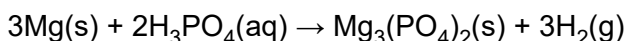


**AS Level Chemistry A**  
**H032/01 Breadth in chemistry**

**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  $\text{H}_3\text{PO}_4 = 0.05 \times 1.24 = 0.062$

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

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

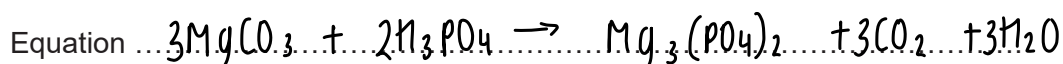
(iii) How could the student obtain a sample of magnesium phosphate after reacting magnesium with phosphoric acid? [2]

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

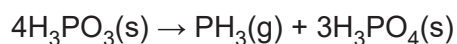
(iv) Magnesium phosphate can also be prepared by reacting phosphoric acid with a compound of magnesium.

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.

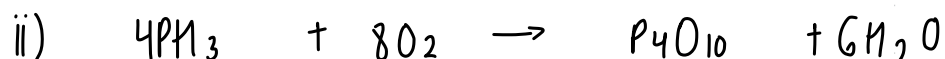
Calculate the volume of phosphine gas formed, in  $\text{cm}^3$ , at 100 kPa pressure and  $200^\circ\text{C}$ .

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**

---

# OCR

Oxford Cambridge and RSA

## **Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge