



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

2002

XVIII

1583

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

$\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$
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

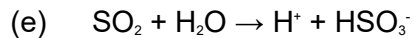
Bonding: Covalent / shared electron pair

1

van der Waals' / dipole–dipole forces between molecules

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

1



Products must be ions

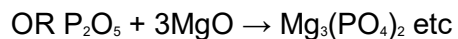
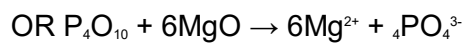
Allow $\text{SO}_2 + \text{H}_2\text{O} \rightarrow 2\text{H}^+ + \text{SO}_3^{2-}$

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

Ignore state symbols

Allow multiples

1



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 $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$

$\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$

Equations can be ionic but must show all of the reagent eg
 $\text{H}^+ +$

Cl^-

Simplified ionic equation without full reagent can score M2 only.

Allow $6\text{MgO} + \text{P}_4\text{O}_{10} \rightarrow 2\text{Mg}_3(\text{PO}_4)_2$

1

(e) $\text{P}_4\text{O}_{10} + 12\text{NaOH} \rightarrow 4\text{Na}_3\text{PO}_4 + 6\text{H}_2\text{O}$

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) S₈ molecules are bigger than P₄ 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 O²⁻ ions

1

These O²⁻ ions react with water forming OH⁻ ions



1

- (d) $\text{P}_4\text{O}_{10} + 12\text{OH}^- \longrightarrow 4\text{PO}_4^{3-} + 6\text{H}_2\text{O}$

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

SO₂ smaller (molecule) (than P₄O₁₀) (or converse)

also SO₂ has lower M_r / less surface area / less polarisable / fewer electrons

penalise SO₃ and P₂O₅ for M2 only

1

vdW forces between molecules 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) SO₂ + H₂O → H₂SO₃ / H⁺ + HSO₃[−] / 2H⁺ + SO₃^{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

SiO₂ + 2NaOH → Na₂SiO₃ + H₂O

Allow CaO + SiO₂ → CaSiO₃ or equation with any suitable base

M2 can score M1 even if equation unbalanced or incorrect

1

[10]

- 5 (a) $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$
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) $2\text{Na} + \frac{1}{2}\text{O}_2 \rightarrow \text{Na}_2\text{O}$ / $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$
Allow multiples, ignore state symbols
Allow $2\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}_2$ 1
- white / yellow solid / ash / smoke
ignore precipitate
ignore fumes 1
- orange / yellow flame 1
- [6]**