Ģ. m(C) = 0.800 g

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

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

 $n(C) : n(H) : n(O) = 0.800 : 0.133 : 1.066$

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

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

The empirical formula is CH_2O .

Total 7 marks

1 mark

1 mark 1 mark

9.

0 1 **(**

(D.

sphere of positively charged matter

megatively charged particles (electrons)

Question 6

Trial Examination 2008

VCE Chemistry Unit 1

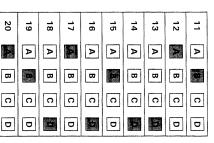
Written Examination

Suggested Solutions

l mark

SECTION A: MULTIPLE-CHOICE QUESTIONS

10	9	8	7	6	55	4	ω	2	٦
Α	Þ	Þ	Þ		Α	Þ	Α		A
- WET	8	В	B	8		B	В	В	В
င	14	134		ဂ	С	ဂ		C	
D	o	O	D	D	D	(a)	D	D	D
						,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			



ä Question 7 ç

Any one of:

Any other suitable answer.

The current model includes orbitals, rather than the orbits found in Bohr's model. The current model includes sub-shells in addition to the shells found in Bohr's model. The current model includes neutrons. These were absent from Bohr's model.

Total 3 marks

1 mark

The total positive charge equalled the total negative charge.

They both contained positive charge that varied from one element to another. They both contained small, negatively charged particles (electrons).

Any other suitable answer.

1 mark

Ö

Any one of:

The energy required to create a new unit of surface area.

requires large amounts of energy. Platinum has strong metallic bonding. Breaking these bonds to create a new surface

ion-dipole bonds (and dispersion forces)

Þ.

hydrogen bonds (and dispersion forces)

≓

yes

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

Total 6 marks

1 mark

1 mark

I mark 1 mark 1 mark

1 mark

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Question 1

charge. The most likely compound they would form is therefore the ionically bonded compound $\mathbf{X}_2\mathbf{Z}$. Element X will form a positive ion with a +1 charge, while element Z will form a negative ion with a -2

Question 2

The balanced equation is $\text{CH}_3\text{CH}_2\text{OH}(\text{aq}) + \text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{COOH}\left(\text{aq}\right) + \text{H}_2\text{O}(\text{l})$

Question 3

$$\begin{array}{cccc} \textbf{C.} & \textbf{1} & \textbf{2} & \textbf{4} & \textbf{5} & \textbf{6} & \textbf{6} \\ \textbf{1} & \textbf{2} & \textbf{H} & \textbf{C} & \textbf{H}_2 & \textbf{C} & \textbf{H}_2 & \textbf{C} & \textbf{H}_3 \\ \textbf{HO} & \textbf{C} & \textbf{H}_3 & \textbf{HO} & \textbf{C} & \textbf{H}_3 & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{3} & \textbf{-methyl-2-hexanol} & \textbf{3} & \textbf{-methyl-2-hexanol} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{3} & \textbf{-methyl-2-hexanol} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} & \textbf{C} \\ \textbf{C} & \textbf$$

Ð.

Question 4

 $_{12}^{25}$ Mg has 12 protons, 13 neutrons and 12 electrons

 $^{25}_{13}$ Al has 13 protons, 12 neutrons and 13 electrons

Question 5

Metallic elements have a small number (1, 2 or 3) of electrons in their outer shell

Question 6

The relevant calculations are shown below

A.
$$N(O) = 2 \times N(CO_2) = 2 \times 1.3 \times 10^{24} = 2.6 \times 10^{24}$$

B.
$$N(O) = 4.0 \times 10^{23}$$

C.
$$N(O) = 2 \times N(O_2) = 2 \times n(O_2) \times N_A = 2 \times 0.25 \times 6.0 \times 10^{23} = 3.0 \times 10^{23}$$

D.
$$N(O) = N(H_2O) = n \times N_A = \frac{m}{M} \times N_A = \frac{22}{18} \times 6.0 \times 10^{23} = 7.3 \times 10^{23}$$

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Question 7

electrons to achieve a stable state. This is characteristic of a Group 16 element which has six electrons in its Group 2 elements are metals). Z bonds to two chlorine atoms. This suggests an atom that shares two Atoms of element Z have high electronegativity. This is characteristic of the non-metals (so A is incorrect outer shell.

Question 8

the molecular formula is $C_4H_8O_2$. (CH₃)₂CHCOOH (II) and CH₃CH₂COOCH₃ (III) both have this An empirical formula of C_2H_4O has a mass of 44. The relative molecular mass of 88 (= 2×44) shows that molecular formula.

Question 9

electronegativity increases. The increased attraction also leads to a decrease in atomic radius. Therefore the properties in II and III increase. When moving across Period 3 from sodium to chlorine, there is an increase in core charge from +1 to +7. This increased core charge means that electrons are more strongly attracted to the nucleus, and so

Question 10

forces) that are affected. The covalent bonds within the molecules are not broken When a sample of methanol is vapourised, it is the intermolecular bonds (hydrogen bonds and dispersion

Question 11

2, 8, 18, 3. Non-metals typically have 4, 5, 6 or 7 electrons in the outer shell. Therefore, Q and X are the are isotopes. Q and X each have an electron shell configuration of 2, 8, 6, and R and Z have the configuration Q and X are isotopes as they have the same atomic number but different mass numbers. Similarly, R and Z required non-metallic isotopes.

Question 12

length is therefore increasing. Bond polarity does not alter, as all the carbon-carbon bonds are non-polar. and a carbon-carbon single bond respectively. The bond strength is therefore decreasing, and the bond The molecules C_2H_2 , C_2H_4 and C_2H_6 contain a carbon-carbon triple bond, a carbon-carbon double bond

Question 13

The monomers used must contain a double bond (so A is incorrect). Look for the repeating units

Question 14

X and Z have the same number of protons, and are therefore the same element. X and Z are the same element **D** is therefore incorrect and so is the required response. therefore a negatively charged ion. Thus the statements in \mathbf{A} , \mathbf{B} and \mathbf{C} are all correct. While \mathbf{Y} and \mathbf{Z} have the with different numbers of neutrons. They are therefore isotopes. X has more electrons than protons. It is same number of neutrons, their numbers of nucleons (i.e. their mass numbers) are different. The statement in

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Question 15

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

Question 16 J

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

Question 17

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

Question 18

Mg (2, 8, 2) is in Group 2 and Period 3. Al (2, 8, 3) is in Group 13 and Period 3. Li (2, 1) is in Group 1 and Period 2.

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

Question 19

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

Question 20

(with a diameter of 10 Å = 1 nm), a virus (with a length of $3 \times 10^{-6} \text{ m} = 30 \text{ nm}$) and DNA (with a width of $2 \times 10^{-6} \text{ m} = 30 \text{ nm}$) mitochondrion, with a length of $0.5 \mu m$ (= 500 nm) is outside the size range for nanotechnology. A buckyball nm) all fall within the size range for nanotechnology Nanotechnology deals with investigation of particles in the size range 1-100 nm, where 1 nm = 10^{-9} m. A

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SECTION B: SHORT-ANSWER QUESTIONS

Question 1

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

à

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

$$= 122.2$$
2 marks

=: It may have been generated artificially. relative atomic mass of 122.2. Hence the sample was not taken from a natural source. The listed relative atomic mass for antimony is 121.8. The sample used gave a Total 7 marks 1 mark

Question 2

ë

- each other, resulting in a stronger metallic bond for aluminium. This stronger bond gives a higher melting point for aluminium. The greater charge means that cations and electrons are more strongly attracted to Aluminium ions have a +3 charge, compared with a +1 charge for sodium ions. l mark mark
- Chlorine molecules (Cl_2) and argon atoms are both bonded together to form solids by point of argon is therefore lower than that of chlorine. therefore have weaker bonds between them than do chlorine molecules. The melting weak, intermolecular dispersion forces. These forces increase in strength with increasing molecular size. Argon atoms 1 mark 1 mark
- ŗ Period 2 of the Periodic Table. Fluorine's core charge of +7 attracts outer-shell electrons This greater attraction for the outer-shell electrons causes the radius of the atom to decrease more strongly than the +1 core charge of sodium. All Period 2 elements have two occupied electron shells. Core charge increases across I mark
- across the Period 2 elements. 1 mark 1 mark
- $_{20}\mathrm{G}$ (metal reactivity increases down the group) ₉L (a Group 17 element in Period 2)

ċ

- Ħ. $_{13}$ M (a metal with three outer-shell electrons)

Total 9 marks

1 mark 1 mark

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Question 3

SCl ₂	SiCl ₄	Molecule
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	-\frac{1}{2} -\fra	Molecule Structural diagram
angular or V-shaped	tetrahedral	Name of shape

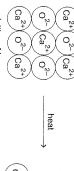
I mark for each diagram I mark for each name 4 marks

- Any one of:
- H₂O
- H_2S
- OF₂
- Any other suitable answer.

Ģ

CaO is an ionic solid consisting of a lattice of cations and anions held together by electrostatic forces of attraction between oppositely charged ions.

allowing them to conduct electricity. Ions are fixed in the solid and so are unable to conduct electricity. Melting frees the ions, 1 mark 1 mark



fixed in position lattice of ions



free to move ions are now

Total 8 marks 1 mark

VCE Chemistry Unit 1 Trial Examination Suggested Solutions

Question 4

1 mark

1 mark

I mark

::

polymer II polymer I ×

×

y

Boiling point increases as the size of the molecules increase. polymer III

ŗ

increases. This leads to higher boiling points. As size increases, the strength of the dispersion forces between the molecules

=: Any two of:

- members of a series have a general formula, e.g. $C_n H_{2n+2}$ for alkanes.
- successive members of a series differ by CH₂.

1 mark

- viscosity increases as molecular mass increases.
- any other suitable answer.

I mark for each characteristic Total 10 marks

Question 5

 $C_9H_8O_4$

 6.02×10^{23} molecules have a mass of 180 g.

I molecule has a mass of x g.

 $-\frac{1}{6.02 \times 10^{23}} = 2.99 \times 10^{-22} \text{ g}$

 $n(\text{acety|salicylic acid}) = \frac{m}{M} = \frac{300 \times 10^{-3}}{180} = 1.67 \times 10^{-3} \text{ mol}$

1 mark

1 mark

1 mark

1 mark

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

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

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

Ħ:

I mark for each polymer 3 marks 1 mark 1 mark

2 marks

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Ÿ.

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