

b.  $m(\text{C}) = 0.800 \text{ g}$

$$m(\text{H}) = n \times M = \frac{N}{N_A} \times M = \frac{8.03 \times 10^{22}}{6.02 \times 10^{23}} \times 1.0 = 0.133 \text{ g}$$

$$m(\text{O}) = n \times M = 0.0666 \times 16.0 = 1.066 \text{ g}$$

$$n(\text{C}) : n(\text{H}) : n(\text{O}) = \frac{0.800}{12.0} : \frac{0.133}{1.0} : \frac{1.066}{16.0}$$

$$= 0.0667 : 0.133 : 0.0666 = 1 : 2 : 1$$

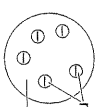
The empirical formula is  $\text{CH}_2\text{O}$ .

1 mark

Total 7 marks

### Question 6

- a.



sphere of positively charged matter

- b.

- Any one of:
- They both contained small, negatively charged particles (electrons).
  - They both contained positive charge that varied from one element to another.
  - The total positive charge equalled the total negative charge.
  - Any other suitable answer.

1 mark

- c.

- Any one of:
- The current model includes neutrons. These were absent from Bohr's model.
  - The current model includes sub-shells in addition to the shells found in Bohr's model.
  - The current model includes orbitals, rather than the orbits found in Bohr's model.
  - Any other suitable answer.

1 mark

Total 3 marks

### Question 7

- a.
- The energy required to create a new unit of surface area. 1 mark
  - Platinum has strong metallic bonding. Breaking these bonds to create a new surface requires large amounts of energy. 1 mark
- b.
- ion-dipole bonds (and dispersion forces) 1 mark
  - hydrogen bonds (and dispersion forces) 1 mark
  - yes 1 mark

The ion-dipole bonds are stronger than the hydrogen bonds in the methanol. Adhesive forces are greater than the cohesive forces, and so wetting occurs. 1 mark

Total 6 marks

# Neap:

Trial Examination 2008

## VCE Chemistry Unit 1

Written Examination

### Suggested Solutions

#### SECTION A: MULTIPLE-CHOICE QUESTIONS

1	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D	11	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
2	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	12	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
3	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D	13	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
4	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D	14	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
5	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	15	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
6	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	16	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
7	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D	17	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
8	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D	18	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
9	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D	19	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
10	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	20	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D



**Question 15 B**

Deflection of positively charged ions in the magnetic field of a mass spectrometer is directly proportional to the charge on the ion, and inversely proportional to the mass of the ion. Thus the ion with the smallest mass and greatest charge will be deflected most strongly.

**Question 16 D**

The bond between two chlorine atoms is non-polar (so A is incorrect). The bond between a chlorine atom and a hydrogen atom is polar (so B is incorrect). The  $\text{Cl}_2$  molecule is non-polar (so C is incorrect). The HCl molecule is polar.

**Question 17 A**

The metallic lattice consists of an array of cation immersed in a sea of electrons. Electrostatic attractions between the cations and electrons hold the lattice together. This is metallic bonding.

**Question 18 D**

Li (2, 1) is in Group 1 and Period 2.

Mg (2, 8, 2) is in Group 2 and Period 3.

Al (2, 8, 3) is in Group 13 and Period 3.

Be (2, 2) is in Group 2 and Period 2.

**Question 19 B**

When moving down a group of the Periodic Table, the radii increase as there are more electron shells for each period. The Group 17 elements show little if any electrical conductivity (so C is incorrect). Melting point for the Group 14 elements varies from very high for carbon (diamond and graphite), to relatively high for lead. It does not increase steadily as it does for the Group 17 elements (so A is incorrect). Electronegativity generally decreases down a group (so D is incorrect).

**Question 20 A**

Nanotechnology deals with investigation of particles in the size range 1–100 nm, where  $1 \text{ nm} = 10^{-9} \text{ m}$ . A mitochondrion, with a length of  $0.5 \mu\text{m}$  ( $= 500 \text{ nm}$ ) is outside the size range for nanotechnology. A buckyball (with a diameter of  $10 \text{ \AA} = 1 \text{ nm}$ ), a virus (with a length of  $3 \times 10^{-8} \text{ m} = 30 \text{ nm}$ ) and DNA (with a width of 2 nm) all fall within the size range for nanotechnology.

**SECTION B: SHORT-ANSWER QUESTIONS****Question 1**

- a. i. The mass of an atom expressed on the scale where an atom of carbon-12 has a mass of 12 exactly.  
For example, each Sb atom has approximately ten times the mass of a carbon-12 atom. 1 mark
- ii. The number of nucleons (protons plus neutrons) in the nucleus of an atom.  
For example, an atom of Sb-123 has 51 protons and 72 (123 – 51) neutrons. 1 mark
- b. i.  $\text{RAM} = \Sigma(\text{RIM} \times \text{abundance fraction})$   

$$= \left(120.9 \times \frac{32.7}{100}\right) + \left(122.9 \times \frac{67.3}{100}\right)$$

$$= 122.2$$
 2 marks

- ii. The listed relative atomic mass for antimony is 121.8. The sample used gave a relative atomic mass of 122.2. Hence the sample was not taken from a natural source. 1 mark

Total 7 marks

**Question 2**

- a. i. Aluminium ions have a +3 charge, compared with a +1 charge for sodium ions. The greater charge means that cations and electrons are more strongly attracted to each other, resulting in a stronger metallic bond for aluminium. This stronger bond gives a higher melting point for aluminium. 1 mark
- ii. Chlorine molecules ( $\text{Cl}_2$ ) and argon atoms are both bonded together to form solids by weak, intermolecular dispersion forces. 1 mark
- These forces increase in strength with increasing molecular size. Argon atoms therefore have weaker bonds between them than do chlorine molecules. The melting point of argon is therefore lower than that of chlorine. 1 mark
- b. All Period 2 elements have two occupied electron shells. Core charge increases across Period 2 of the Periodic Table. Fluorine's core charge of +7 attracts outer-shell electrons more strongly than the +1 core charge of sodium. 1 mark
- This greater attraction for the outer-shell electrons causes the radius of the atom to decrease across the Period 2 elements. 1 mark
- c. i.  ${}_6\text{L}$  (a Group 17 element in Period 2) 1 mark
- ii.  ${}_{20}\text{G}$  (metal reactivity increases down the group) 1 mark
- iii.  ${}_{13}\text{M}$  (a metal with three outer-shell electrons) 1 mark

Total 9 marks

## Question 3

a. i.

Molecule	Structural diagram	Name of shape
$\text{SiCl}_4$		tetrahedral
$\text{SCl}_2$		angular or V-shaped

4 marks

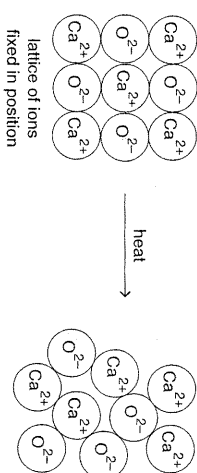
1 mark for each diagram  
1 mark for each name

ii. Any one of:

- $\text{H}_2\text{O}$
- $\text{H}_2\text{S}$
- $\text{OF}_2$
- Any other suitable answer:

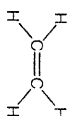
b.  $\text{CaO}$  is an ionic solid consisting of a lattice of cations and anions held together by electrostatic forces of attraction between oppositely charged ions.

Ions are fixed in the solid and so are unable to conduct electricity. Melting frees the ions, allowing them to conduct electricity.

ions are now  
free to move1 mark  
Total 8 marks

## Question 4

a. i.



ii.

I. The branched chains in polymer II do not pack closely together. This reduces the strength of the dispersion forces between them and so lowers the melting point of the polymer.

iii.

polymer I	x	y	z
polymer II	x	y	z
polymer III	x	y	z

3 marks  
1 mark for each polymer

b. i. Boiling point increases as the size of the molecules increase. As size increases, the strength of the dispersion forces between the molecules increases. This leads to higher boiling points.

1 mark

ii.

Any two of:

- members of a series have a general formula, e.g.  $\text{C}_n\text{H}_{2n+2}$  for alkanes.
- successive members of a series differ by  $\text{CH}_2$ .
- viscosity increases as molecular mass increases.
- any other suitable answer.

2 marks  
1 mark for each characteristic  
Total 10 marks

## Question 5

a. i.



1 mark

ii.  $6.02 \times 10^{23}$  molecules have a mass of 180 g.  
1 molecule has a mass of x g.

$$x = \frac{180}{6.02 \times 10^{23}} = 2.99 \times 10^{-22} \text{ g}$$

1 mark

iii.  $n(\text{acetylsalicylic acid}) = \frac{m}{M} = \frac{300 \times 10^{-3}}{180} = 1.67 \times 10^{-3} \text{ mol}$ 

1 mark

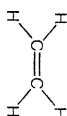
iv.  $n(\text{C}) = 9 \times n(\text{acetylsalicylic acid})$ 

$$N(\text{C atoms}) = n \times N_A = 9 \times 1.67 \times 10^{-3} \times 6.02 \times 10^{23} = 9.05 \times 10^{21}$$

1 mark

## Question 4

a. i.



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polymer I	x	y	z
polymer II	x	y	z
polymer III	x	y	z

3 marks  
1 mark for each polymer

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1 mark

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- successive members of a series differ by  $\text{CH}_2$ .
- viscosity increases as molecular mass increases.
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Total 10 marks

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1 mark

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1 mark

iv.  $n(\text{C}) = 9 \times n(\text{acetylsalicylic acid})$ 

$$N(\text{C atoms}) = n \times N_A = 9 \times 1.67 \times 10^{-3} \times 6.02 \times 10^{23} = 9.05 \times 10^{21}$$

1 mark