Atoms, compounds, molecules and equations – 2021/20 GCE AS Chemistry A

1. Nov/2021/Paper_H032/01/No.4

Pauling electronegativity values for the halogens F to I and some elements in period 2 of the periodic table are shown below.

B 2.04	C 2.55	N 3.04	O 3.44	F 3.98
				Cl 3.16
				Br 2.96
				I 2.66

Which bond has the correct polarity?

A	B	C	D
$^{\delta-}$N—I$^{\delta+}$	$^{\delta-}$C—F$^{\delta+}$	$^{\delta-}$B—Cl$^{\delta+}$	$^{\delta-}$Br—Cl$^{\delta+}$

Your answer ☐ **[1]**

2. Nov/2021/Paper_H032/01/No.21

This question is about atomic structure.

(a) Complete the table to show the maximum number of electrons that can occupy each shell and sub-shell. Some boxes may need to be left blank.

Shell	Total number of electrons	Sub-shell		
		s	p	d
1st				
2nd				
3rd				

[2]

(b) Selenium, Se, has the atomic number 34.

^{76}Se and ^{82}Se are two isotopes of selenium.

Complete the table to show the numbers of protons, neutrons and electrons in these two isotopes.

	Protons	Neutrons	Electrons
^{76}Se	.....	.....	.....
^{82}Se	.....	.....	.....

[1]

(c) The relative atomic mass of an element can be determined from its mass spectrum.

The table shows the results of a mass spectrum of a sample of sulfur, S.

Isotope	Abundance (%)
^{32}S	94.93
^{33}S	0.78
^{34}S	4.29

Calculate the relative atomic mass of the sample of sulfur.

Give your answer to **3** decimal places.

relative atomic mass = ... **[2]**

(d) Halothane, $C_2HBrCIF_3$, (M_r = 197.4) is used as a general anaesthetic in medicine.

(i) The systematic name for halothane is 2-bromo-2-chloro-1,1,1-trifluoroethane.

Draw the structure of a halothane molecule.

[1]

(ii) What is the number of fluorine **atoms** in 7.896 g of halothane, $C_2HBrCIF_3$?

number of fluorine atoms = ... **[2]**

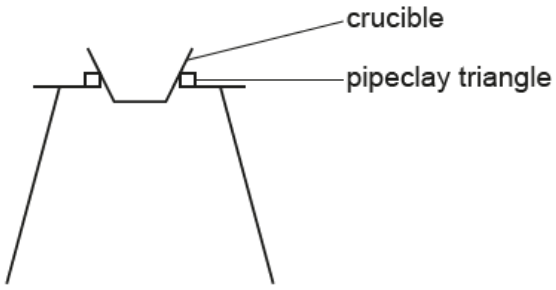
3. Nov/2021/Paper_H032/01/No.25(a)

This question is about the analysis of unknown compounds.

(a) Scandium (atomic number 21) reacts with oxygen to form an oxide of scandium.

A student carries out an experiment to determine the empirical formula of the scandium oxide.

A diagram of the apparatus used by the student is shown below.



The student's method is outlined below.

- Weigh an empty crucible.
- Add scandium to the crucible and reweigh.
- Heat the crucible and contents for 10 minutes.
- Allow to cool and reweigh.

The student's results are shown below.

Mass of crucible / g	12.165
Mass of crucible + scandium / g	12.435
Mass of crucible + scandium oxide / g	12.579

(i) Determine the empirical formula of the scandium oxide.

empirical formula = ... **[2]**

(ii) The student was unsure that all of the scandium had reacted.

Suggest **one** modification that the student could make to their method to be confident that all the scandium had reacted. Explain your reasoning.

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..... **[1]**

4. Nov/2020/Paper_H032/01/No.2

What is the formula of silver carbonate?

A $AgCO_3$

B $Ag(CO_3)_2$

C Ag_2CO_3

D Ag_3CO_3

Your answer ☐ **[1]**

5. Nov/2020/Paper_H032/01/No.21(b)

(b) Most elements contain atoms of different isotopes.

State any differences and similarities between the atomic structures of isotopes of the same element.

Differences .....

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Similarities .....

.....

[2]