4.1 Stoichiometry

01. 0620_s17_qp_41 Q: 1

This question is about subatomic particles.

(a) Define the terms

proton number, ...

.....

nucleon number. .....

.....

[3]

(b) Why is the $^{1}_{1}H$ hydrogen atom the **only** atom to have an identical proton number and nucleon number?

.....

..... [1]

(c) Complete the table to show the number of protons, neutrons and electrons in the atoms and ions given.

	number of protons	number of neutrons	number of electrons
^{19}F			9
^{26}Mg	12		
$^{31}P^{3-}$			
$^{87}Sr^{2+}$			

[6]

(d) **(i)** Write the formula of the compound formed from fluorine and magnesium.

..... [1]

(ii) Write the formula of the compound formed from Sr^{2+} and P^{3-}.

..... [1]

[Total: 12]

02. 0620_w17_qp_42 Q: 2

(a) Complete the table to show the electronic structure of the atoms and ions.

	electronic structure
F	2,7
Si	
Ca^{2+}	
N^{3-}	

[3]

(b) Predict the formula of the compound formed between Ca^{2+} and N^{3-}.

..... [1]

(c) Draw a dot-and-cross diagram to show the electron arrangements in the **two** ions present in lithium chloride, LiCl.
Show outer shell electrons only. Include the charges on the ions.

[3]

(d) Sulfur dichloride, SCl_2, is a covalent compound. It has the structure Cl–S–Cl.

Draw a dot-and-cross diagram to show the electron arrangement in a molecule of sulfur dichloride.
Show outer shell electrons only.

(e) In terms of attractive forces, explain why LiCl has a higher melting point than SCl_2.

.....

.....

.....

.....

..... [3]

(f) Suggest the identity of a **covalent compound** with a higher melting point than LiCl.

..... [1]

[Total: 14]

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03. 0620_s15_qp_33 Q: 1

Use your copy of the Periodic Table to help you answer these questions.

(a) Predict the formula of each of the following compounds.

(i) aluminium fluoride ..... [1]

(ii) arsenic oxide ..... [1]

(iii) silicon bromide ..... [1]

(b) Deduce the formula of each of the following ions.

(i) phosphide ..... [1]

(ii) barium ..... [1]

(iii) francium ..... [1]

(c) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound carbon dioxide.

Use x to represent an electron from a carbon atom.
Use o to represent an electron from an oxygen atom.

[3]

[Total: 9]

04. 0620_w15_qp_31 Q: 2

Describe how to separate the following. In each example, give a description of the procedure used and explain why this method works.

(a) Copper powder from a mixture containing copper and zinc powders.

procedure .....

.....

explanation .....

.....

[3]

(b) Nitrogen from a mixture of nitrogen and oxygen.

procedure .....

.....

explanation .....

.....

[3]

(c) Glycine from a mixture of the two amino acids glycine and alanine. Glycine has the lower R_f value.

procedure .....

.....

explanation .....

.....

[2]

(d) Magnesium hydroxide from a mixture of magnesium hydroxide and zinc hydroxide.

procedure .....

.....

explanation .....

.....

[3]

[Total: 11]

01. 0620_s17_ms_41 Q: 1

(a)	*proton number*: the number of protons	1
	nucleon number: the total number of protons and neutrons	1
	nucleon number: in the nucleus / nuclei (of an atom)	1
(b)	(hydrogen is the only atom to have) no neutrons	1
(c)		

	number of protons	number of neutrons	number of electrons
^{19}F	9	10	9
^{26}Mg	12	14	12
$^{31}P^{3-}$	15	16	18
$^{87}Sr^{2+}$	38	49	36

	fluorine protons **AND** neutrons correct	1
	magnesium neutrons **AND** electrons correct	1
	phosphorus protons **AND** neutrons correct	1
	phosphorus electrons correct	1
	strontium protons **AND** neutrons correct	1
	strontium electrons correct	1
(d)(i)	MgF_2	1
(d)(ii)	Sr_3P_2	1

02. 0620_w17_ms_42 Q: 2

(a)	*Si:* 2: 8 : 4	1
	Ca^{2+}: 2 : 8: 8	1
	N^{3-}: 2 : 8	1
(b)	Ca_3N_2	1
(c)	Li shown as having one shell with 2 electrons **OR** no electrons **OR** no outer shell	1
	Cl shown as having an outer shell of 7 electrons of one type, plus one different electron which matches Li electrons	1
	'+' charge on Li **AND** '–' charge on *Cl*	1

(d)	two shared pairs of electrons	1
	both *Cl* with complete outer shells	1
	S with complete outer shell	1
(e)	SCl_2 has intermolecular forces (of attraction)	1
	LiCl has (electrostatic) forces (of attraction) between ions	1
	intermolecular forces are weaker / less energy is needed to break intermolecular forces	1
(f)	silicon(IV) oxide	1

03. 0620_s15_ms_33 Q: 1

(a)(i)	AlF_3;	**1**	
(a)(ii)	As_2O_3;	**1**	**A** As_2O_5
(a)(iii)	$SiBr_4$;	**1**	
(b)(i)	P^{3-};	**1**	
(b)(ii)	Ba^{2+};	**1**	
(b)(iii)	Fr^{+};	**1**	
(c)	M1 2 double bonds, one between each O and the C atom; M2 each O has 8 outer electrons; M3 each C has 8 outer electrons;	**3**	**R** wrong symbols for O for M2 **R** wrong symbols for C for M3 **I** missing symbols **A** any combination of x and o

04. 0620_w15_ms_31 Q: 2

(a)	add a (dilute) acid; filter; copper does not react or dissolve / zinc reacts or dissolves or forms a salt;	**1** **1** **1**
(b)	diffusion (through a membrane); nitrogen diffuses faster; because it has the smaller M_r; **or** (turn into) liquid; (fractional) distillation; different boiling points; **or** burn a named substance to make non-gaseous product; oxygen reacts / nitrogen does not react; name of product of combustion;	**3**
(c)	chromatography; use a locating agent / the two acids move at different rates / alanine travels faster / alanine higher up paper / travels further;	**1** **1**
(d)	add sodium hydroxide solution; filter; zinc hydroxide (is amphoteric it) will react or will dissolve / magnesium hydroxide does not react or does not dissolve;	**1** **1** **1**