Year 11 – Unit 1 Chemistry

Metallic and ionic bonding and quantitative analysis

Test

Section 1: Multiple Choice

12 questions (1 mark each = 12 marks)

Section 2: Short Answer

4 questions – 39 marks in total

Answer all questions in the space provided in the test booklet.

Total:

Length of test: 51 minutes

SECTION	MARKS AVAILABLE	MARKS OBTAINED
PART A: Multiple Choice	12	/12
PART B: Short Answer	39	/39
Total		/51

Multiple choice

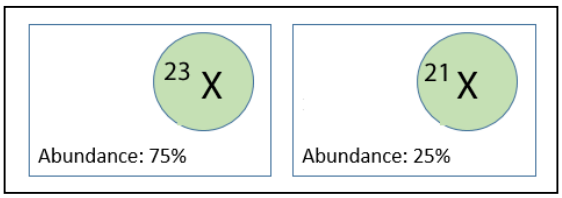
1) An amount of 0.35 mol of H_2SO_4 contains:
   a. 0.35 mol of hydrogen atoms,
   b. 2.45 mol of atoms,
   c. 2.45 mol of H_2SO_4 molecules,
   d. 0.70 mol of sulphur atoms.

2) Carbon dioxide (CO_2) has a molar mass of 44.0 grams/mol. An amount of 1.81×10^{24} molecules of CO_2 :
   a. has a mass 44.0 grams,
   b. contains 1.81×10^{24} oxygen atoms,
   c. contains 3 mol of oxygen atoms,
   d. has a mass of 132 grams.

3) A pure sample of HNO_3 is weighed at 6.50 grams. This sample of HNO_3 most likely contains:
   a. 1 mol of hydrogen atoms,
   b. 1.40 grams of nitrogen atoms,
   c. 4.80 grams of oxygen atoms,
   d. close to 0.3 mol of oxygen atoms.

4) What is the percentage composition, by mass, of $KClO_3$.
   a. 39.2 % Oxygen : 31.9 % Potassium : 28.9 % Chlorine
   b. 25.2 % Oxygen : 35.9 % Potassium : 39.9 % Chlorine
   c. 39.2 % Potassium: 31.9 % Oxygen : 28.9 % Chlorine
   d. None of the above represent the percentage composition, by mass, of $KClO_3$.

5) An element("X") has two isotopes of atomic mass 23 and 21. The percentage abundance of each isotope is shown on the right.
The relative atomic mass of X, in atomic mass units, is:



   a. slightly less than 21,
   b. just over 23,
   c. 22.5,
   d. 22.0.

6) The mass of one atom of sulphur is closest to:
   a. 5.32×10^{-23} grams,
   b. 32.0 grams,
   c. 3.20×10^{-23} grams,
   d. 3.20×10^{23} grams.

7) What property of metals cannot be explained by the metallic bonding model?
   a. Malleability.
   b. Ductility.
   c. Magnetic property
   d. Conductivity of heat.

The list of properties below relates to questions 8 -10.

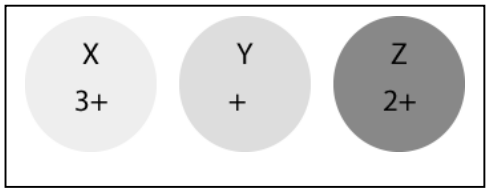
i. Relatively high melting temperatures
ii. High electrical conductivity in the solid state.
iii. High electrical conductivity in the liquid state.
iv. High electrical conductivity in the aqueous state.
v. Malleable.
vi. Can be soluble in water.

8) What properties are shared between ionic substances and metallic substances?
   a. i and iii only
   b. ii, iii and v only
   c. ii and iii only
   d. I, vi and iii only

9) A substance formed when a metal and non-metal react chemically may have the following properties:
   a. i, and vi only
   b. iii, iv and vi only
   c. i, iii, iv and vi only
   d. i, iii and vi only

10) Non-directional forces of attraction enable:
   a. ionic substances to exhibit properties I and vi.
   b. metals to exhibit property v only.
   c. metals to exhibit properties ii and vi.
   d. Ionic substances to exhibit property iii only.

11) The diagram shows the charge and the size of three different stable ions of metals in the same period of the periodic table. Which statement is most likely correct?



   a. Metal X is most likely to have the highest melting temperature.
   b. Metal Z will most likely react with chlorine to form a compound with the formula Z_3Cl_2
   c. Metal Y will most likely have the highest structural strength and conductivity.
   d. Metal X will be the most reactive.

12) Iron is mixed with a small amount of carbon to form an:
   a. ionic substance that is lustrous and not brittle,
   b. ionic substance that can conduct electricity in the solid state,
   c. alloy that has properties of both carbon and iron so that it can burn in a furnace to produce CO_2 and H_2O,
   d. alloy that has different physical properties to pure iron.

Section B

1. NutraSweet is an artificial sweetener with the following percentage composition, by mass. 57.14% C, 6.16% H, 9.52% N, and 27.18% O.
   All working out must be shown in the space provided for full marks.
   a. Calculate the empirical formula of NutraSweet

   4 marks

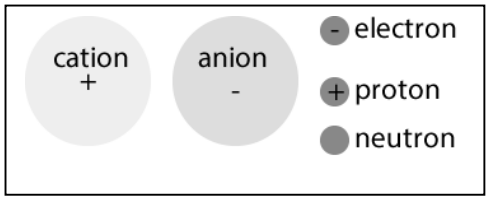
   b. Find the molar mass of NutraSweet if an amount of 0.25 mol of this substance has a mass of 73.6 grams.

   2 marks

   c. Find the molecular formula of NutraSweet.

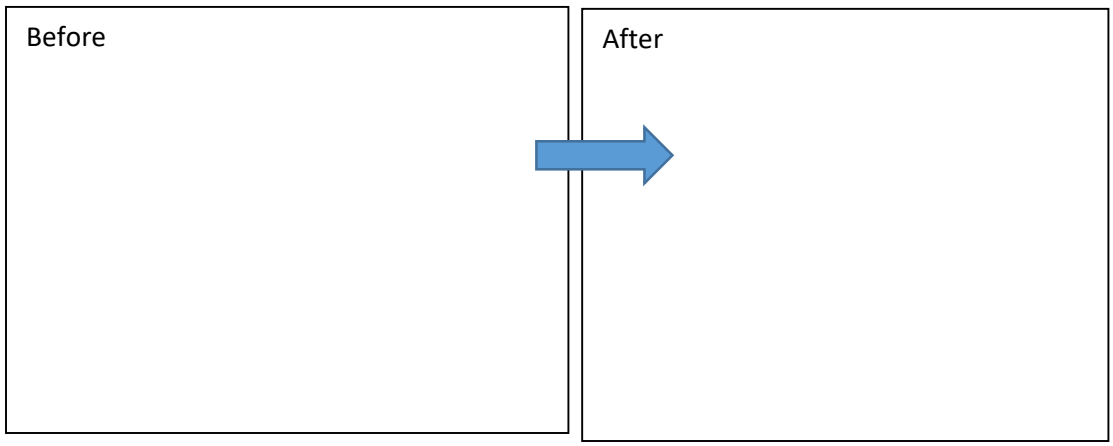
   3 marks

2. Using some or all the symbols shown on the right answer the questions below.



a. In the box below draw a detailed and correctly labelled diagram of a small section of the lattice of an ionic substance before and after impact with a hammer. Describe how the substance will respond to the impact.

4 marks



i. Describe the forces acting in the ionic lattice prior to impact.

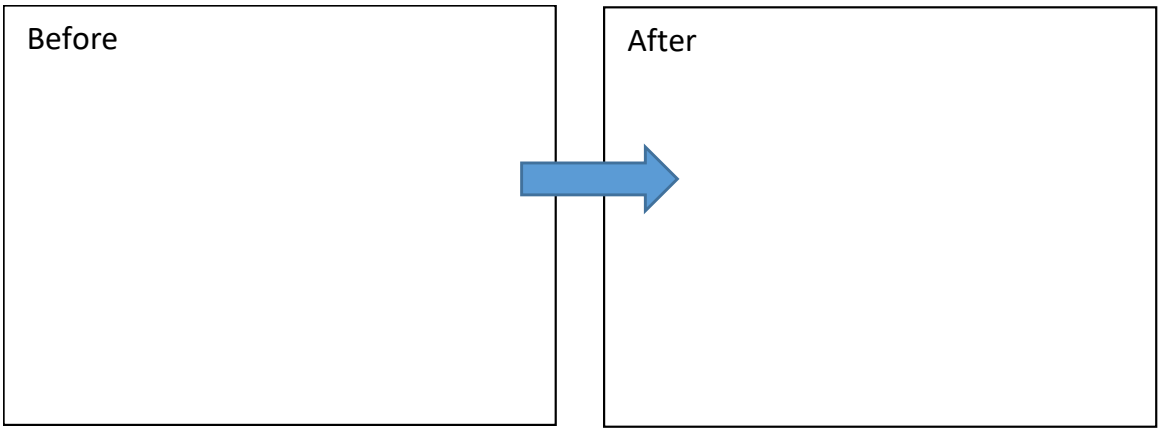
2 marks

ii. Describe how these forces change after impact.

2 marks

b. In the box below draw a detailed and correctly labelled diagram of a small section of the metallic lattice of pure iron before and after impact with a hammer. Describe how the lattice will react to the impact.

2 marks



i. Describe the metallic bonding model.

2 marks

ii. Describe the forces that hold the metal lattice together before impact

1 mark

iii. Describe how the forces that hold the metal lattice together change after impact.

1 mark

3. Propane is used to heat up the backyard BBQ. Propane is a gas with the formula C_3H_8.
   If an amount of 8.80 **kilograms** of propane is present in the bottle calculate the following.

   a. The amount, in mol, of propane present in the bottle.

   2 marks

   b. The amount in mol of atoms present in the bottle.

   2 marks

   c. Calculate the amount, in grams, of carbon present in the bottle.

   2 marks

d. The chemical equation for the combustion reaction of propane with atmospheric oxygen is given below.

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

i. Calculate the amount, in mol, of CO_2 produced if 3 mol of propane react completely with oxygen.

2 marks

ii. What mass of oxygen must be supplied in order to fully burn 180.0 grams of propane?

4 marks

4) Blacksmiths often used quenching to change the properties of iron.

i. What is quenching?

1 mark

ii. How does quenching change the properties of iron?

1 mark

iii. Explain how these changes come about?

2 marks

End of test.