Mark schemes

Q1.

(a) $P_4 + 5\ O_2 \rightarrow P_4O_{10}$

Allow 4 P + 5 $O_2 \rightarrow P_4O_{10}$

1

(b) $SO_2 + H_2O \rightarrow H_2SO_3$

Or

$SO_2 + H_2O \rightarrow 2\ H^+ + SO_3^{2-}$

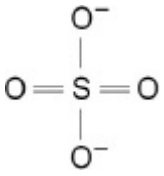
Or

$SO_2 + H_2O \rightarrow H^+ + HSO_3^-$

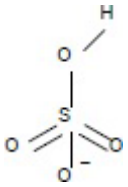
Do not accept H_2SO_4

1

(c)



Allow



1

(d) **M1** $Mg + H_2O \rightarrow MgO + H_2$

M2 White solid/white powder

OR (Bright) white light/white flame

Do not accept white ppt

Do not accept effervescence

2

(e) $3\ MgO + 2\ H_3PO_4 \rightarrow Mg_3(PO_4)_2 + 3\ H_2O$

Allow

3 MgO + 2 $H_3PO_4 \rightarrow 3\ Mg^{2+} + 2\ PO_4^{3-} + 3\ H_2O$

1

[6]

Q2.

(a) forms a solution with pH = 14 at 25°C

auto

1

(b) $Al_2O_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2O$

allow multiples

ignore state symbols

1

(c) universal indicator

1

SO_2(aq) orange-red

1

SO_3(aq) red

1

allow correct comparison of acidic colours (red, orange, yellow)

or

pH meter

SO_2(aq) pH 2-3

SO_3(aq) pH 0-1

allow correct comparison of acidic pH ignoring values

or

any named metal carbonate (**or** formula) **or** Mg **or** Ca **or** Zn

SO_2(aq) slower effervescence

SO_3(aq) faster effervescence

if reagent is incomplete lose M1 and mark on

allow observation

allow correct comparison

allow named oxidising agent

*eg (acidified) $KMnO_4$ **or** (acidified) $K_2Cr_2O_7$*

SO_2(aq) correct colour acidified change

*SO_3(aq) no visible change **or** NVC*

allow (acidified) barium chloride solution

***or** allow (acidified) barium chloride solution*

*SO_2(aq) no visible change **or** NVC*

SO_3(aq) white precipitate

(d) $^{31}P_4^+$

Allow P_4^+ = 1 mark

Allow ^{31}P = 1 mark

2

(e) $P_4O_{10} + 12\ NaOH \rightarrow 4\ Na_3PO_4 + 6\ H_2O$

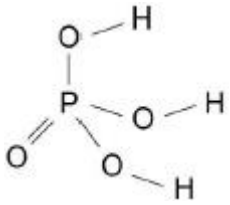
allow formation of acid salts

$P_4O_{10} + 4\ NaOH + 2\ H_2O \rightarrow 4\ NaH_2PO_4$

$P_4O_{10} + 8\ NaOH \rightarrow 4\ Na_2HPO_4 + 2\ H_2O$

1

(f)



must show all bonds

1

(g) This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.

Level 3 **5-6 marks**	All stages are covered and the description of each stage is generally correct and virtually complete. Answer is communicated coherently and shows a logical progression from stage 1 to stage 2 and stage 3.
Level 2 **3-4 marks**	All stages are covered but the description of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete. Answer is mainly coherent and shows progression from stage 1 to stage 2 and/or stage 3.
Level 1 **1-2 marks**	Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR only one stage is covered but is generally correct and virtually complete. Answer includes isolated statements and these are presented in a logical order.
0 marks	Insufficient correct chemistry to gain a mark.

indicative chemistry content

contradictions negate statements

<u>Stage 1 **structure**</u>

1a NaCl ionic lattice **or** giant ionic

1b Cl_2 **and** HCl molecular (covalent)
or
Cl_2 **and** HCl (simple) molecules

Stage 2 **forces responsible for melting point**

2a NaCl attractions between + and – ions

2b Cl_2 vdw forces

2c HCl dipole dipole forces

Stage 3 **comparison of melting point**

3a ionic bonds stronger than IMF

3b chlorine/Cl_2 is a bigger (molecule) than HCl
or
chlorine/Cl_2 has more electrons than HCl

3c more/stronger forces between molecules in Cl_2 than those in HCl
or
more/stronger IMF in Cl_2 than those in HCl
or
vdw between molecules in Cl_2 > dipole dipole between molecules in HCl

[15]