EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

Time allowed
60 Minutes

Score /50

Percentage %

CHEMISTRY

AQA
AS & A LEVEL

Mark Scheme

3.2 Inorganic chemistry

1 (a) White powder / solid / ash / smoke

Ignore ppt / fumes

1

Bright / white light / flame

Allow glows white / glows bright

1

$Mg + H_2O \rightarrow MgO + H_2$

Ignore state symbols

Ignore reference to effervescence or gas produced

1

(b) Mg^{2+} / magnesium ion has higher charge than Na^+

Allow Mg^{2+} ions smaller / greater charge density than Na^+ ions

Allow Mg atoms smaller than Na (atoms)

Allow magnesium has more delocalised electrons

Must be a comparison

Ignore reference to nuclear charge

1

Attracts delocalised / free / sea of electrons more strongly / metal–metal bonding stronger / metallic bonding stronger

Wrong type of bonding (vdW, imf), mention of molecules CE = 0

1

(c) **Structure:** Macromolecular / giant molecule / giant covalent

Mark independently

1

Bonding: Covalent / giant covalent

1

Physical Properties:

Any **two** from: Hard/
Brittle / not malleable
Insoluble
Non conductor

Ignore correct chemical properties

Ignore strong, high boiling point, rigid

2

(d) **Formula:** P_4O_{10}

Mention of ionic or metallic, can score M1 only

1

Structure: Molecular

If macromolecular, can score M1 & M3 only

1

Bonding: Covalent / shared electron pair

1

van der Waals' / dipole–dipole forces <u>between molecules</u>

Allow vdW, imf and dipole–dipole imf but do not allow imf alone

1

(e) $SO_2 + H_2O \rightarrow H^+ + HSO_3^-$

Products must be ions

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

Allow two equations showing intermediate formation of H_2SO_3 *that ends up as ions*

Ignore state symbols

Allow multiples

1

(f) $P_4O_{10} + 6MgO \rightarrow 2Mg_3(PO_4)_2$

OR $P_4O_{10} + 6MgO \rightarrow 6Mg^{2+} + {}_4PO_4^{3-}$

OR $P_2O_5 + 3MgO \rightarrow Mg_3(PO_4)_2$ etc

Ignore state symbols

Allow multiples

1

[15]

2 (a) MgO is ionic

If not ionic, CE = 0

1

Melt it

If solution mentioned, cannot score M2 or M3

1

(Molten oxide) conducts electricity

Allow acts as an electrolyte.

Cannot score M3 unless M2 is correct.

1

(b) Macromolecular

CE = 0 if ionic, metallic or molecular.

Allow giant molecule.

1

Covalent bonding

Giant covalent scores M1 and M2

1

Water cannot (supply enough energy to) break the covalent bonds / lattice

Hydration enthalpy < bond enthalpy.

1

(c) (Phosphorus pentoxide's melting point is) lower

If M1 is incorrect, can only score M2

1

Molecular with covalent bonding

M2 can be awarded if molecular mentioned in M3

1

Weak / easily broken / not much energy to break intermolecular forces
OR weak vdW / dipole-dipole forces of attraction between molecules

Intermolecular / IMF means same as between molecules.

1

(d) Reagent (water or acid)

Can be awarded in the equation.

1

Equation eg $MgO + 2HCl \rightarrow MgCl_2 + H_2O$

$MgO + H_2O \rightarrow Mg(OH)_2$

Equations can be ionic but must show all of the reagent eg H^+ + Cl^-

Simplified ionic equation without full reagent can score M2 only.

Allow $6MgO + P_4O_{10} \rightarrow 2Mg_3(PO_4)_2$

1

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

Allow P_2O_5 and acid salts.

Must be NaOH not just hydroxide ions.

1

[12]

3 (a) The number of protons increases (across the period) / nuclear charge increases

1

Therefore, the attraction between the nucleus and electrons increases

Can only score M2 if M1 is correct

1

(b) S_8 molecules are bigger than P_4 molecules

Allow sulfur molecules have bigger surface area and sulfur molecules have bigger M_r

1

Therefore, van der Waals / dispersion / London forces between molecules are stronger in sulfur

1

(c) Sodium oxide contains O^{2-} ions

1

These O^{2-} ions react with water forming OH^- ions

$O^{2-} + H_2O \longrightarrow 2OH^-$ *scores M1 and M2*

1

(d) $P_4O_{10} + 12OH^- \longrightarrow 4PO_4^{3-} + 6H_2O$

1

[7]

4 (a) (i) 1500

1

(ii) Ionic lattice / giant ionic

Mention of vdW / covalent bonding / molecules / atoms / metal etc. CE = 0

1

Strong attraction between oppositely charged ions / Na^+ and O^{2-}
OR
lots of energy required to separate / overcome attraction between oppositely charged ions / Na^+ and O^{2-}

Do not allow incorrect formulae for ions.

1

(iii) 200 (K)

Allow range 10−273 (K)

CE = 0 if temperature >573 K, otherwise mark on

Allow correct answers in °C but units must be given.

1

SO_2 smaller (molecule) (than P_4O_{10}) (or converse)

also SO_2 has lower M_r / less surface area / less polarisable / fewer electrons

penalise SO_3 and P_2O_5 for M2 only

1

vdW forces <u>between molecules</u> are weaker / require less energy to separate molecules

ignore dipole−dipole

If covalent bonds broken lose M2 and M3 but can gain M1

1

(b) $SO_2 + H_2O \rightarrow H_2SO_3 / H^+ + HSO_3^- / 2H^+ + SO_3^{2-}$

can be equilibrium sign instead of arrow

1

1

Allow values between 1−3

mark independently

1

(c) Reacts with / neutralises bases / alkalis

Allow any given base or alkali including OH^-

1

$SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$

Allow $CaO + SiO_2 \rightarrow CaSiO_3$ or equation with any suitable base

M2 can score M1 even if equation unbalanced or incorrect

1

[10]

5 (a) $Mg + H_2O \rightarrow MgO + H_2$

ignore state symbols

1

White solid / powder / ash / smoke

ignore precipitate

ignore fumes

1

(Bright) white light / flame

allow glow

penalise effervescence under list principle

1

(b) $2Na + \frac{1}{2} O_2 \rightarrow Na_2O$ / $4Na + O_2 \rightarrow 2Na_2O$

Allow multiples, ignore state symbols

Allow $2Na + O_2 \rightarrow Na_2O_2$

1

white / yellow solid / ash / smoke

ignore precipitate

ignore fumes

1

orange / yellow flame

1

[6]