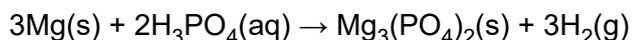


**AS Level Chemistry A**  
**H032/01 Breadth in chemistry**

**Question Set 14**

1. This question is about compounds of magnesium and phosphorus.

(a) A student plans to prepare magnesium phosphate using the redox reaction of magnesium with phosphoric acid,  $\text{H}_3\text{PO}_4$ .



(i) In terms of the number of electrons transferred, explain whether magnesium is being oxidised or reduced. [1]

① a) i) Mg is being oxidised because it loses 2 electrons (oxidation number changes from 0 to +2; oxidation number increases).

(ii) The student plans to add magnesium to  $50.0 \text{ cm}^3$  of  $1.24 \text{ mol dm}^{-3} \text{ H}_3\text{PO}_4$ .

Calculate the mass of magnesium, in g, that the student should add to react exactly with the phosphoric acid.

Give your answer to **three** significant figures. [3]

ii) moles of  $\text{H}_3\text{PO}_4 = 0.05 \times 1.24 = 0.062$

$$\text{moles of Mg} = 0.062 \times \frac{3}{2} = 0.093$$

$$\text{mass of Mg} = n \times M_r = 0.093 \times 24.3 = 2.26 \text{ g}$$

(iii) How could the student obtain a sample of magnesium phosphate after reacting magnesium with phosphoric acid? [2]

iii) remove the  $\text{H}_2$  gas from the product mixture

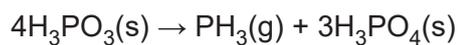
(iv) Magnesium phosphate can also be prepared by reacting phosphoric acid with a compound of magnesium.

Choose a suitable magnesium compound for this preparation and write the equation for the reaction. [2]

Formula of compound .....  $\text{MgCO}_3$  .....



- (d) Phosphine,  $\text{PH}_3$ , is a gas formed by heating phosphorous acid,  $\text{H}_3\text{PO}_3$ , in the absence of air.



- (i)  $3.20 \times 10^{-2}$  mol of  $\text{H}_3\text{PO}_3$  is completely decomposed by this reaction.

Calculate the volume of phosphine gas formed, in  $\text{cm}^3$ , at 100 kPa pressure and  $200^\circ\text{C}$ .

d)i)  $pV = nRT$  [4]

$$V = \frac{nRT}{p}$$

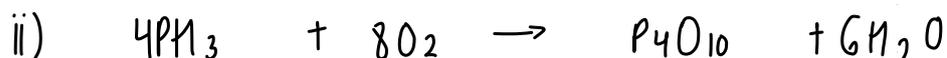
$$V = \frac{(3.2 \times 10^{-2}) \times 8.31 \times 473}{100\,000}$$

$$V = 1.2578 \times 10^{-3} \text{ m}^3$$

$$V = 1258 \text{ cm}^3$$

- (ii) When exposed to air, phosphine spontaneously ignites, forming  $\text{P}_4\text{O}_{10}$  and water. [1]

Construct an equation for this reaction.



**Total Marks for Question Set 14: 13**

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