{aq}) \longrightarrow \text{Mg}(\text{OH})_2(\text{s})$
- $\text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \longrightarrow \text{CaCO}_3(\text{s})$
- $\text{Cl}_2(\text{g}) + 2\text{e}^{-} \longrightarrow 2\text{Cl}^{-}(\text{aq})$
 $\text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{HClO}(\text{aq}) + 2\text{e}^{-} + 2\text{H}^{+}(\text{aq})$
- $2\text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{HClO}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) + 2\text{H}^{+}(\text{aq})$
- $\text{Cl}_2(\text{g})$

6 marks

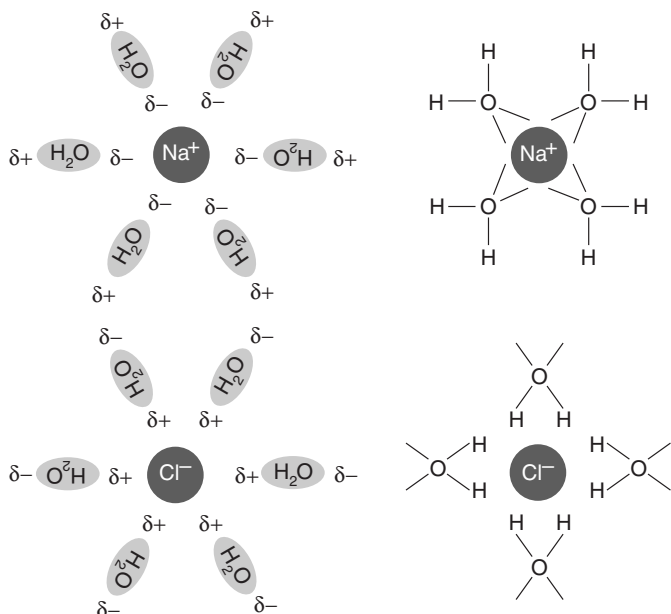
Question 2.

- a. Covalent bonding, hydrogen bonding and dispersion forces
- b. These molecules do not show hydrogen bonding. As the molar mass increases, the strength of the dispersion forces between the molecules increases.

- c. Two possible representations:



ii.



- e. Only water is volatile; sodium chloride remains as an ionic salt after evaporation

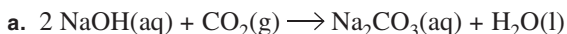
7 marks

Question 3.

- a. $\text{Mg(OH)}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{MgSO}_4(\text{aq}) + 2\text{H}_2\text{O(l)}$
- b. $\text{Li}_2\text{CO}_3(\text{aq}) + 2\text{HCl}(\text{aq}) \longrightarrow 2\text{LiCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O(l)}$
- c. $\text{SO}_3^{2-}(\text{aq}) + \text{H}_2\text{O(l)} \longrightarrow \text{HSO}_3^-(\text{aq}) + \text{OH}^-(\text{aq})$
- d. $\text{HPO}_4^{2-}(\text{aq}) + \text{H}_2\text{O(l)} \longrightarrow \text{H}_2\text{PO}_4^-(\text{aq}) + \text{OH}^-(\text{aq})$
 $\text{HPO}_4^{2-}(\text{aq}) + \text{H}_2\text{O(l)} \longrightarrow \text{PO}_4^{3-}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
- e. $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O(l)} \longrightarrow 2\text{H}_3\text{O}^+(\text{aq}) + \text{PO}_4^{3-}(\text{aq})$

6 marks

Question 4.



2 marks

b. $n(\text{NaOH}) = 5.23 \times 10^{-3} \times 0.1 \text{ mol} \quad (n = cV)$
 $= 5.23 \times 10^{-4} \text{ mol}$
 $n(\text{CO}_2) = \frac{1}{2}n(\text{NaOH})$
 $= \frac{1}{2} \times 5.23 \times 10^{-4} \text{ mol}$
 $m = \frac{1}{2} \times 5.23 \times 10^{-4} \text{ g} \quad (m = nMr)$
 $\% \text{CO}_2 = 2.62 \times 10^{-4} \times 100/0.500$
 $= 0.0523\%$

4 marks

c. $c = \frac{n}{V}$
 $= \frac{2.62}{500}$
 $= 5.23 \times 10^{-3} \text{ mol L}^{-1}$

1 mark

Question 5.

- a. $2\text{O}_3(\text{g}) \longrightarrow 3\text{O}_2(\text{g})$
- b. $\text{Fe}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s}) \longrightarrow \text{Al}_2\text{O}_3(\text{s}) + 2\text{Fe}(\text{s})$
- c. $\text{Zn}(\text{s}) \longrightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
 $\text{HNO}_3(\text{aq}) + \text{H}^+(\text{aq}) + \text{e}^- \longrightarrow \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{aq})$

4 marks

Question 6.

- a. N_2
- b. O_2
- c. $2\text{NO}_2(\text{g}) + \text{H}_2\text{O(l)} \longrightarrow \text{HNO}_2(\text{aq}) + \text{HNO}_3(\text{aq})$
- d. $2\text{HNO}_3(\text{aq}) + \text{CaCO}_3(\text{s}) \longrightarrow \text{Ca(NO}_3)_2(\text{aq}) + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g})$

- e. $PV = nRT$

$$124.8 \times 3.15 = n \times 8.31 \times 300$$

$$n = 0.158$$

$$M = \frac{10.10}{0.158} = 63.9$$

- f. $\text{SO}_2; \text{SO}_2(\text{g}) + \text{H}_2\text{O(l)} \longrightarrow \text{H}_2\text{SO}_3(\text{aq})$

8 marks

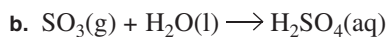
Question 7.

- a. $2\text{C}_8\text{H}_{18}(\text{g}) + 25\text{O}_2(\text{g}) \longrightarrow 16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O(g)}$
 $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g}) \longrightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O(l)}$
- b. Thistle funnel, conical flask, stopper, gas tube, pneumatic trough, gas jar
- c. $2\text{HCl}(\text{aq}) + \text{CaCO}_3(\text{s}) \longrightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g})$
- d. Dry ice, fire extinguishers, preservative
- e. Photosynthesis:
 $6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O(l)} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g})$

8 marks

Question 8.

a. $V_{\text{SO}_2} = V_{\text{SO}_3} = 2.50 \text{ L}$



$$n(\text{H}_2\text{SO}_4) = (n\text{SO}_3)$$

$$n = \frac{2.5}{24.5} = 0.102$$

$$c = \frac{0.102}{0.025} = 4.08 \text{ mol L}^{-1}$$

$$[\text{H}^+] = 2 \times 4.08$$

$$= 8.16 \text{ mol L}^{-1}$$

$$\text{pH} = -\log(8.16)$$

$$= -0.91$$

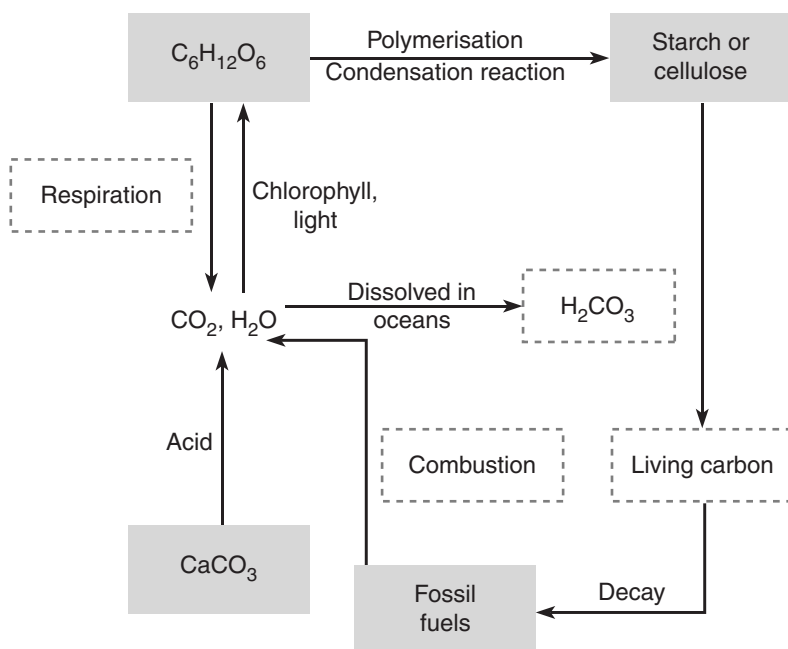
c. $[\text{H}^+] = \frac{10^{-14}}{[\text{OH}^-]}$

$$[\text{H}^+] = \frac{10^{-14}}{0.001 \text{ mol L}^{-1}}$$

$$\text{pH} = -\log(10^{-11})$$

$$\text{pH} = 11$$

7 marks

Question 9.


7 marks

Question 10.

- Nitrogen
- Noble gases
- CO_2
- O_3

4 marks

End of Section B