

## Part A – Multiple-choice questions

Total marks (16)

Attempt Questions 1 – 16

- 1 Which of the descriptions below could apply to an element?
- (A) Conducts electricity as a solid and also when molten.
  - (B) Burns in air to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .
  - (C) Changes colour and loses oxygen when heated.
  - (D) Produces several fractions when distilled.
- 2 Which of the properties listed below distinguishes a compound from an element?
- (A) Elements are pure substances, compounds are not.
  - (B) Compounds are not very reactive.
  - (C) Compounds can be decomposed by chemical methods.
  - (D) Compounds have a constant and definite set of properties.
- 3 Which of the following is a set of binary compounds?
- (A)  $\text{NaBr}$ ,  $\text{NaCl}$ ,  $\text{NaI}$ ,  $\text{NaOH}$
  - (B)  $\text{Na}_2\text{O}$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{H}_2\text{O}_2$ ,  $\text{PbO}_2$
  - (C)  $\text{CO}$ ,  $\text{SO}_2$ ,  $\text{NH}_3$ ,  $\text{CH}_4$
  - (D)  $\text{H}_2\text{SO}_4$ ,  $\text{H}_2\text{CO}_3$ ,  $\text{H}_2\text{SO}_3$ ,  $\text{H}_2\text{CrO}_4$
- 4 An atom of element X has 5 valence electrons, an atom of element Y has 7 valence electrons. Which of the formulas below represents a possible compound of X and Y?
- (A)  $\text{X}_7\text{Y}_5$
  - (B)  $\text{X}_5\text{Y}_7$
  - (C)  $\text{XY}_3$
  - (D)  $\text{X}_3\text{Y}$

5 Elements represented by the letters UVYZ form compounds whose properties are tabled below...

Formula of compound	Melting point of compound (°C)	Electrical conductivity of solid compound	Electrical conductivity of molten compound
UY	2700	nil	good
V <sub>2</sub> Y	0	nil	nil
ZY <sub>2</sub>	1700	nil	nil

If each compound is dissolved in water, which of the following solutions would most likely be an electrical conductor?

- (A) UY
- (B) V<sub>2</sub>Y
- (C) ZY<sub>2</sub>
- (D) Both UY and ZY<sub>2</sub>

6 A mixture contains three compounds; alum, camphor and sugar. The solubilities of these substances in different solvents are shown in the table below...

	SOLVENTS		
	WATER	ETHANOL	ETHER
alum	soluble	insoluble	insoluble
sugar	soluble	soluble	insoluble
camphor	insoluble	soluble	soluble

What would be the quickest way to separate the alum from the mixture?

- (A) Add water to the mixture, stir and filter, and dry the residue.
- (B) Add ethanol to the mixture, stir and filter, and dry the residue.
- (C) Add ether to the mixture, stir and filter, and dry the residue.
- (D) Add water to the mixture, stir and filter, and dry the evaporate the filtrate.

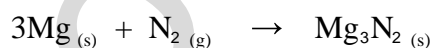
7 Benzene and water form an immiscible mixture. If placed together in a test tube, they form two separate layers. Which of the following procedures could be used to identify the water layer?

- (A) Add a little more water.
- (B) Add a little more benzene.
- (C) Look up the densities of water and benzene in a data book.
- (D) **Any** of the above procedures could be used.

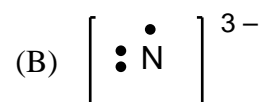
8 Which of the following shows the correct formula?

- (A) Ammonium hydrogen sulfate =  $\text{NH}_4\text{HSO}_4$
- (B) Calcium dihydrogen phosphate =  $\text{CaH}_2\text{PO}_4$
- (C) Sodium hydrogen phosphate =  $\text{NaHPO}_4$
- (D) Potassium hydrogen carbonate =  $\text{K}_2\text{HCO}_3$

9 At high temperature magnesium will react with nitrogen to form magnesium nitride...



Which of these Lewis electron dot structures is a correct representation of the nitride ion?



10 An element X forms an oxide with the formula,  $\text{XO}_2$ . Which of the following electronic configurations represents X?

- (A) 2-2
- (B) 2-6
- (C) 2-8-4
- (D) 2-8-8-2

- 11 Which of the following pairs of electronic configurations is most likely to form a covalent bond when the atoms react?
- (A) 2-8-7 and 2-8-1
  - (B) 2-8-1 and 2-6
  - (C) 2-8-7 and 2-8-4
  - (D) 2-8-7 and 2-8-2
- 12 Bromine and chlorine react to form a compound. Which of the following best describes the compound formed?
- (A)  $\text{Br}^+\text{Cl}^-$  ~ ionically bonded
  - (B)  $\text{Br} - \text{Cl}$  ~ covalently bonded
  - (C)  $\text{Br}_2^{2+}\text{Cl}_2^{2-}$  ~ ionically bonded
  - (D)  $\text{Br}_2 = \text{Cl}_2$  ~ covalently bonded
- 13 If X represents an element from Group II and Y represents an element from Group VII, which of the following statements would best describe the compound formed between X and Y?
- (A) ionic, with formula  $\text{XY}_2$
  - (B) covalent, with formula  $\text{XY}_2$
  - (C) ionic, with formula  $\text{X}_2\text{Y}$
  - (D) covalent, with formula  $\text{X}_2\text{Y}$
- 14 Which of the following species has the same electronic configuration as helium?
- (A)  $\text{H}^+$
  - (B) Ne
  - (C)  $\text{Li}^-$
  - (D)  $\text{Be}^{2+}$

15 X, Y and Z are three solid compounds, which have the following properties...

	X	Y	Z
Aqueous solubility	good	very poor	nil
Water solution is an electrolyte ?	yes	no	no
Fused (molten) solid is an electrolyte ?	yes	yes	no
Melting point	high	high	low

According to the above data, which compounds are most likely to be ionic?

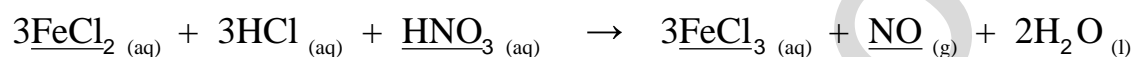
- (A) X and Y
  - (B) Y and Z
  - (C) X and Z
  - (D) Z
- 16 In the laboratory, you observed the electrolysis of water. Which of the following statements is true?
- (A) Ionic bonds are broken during the electrolysis of water.
  - (B) Electrolysis causes the decomposition of water.
  - (C) During electrolysis the water becomes diatomic.
  - (D) Electrolysis causes the vaporisation of water.

## Part B – Short answer questions

Total marks (15)

Attempt Questions 17 – 21

Question 17 refers to the chemical equation below... (2 marks)



Write the names of the four compounds underlined.

Question 18 refers to the table below... (2 marks)

Element	m.p. (°C)	b.p. (°C)	Electrical Conductivity	Type of bonding in the element's chloride
U	181	1331	good	ionic
V	119	445	nil	covalent
W	-270	-269	nil	no chloride forms
X	114	183	nil	covalent
Y	838	1440	good	ionic
Z	3730	4830	good	covalent

- (a) Which *two* of the elements could be metals?
- (b) Which *two* of the elements could exist at 25°C, not as atoms, but as *small* molecules in the solid state?

**Question 19 (4 marks)**

Magnesium reacts vigorously with sulfur forming MgS.

- (a) What is the name of this compound?
- (b) Draw the Lewis electron dot structures for...
- (i) magnesium
  - (ii) sulfur
  - (iii) MgS

**Question 20 (4 marks)**

This question refers to the chemical composition of the various 'spheres'.

- (a) Write the chemical formula of an ionic compound abundant in the hydrosphere.
- (b) Write the chemical formulas of two common ores found in the Australian lithosphere.
- (c) Identify the element which is abundant in the biosphere, but is rare in the atmosphere, hydrosphere and lithosphere.

**Question 21 (3 marks)**

During a Prac Test, Ken Chemiski performed a gravimetric analysis of a mixture of salt, pepper and water. (This was similar to your first experiment in Year 11). Ken separated the mixture by filtration, followed by evaporation. His weighing data is tabled below...

Mass of dry beaker	91.73 g
Mass of beaker + mixture	207.66 g
Mass of filter paper	1.33 g
Mass of dry filter paper + pepper	9.93 g
Mass of dry flask	88.26 g
Mass of flask + dry salt	94.83 g

Using Ken's data, calculate the mass % of pepper, salt and water.

- +  $pepper \% + salt \% + water \% = 100\%$
- + All percentages should be rounded-off to two decimal places, ### %