**Raffles Institution Raffles Programme**
**Year Four Chemistry**

Name: _____ (  ) Class: _____ Date: _____

**2022 FE Revision – Formulae, Stoichiometry and Mole Concept  Answers**

1

| | | | |
|---|---|---|---|
| a. magnesium nitrate | **$Mg(NO_3)_2$** | g. ammonium sulfate | **$(NH_4)_2SO_4$** |
| b. copper(II) carbonate | **$CuCO_3$** | h. ammonia | **$NH_3$** |
| c. iron(III) sulfate | **$Fe_2(SO_4)_3$** | i. sulfur dioxide | **$SO_2$** |
| d. sodium oxide | **$Na_2O$** | j. propene | **$C_3H_6$** |
| e. calcium hydroxide | **$Ca(OH)_2$** | k. ethanol | **$C_2H_5OH$** |
| f. potassium manganate(VII) | **$KMnO_4$** | l. ethanoic acid | **$CH_3COOH$** |

2 The relative molecular mass, $M_r$, of a molecular substance is the average mass of one **molecule** compared with **one-twelfth** of the mass of an atom of carbon-12.
1 mol of a substance contains **$6 \times 10^{23}$** particles.
1 mol of any **gas** occupies **$24\ dm^3$** at room temperature and pressure.

| | | |
|---|---|---|
| 1.0 mol of ammonia, $NH_3$ (molecular compound) | contains | • $6 \times 10^{23} \times 1.0$ = $6 \times 10^{23}$ $NH_3$ molecules<br>• **$6 \times 10^{23}$** N atoms<br>• **$6 \times 10^{23} \times 3 = 1.8 \times 10^{24}$** H atoms |
| 0.5 mol of ammonium sulfate, $(NH_4)_2SO_4$ (ionic compound) | contains | • $6 \times 10^{23} \times 0.5$ = $3 \times 10^{23}$ $(NH_4)_2SO_4$ formula units<br>• **$3 \times 10^{23} \times 2$** **= $6 \times 10^{23}$** $NH_4^+$ ions<br>• **$3 \times 10^{23}$** $SO_4^{2-}$ ions |

**Practice Questions**

1 D  2 C  3 A  4 A  5 A  6 D

7 (a)(i) to absorb water vapour  (ii) nitrogen
(b) 3.50 g  (c) 11.00 g  (d) 85.7%
(e) $CH_2$  (f) $C_3H_6$

8 (a) 0.400 mol $dm^{-3}$ (3sf)  (b)(i) 0.100 mol $dm^{-3}$ (3sf)
(ii) 20.5 $cm^3$ (3sf)  (iii) 19.5 $cm^3$ (3sf)

9 (a) $2HCl\ (aq) + CaCO_3\ (s) \rightarrow CaCl_2\ (aq) + CO_2\ (g) + H_2O\ (l)$
(b) 0.00365 mol
(c) 0.300 mol $dm^{-3}$ (3sf)

10 (a) $CO_2\ (g) + 2NaOH\ (aq) \rightarrow Na_2CO_3\ (aq) + H_2O\ (l)$
(b) 0.0284 mol (3sf)
(c) 0.0108 mol (3sf)
(d) 95.0%
(e)(i) $N_2 + 3H_2 \rightarrow 2NH_3$

(ii) amount of $NH_3 = \frac{0.0180}{14+1+1+1} = 0.001059$ mol

amount of $N_2 = 0.001059 \times 0.5 = 0.000529$ mol

% by mass of $N_2 = \frac{0.000529 \times (14 \times 2)}{0.500} \times 100\% = 2.96\%$ (3sf)