Year Ten PCS – Practice test on Chemistry

ANSWERS

1. What is the mass percent of each element in dichloromethane, CH2Cl2?

   a. 10.06% C, 60.24% H, 29.70% Cl
   b. 20.00% C, 20.00% H, 60.00% Cl
   c. 24.10% C, 3.11% H, 72.79% Cl
   d. 33.87% C, 0.22% H, 65.91% Cl
   e. 14.14% C, 2.37% H, 83.48% Cl

   $\%C = \frac{\text{no. of C} \times \text{mass of C}}{MM} = \frac{1 \times 12}{85} = 0.1414$

   (1 mark)

2. If 1.00 g (m) of an unknown molecular compound is equivalent to 0.0139 moles (n) of that compound. Calculate the molar mass of the compound.

   a. 44.0 g/mol
   b. 66.4 g/mol
   c. 72.1 g/mol
   d. 98.1 g/mol
   e. 132 g/mol

   $n = \frac{m}{MM}$ & $0.0139 = \frac{1}{MM}$

   $MM = \frac{1}{0.0139} = 71.9$

   (1 mark)

3. Identify the compound which would have a molar mass of 52 g.

   a. $Ca(OH)_2$ – MM = 74.1
   b. BaO – too high (Ba)
   c. $(NH_4)_2O$ — $2 \times N + 8 \times H + 1 \times O$, $28 + 8 + 16 = 52$
   d. $Al_2(SO_4)_3$ (too high)

   (1 mark)

4. Aluminium reacts with oxygen to produce aluminium oxide.

   $$4\ Al_{(s)} + 3\ O_{2(g)} \rightarrow 2\ Al_2O_{3(s)}$$

   If 5.0 moles of Al react with excess O_2, how many moles of Al_2O_3 can be formed?

   a. 2 mol
   b. 2.5 mol
   c. 5.0 mol
   d. 10.0 mol

   $5 \times \frac{2}{4} = 2.5$ (this step)

   (1 mark)

5. Calculate the mass of hydrogen formed when 25 grams of aluminium reacts with excess hydrochloric acid.

   $$2Al + 6HCl \longrightarrow Al_2Cl_6 + 3H_2$$
   (25 g) (? g)

   a. 0.41 g
   b. 1.2 g
   c. 1.8 g
   d. 2.8 g
   e. 0.92 g

   3 Step ① $n_{Al} = \frac{m}{MM} = \frac{25}{27} = 0.93$ ② $n_{H_2} = \frac{3}{2} \times n_{Al} = 1.39$ ③ $m = n \times MM = 1.39 \times 2 = 2.78$

   (1 mark)

6. What volume of sulfuric acid (0.77 M) contains 25.0 grams of H_2SO_4?
   (V? — Conc M — m — MM)

   $n = \frac{m}{MM} = \frac{25}{98}$ (½)

   $= 0.255$ (½)

   $n = C \times V$

   $\frac{n}{C} = V$ (½)

   $\frac{0.255}{0.77} = V = 0.33\ L$ (or 330 mL) (½)

   (2 marks)

7. How many grams of calcium phosphate can be produced from the reaction of 2.50 L of 0.250 M Calcium chloride with an excess of phosphoric acid?

$$3CaCl_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6HCl$$

2.50L, 0.25M ① → ② → mass? ③

① $n_{CaCl_2} = C \times V$
$= 0.25M \times 2.5L$ (½)
$= 0.625$ moles (½)

② $n_{Ca_3(PO_4)_2} = \frac{1}{3} \times n_{CaCl_2}$ (½)
$= \frac{1}{3} \times 0.625$
$= 0.2083$ (½)

③ $m = n \times MM$
$= 0.2083 \times 310.3$ (½)
$= 64.6\,g$ (½)

(3 marks)

8. Calculate the number of grams of silver sulphide (Ag_2S) produced when 35.5 g of silver nitrite ($AgNO_2$) is reacted with 35.5 grams of sodium sulphide (Na_2S).

$$2AgNO_2 + Na_2S \rightarrow Ag_2S + 2NaNO_2$$

35.5 ①, 35.5 ①, LR? ② ③

① $n_{AgNO_2} = \frac{m}{MM} = \frac{35.5}{153.86} = 0.231$ (½) LR

$n_{Na_2S} = \frac{m}{MM} = \frac{35.5}{78} = 0.455$ (½)

② $n_{Ag_2S} = \frac{1}{2} \times n_{AgNO_2}$ (½)
$= \frac{1}{2} \times 0.231$
$= 0.116$ (½)

③ $m = n \times MM$
$= 0.116 \times 247.8$
$= 28.7\,g$ (½)

L.R calculation

$AgNO_2$: $\frac{0.231}{2} = 0.116$ Na_2S: $\frac{0.455}{1} = 0.455$

LR = $AgNO_2$. (1)

(4 marks)

CHALLENGE Q

In an experiment 1.056 g of a metal carbonate (MCO_3), containing an unknown metal M, is heated to give the metal oxide (MO) and 0.376 g of CO_2.

$$MCO_{3\,(s)} + \text{heat} \rightarrow MO_{(s)} + CO_{2\,(g)}$$

Identity which of the following is the correct identity of the metal (M) in the carbonate (MCO_3)

a. M = Ni b. M = Cu c. M = Zn d. M = Ba

Two ways to do this Q.

- First way is do three steps for each of four options, see which one gives you a mass of CO_2 close to 0.376 g.
- Second way is to calculate moles of CO_2 (8.55×10^{-3}), then moles of MCO_3 (8.55×10^{-3}), then calculate the MM of MCO_3 (123.5), subtract CO_3, mass of metal = 63.5 (B).