**YEAR 11 UNIT 1 – Practice Exam**

**Section A Multiple Choice (18 Questions, 18 Marks, 25 minutes)**

**Question 1**

Which one of the following compounds would have the highest percentage by mass of chlorine?

1. KCl
2. GaCl3
3. SrCl2
4. NaCl

**Question 2**

The atomic structures of three particles (X, Y, Z) are given in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| Particle | No. of protons | No. of electrons | No. of neutrons |
| X | 13 | 10 | 14 |
| Y | 12 | 10 | 13 |
| Z | 11 | 10 | 12 |

These particles are:

1. isotopes
2. anions
3. non-metals
4. cations

**Question 3**

The ground state electronic configuration, in terms of subshells, for the chloride atom is:

1. 1s22s22p63s23p6
2. 1s22s22p63s23p5
3. 1s22s22p63s23p63d1
4. 1s22s22p63s23p53d1

**Question 4**

Two organic compounds are structural isomers if they:

1. have the same molecular formula but different structural formulae
2. have the same structure in the solid state but different melting temperatures
3. differ from each other by a CH2 unit
4. have the same physical properties but different molecular formulae

**Question 5**

Which of the following is the empirical formula of ethanoic acid?

1. CH3COOH
2. C2H4O2
3. CH2O
4. 

**Question 6**

The formulae for the ionic compounds sodium carbonate, aluminium sulfate, iron (III) chloride would be correctly written as:

1. NaCO3, Al3(SO4)2, FeCl3
2. Na2CO3, Al3(SO3)2, FeCl3
3. NaCO3, Al2(SO4)3, Fe2Cl3
4. Na2CO3, Al2(SO4)3, FeCl3

**Question 7**

Metals are malleable and ductile because:

1. their lattice of cations and anions can bend without breaking
2. the electrons prevent cations from moving out of position
3. the constant motion of the cations in the lattice allowed the electrons to remain attracted to them
4. the constant motion of the delocalised electrons prevents repulsions when the cations are displaced

**Question 8**

Potassium and bromine are in the same period of the Periodic Table. Potassium is in Group 1 and bromine in Group 17. Compared to potassium, bromine will be:

1. denser, less metallic, less electronegative
2. larger, more electronegative, less metallic
3. harder, more metallic, more reactive
4. heavier, more electronegative, smaller in diameter

**Question 9**

An organic compound has the systematic name 2,3-dimethylbutane. Which one of the following statements about this compound is incorrect?

1. It is an alkane
2. Each molecule contains six carbon atoms
3. The molecule is symmetrical
4. The molecules contain a double bond

**Question 10**

A sample of ethane, C2H6, contains 9.6 x 1022 atoms. How many mole of ethane is present in the sample?

1. 0.020 mol
2. 0.080 mol
3. 0.027 mol
4. 0.160 mol

**Question 11**

From the information in Question 11, the mass, in grams, of ethane would therefore be:

1. 0.60g
2. 2.40g
3. 0.81g
4. 4.80g

**Questions 12**

A substance, on analysis, was found to contain 27.3% carbon and 72.7% oxygen. Which of the following is the empirical formula of the substance?

1. CO2
2. CO3
3. C2O4
4. C3O7

**Question 13**

The structure and bonding in solid sodium metal at room temperature can best be described as:

1. A network lattice of closely packed sodium atoms, held together by strong ionic bonds
2. A lattice of Na2 molecules
3. A lattice of sodium cations, held together by a ‘sea’ of delocalised electrons
4. A lattice of Na2 molecules held together by weak bonds

**Question 14**

Naturally occurring iridium has a relative atomic mass of 192.2 and consists of two isotopes, $$ and $$. The percentage of the lighter isotope is:

1. 80%
2. 60%
3. 40%
4. 20%

**Question 15**

A and B are elements. The ionic compound AB2 is known to exist. If A2+ and B- both have the same electron configuration as the neon atom, then AB2 is:

1. Magnesium fluoride
2. Magnesium chloride
3. Magnesium bromide
4. Calcium fluoride

**Question 16**

Which one of the following lists of compounds contains members of a homologous series?

1. C2H2, C2H4, C2H6
2. CH4, C2H4, C3H4
3. C2H6O, C2H4O, C2H4O2
4. C2H4, C3H6, C4H8

**Question 17**

The electron configuration of a neutral atom with its electrons in an excited state is:

1. 1s22s22p2 (atomic number = 6)
2. 1s22s22p33s1 (atomic number = 8)
3. 1s22s22p53s1 (atomic number = 9)
4. 1s22s22p5 (atomic number = 10)

**Question 18**

The relative atomic mass of magnesium, *Ar*(Mg), is 24.31. The most important reason why it is not a whole number is that:

1. Magnesium atoms lose electrons when they react
2. The relative atomic mass given is only an approximation
3. Not all atoms of magnesium have the same number of neutrons
4. The mass of the magnesium atom is compared to the mass of the 12C isotope.

**END OF MULTIPLE CHOICE SECTION**

**Section B Short Answers (10 questions, 60 marks, 75 minutes)**

**Question 1 (2 marks)**

Explain why lead can conduct electricity in both solid and liquid states, whereas lead nitrate can only conduct electricity when molten or in an aqueous solution.

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**Question 2 (4 + 1 + 1 = 6 marks)**

1. Predict the trend in the following properties of the second period elements moving from lithium to fluorine, giving an explanation in support of each prediction.

|  |  |  |
| --- | --- | --- |
| **Property** | **Increases or Decreases** | **Explanation for predicted trend** |
| Atomic size |  |  |
| Electronegativity |  |  |

1. There is also a general trend in first ionisation energy both across periods and down groups of the periodic table.
	* 1. What is meant by the term ‘ionisation energy’?
		2. Given that the atomic size of potassium is greater than that of sodium, explain why the first ionisation energy of sodium is greater than that of potassium.

**Question 3 (2+2+2+2=8 marks)**

Draw the structural formulae for the following compounds:

a) Butane

b) hex-2-ene

c) 2 methyl pent-1-ene

d) Explain the difference between saturated and unsaturated hydrocarbons and give an

 example of each type

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**Question 4 (2+1=3 marks)**

Aspirin is a drug used extensively for the relief of pain in humans. Chemical analysis of an aspirin tablet determined that it was composed of 57.5% carbon, 37.8% oxygen and 4.7% hydrogen.

a) Determine the empirical formula for this compound

b) The relative formula mass was determined to be 171. What is the molecular

 formula for this compound?

**Question 5 (6 marks)**

Complete the following table

|  |  |
| --- | --- |
| **Name of Compound** | **Formula of Compound** |
| Calcium sulfate |  |
| Sodium Nitrate |  |
|  | Cu2CO3 |
|  | Al(NO3)3 |
|  | CH2CHCH2CH3 |
|  | CH3CH(CH3)CH(CH3)CH3(brackets indicate they are branched) |

**Question 6 (1+1+1+1+1+1+2+2=10 marks)**

Magnesium is a metallic element whereas fluorine is a non-metallic element. When the elements react together magnesium fluoride is formed.

1. Give the electron subshell arrangement of a magnesium atom.
2. Describe the structure and bonding found in magnesium metal
3. List two properties you would expect magnesium to show.
4. Use this model to explain why magnesium can be:

i) Moulded into various shapes

ii) Used to conduct electricity

1. Give the electron subshell arrangement of fluorine
2. In terms of the electron arrangement (shells), describe what happens when magnesium and fluorine react.
3. Write down the formula and name the type of bonding for the substance that is formed when magnesium and fluorine react.

**Question 7 (1+1+1+2=5 marks)**

Many trends are apparent in the Periodic Table when electronegativity and atomic radii data are analysed. Consider these elements of Period 3:

Na Mg Al Si P S Cl

 a) Classify each of these elements as metal or non-metal

1. Rank these elements in order of **increasing** electronegativity
2. Rank these elements in order of **increasing** atomic size
3. Explain why the ionisation energy decreases as you move down a group in the Periodic Table.

**Question 8 (5 marks)**

A compound contains 0.15 mole of carbon combined with 0.40 g of hydrogen and 9 x 1022 atoms of oxygen. What is the empirical formula of the compound?

**Question 9 (3 + 2 + 2 = 7 marks)**

Reactions involving hydrocarbons are an essential part of our everyday life, be that for energy to power cars or the formation of glucose or essential amino acids.

1. Esters are formed when carboxylic acids react with hydroxyl groups.

Using structural formula, show the reaction between propan-1-ol and ethanoic acid and name the resulting products

.

1. Write a balanced chemical equation showing the combustion of hexane
2. Alkenes undergo addition reactions. Using structural formula, show the reaction between but-2-ene and chlorine gas.

**Question 10 (2+2+2+2=8 marks)**

Balance the following equations:

1. Ag (s) + H2S (g) + O2 (g) → Ag2S (s) + H2O (l)
2. Al (s) + O2 (g) → Al2O3 (s)
3. N2 (g) + H2 (g) → NH3 (g)
4. C5H12 (g) + O2 (g) → CO2 (g) + H2O (l)

**END OF SHORT ANSWER SECTION**

**Topics on the exam include:**

* Structure of atom, nucleus, protons, electrons, neutrons
* Electron configuration, subshell notation, ground state, excited state
* Trends in the periodic table, explanations for the trends
* Relative Atomic mass/isotopes/mass spectrum data
* Mole, avogadros constant
* Empirical/molecular formula
* Percentage composition
* Metallic bonding model and limitations, properties of metals
* Ionic bonding model, properties of ionic compounds, ionic formulae
* Naming alkanes, alkenes, combustion reactions, esters, addition reactions, structural isomers

Chapters 2, 3, 4, 5, 6, 8 are covered in the exam.

*You will not be allowed any cheat sheets. You will be provided with a periodic table and a data sheet like you had for your first SACT. You will need a calculator.*