

**MARK SCHEME for the May/June 2010 question paper
for the guidance of teachers**

9701 CHEMISTRY

9701/22

Paper 2 (AS Structured Questions), maximum raw mark 60

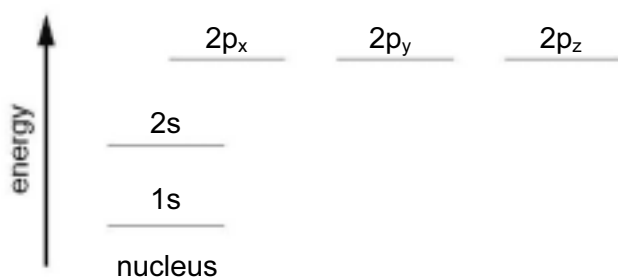
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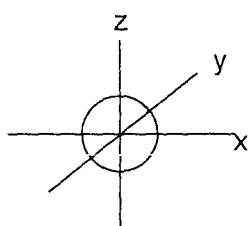
1 (a) (i)



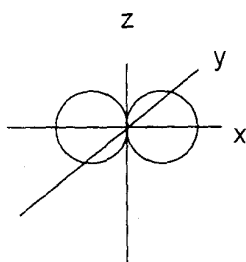
correct 1s and 2s (1)

correct 2p_x, 2p_y and 2p_z (1)

(ii)



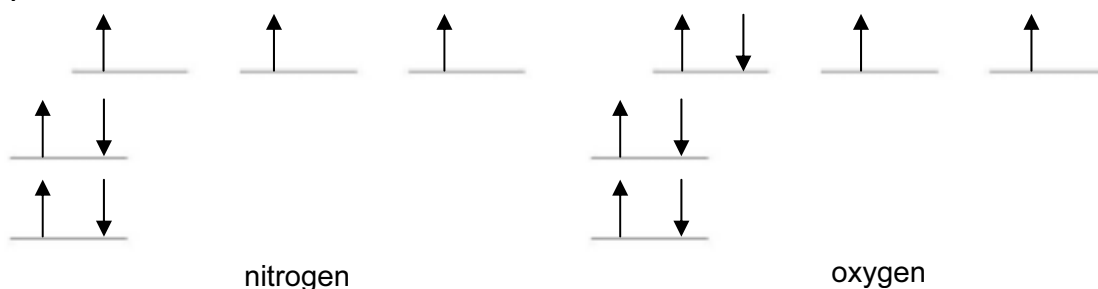
spherical s orbital (1)



double lobed p orbital along one axis (1)

both orbitals correctly labelled (1)

(iii)



nitrogen

oxygen

both correct (1)

[6]

(b) (i) N 1400 kJ mol⁻¹ O 1310 kJ mol⁻¹ **both** (1)

(ii) N is all singly filled 2p orbitals **or** O has one filled/paired 2p orbital (1)
these paired 2p electrons in the O atom repel one another (1)

[3]

[Total: 9]

2 (a)

element	particle	formula
copper	cation	Cu ²⁺ allow Cu ⁺
argon	atom or molecule	Ar

one mark for each correct row **or** column (2 × 1)

[2]

(b) **Cu** cations held in 'sea' of delocalised electrons (1)
by strong metallic bonds (1)

Ar van der Waals' forces between molecules (1)
which are weak (1)

[4]

(c) (i) oxidising agent **or** electron acceptor (1)

Ar has very high first I.E

or E_a for reaction is very high

or Ar has full valency shell/complete octet (1)

[2]

(d) from Ne to Xe more electrons in atom (1)

hence more induced dipoles/van der Waals' forces (1)

[2]

[Total: 10]

Page 4	Mark Scheme: Teachers' version	Syllabus
	GCE AS/A LEVEL – May/June 2010	9701

3 (a)

oxide	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	P ₄ O ₆	S
bonding	ionic	ionic	ionic/covalent	covalent	covalent	covalent
structure	giant	giant	giant	giant	simple	simple

(i) fully correct 'bonding' row (1)

(ii) fully correct 'structure' row (1) [2]

(b) Al₂O₃ or SiO₂ (1) [1]

(c) (i) Na₂O Na₂O + H₂O → 2NaOH (1)
 pH 10–14 (1)

 SO₂ SO₂ + H₂O → H₂SO₃ (1)
 pH 2–5 (1)

(ii) NaOH + H₂SO₃ → NaHSO₃ + H₂O
 or 2NaOH + H₂SO₃ → Na₂SO₃ + 2H₂O (1) [5]

(d) MgO(l) conducts (1)
 MgO(l) contains free/mobile ions (1)
 SiO₂(l) does not conduct (1)
 SiO₂(l) has no free ions (1) [4]

[Total: 12]

Page 5	Mark Scheme: Teachers' version	Syllabus
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4 (a) $C : H : O = \frac{48.7}{12} : \frac{8.1}{1} : \frac{43.2}{16}$ (1)
 $= 4.06 : 8.1 : 2.70$
 $= 1.5 : 3 : 1$
 $= 3 : 6 : 2$

empirical formula is $C_3H_6O_2$ (1)

[2]

(b) (i) $M_r = \frac{mRT}{pV} = \frac{0.13 \times 8.31 \times 400}{1.00 \times 10^5 \times 58.0 \times 10^{-6}}$ (1)

$= 74.5$ (1)

(ii) $C_3H_6O_2 = 36 + 6 + 32 = 74$ (1)

$n(C_3H_6O_2) = 74.5$

hence molecular formula of **E** is $C_3H_6O_2$ (1)

[4]

(c) structures of **F** are

$HCO_2CH(CH_3)_2$	$HCO_2CH_2CH_2CH_3$	$CH_3CO_2CH_2CH_3$	$CH_3CH_2CO_2CH_3$
S	T	U	V

each correct structure is worth one mark (3×1)

[3]

(d) (i) H_2SO_4/HCl /mineral acid **or** $NaOH/KOH$ (1)

(ii) carboxylic acid **not** 'acid' (1)

[2]

(e) (i) aldehyde (1)

(ii) must be a primary alcohol (1)

(iii) CH_3OH **or** CH_3CH_2OH **or** $CH_3CH_2CH_2OH$ (1)

[3]

(f) (i) **S** (1)

(ii) only **S** is **not** the ester of a primary alcohol
or only **S** is the ester of a secondary alcohol (1)

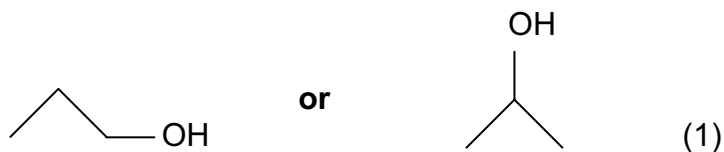
[2]

[Total: 16]

Page 6	Mark Scheme: Teachers' version	Syllabus
	GCE AS/A LEVEL – May/June 2010	9701

5 (a) (i) propan-1-ol or propan-2-ol (1)

(ii)



(iii) dehydration or elimination (1)

[3]

(b) (i) carbon (1)

by decomposition/cracking of the alcohol (1)

(ii) to avoid 'sucking back' of water into the hot tube (1)

(iii) SiO₂ (1)

(iv) conc. H₂SO₄ or P₄O₁₀ or Al₂O₃ or H₃PO₄ (1)

[5]

(c) (i) CH₃CHBrCH₂Br (1)

(ii) CH₃CH(OH)CH₂OH (1)

(iii) CH₃CO₂H (1)

[3]

(d) (i) (very) high pressure or Ziegler-Natta catalyst (1)

(ii) does not biodegrade or gives harmful combustion products (1)

[2]

[Total: 13]