**Unit 1 Chemistry 2023 Trial Exam Solutions**

**Section A**

1. B: The fruit waste will be manufactured anyway, so it not using a useful resource. The product is compostable so it has no further impact on the environment. Option A is using a waste material but the process of steel making is still a linear process. Making polyethene from bioethanol is good but it is not a degradable polymer.

2. B: The answer needs to be an ion so argon is not correct.

3. D: Group 1 metals get more reactive as you move down the group.

4. D: carbon is in Group 14, a non-metal and a standard for relative atomic mass

5. D: The properties of compounds are usually different from the elements they are made from.

6. C: CO3 ions are -2, making X3+

7. A: One of hydrogen or oxygen cannot be its usual value and the name ‘per’oxide tells you it is the

 oxygen that has changed.

 8. A: C is not correct as the electrons are not ‘shared’

9: D: Balancing correct

10. B: Ionics will conduct when the ions are free to move.

11. A: 0.1 x 207 = 20.7 g

12. D: Each AlCl3 contains 4 atoms. There are 3 mol and there are 6.02 x 1023 in each mol.



13. B: CH4O2 *M*r = 60 g mol-1

14. B: Ethane is C2H6. The % C is 24/30 x 100 = 80%

15. D: Phosphorous has 5 outer shell electrons so often forms 3 covalent bonds.

16. B: All alkenes have the empirical formula CH2

17. A: Hydrogen bonds require hydrogen to be bonded to fluorine, oxygen or nitrogen. Ethanol is the only option where this is the case.

18. B: Monomers used for condensation polymers require functional groups on both ends for a chain to form.

19. C: The longest chain of carbons is 7 not 6.

20. C: Polyvinyl alcohol is formed from ethenol.

 **Section B Short answer**

**Question 1** (6 marks)

**a**. Conclusion 1: the atom is mostly apace 4 marks

Observation that led to this conclusion. Most of the alpha particles passed through easily

Conclusion 2: atoms have a small, positively charged nucleus

Observation that led to this conclusion: occasional drastic rebound of an alpha particle

**b**. 1s22s22p63s23p63d104s24p5  1 mark

**c**.  1 mark

**Question 2** (8 marks)

**a. i**. The amount of energy required to remove the first electron from the outer shell of an element. 1 mark

 **ii**. As you move down the group, the number of electron shells increases and the attraction of the nucleus to

 the outer shell becomes less significant. 2 marks

**b.** This is the atomic radius of the element. It drops as you move across the period due to the increasing core

 charge. 2 marks

**c.**  **i**. Transition metals correspond to the filling of the 5 d orbitals in a shell. 5 orbitals = 10 electrons 1 mark

 **ii**. Each new shell offers further d orbitals to fil 1 mark

**d**. selenium 1 mark

**Question 3** (10 marks)

**a**. **i**. determine the mass of magnesium 0.90 g 1 mark

 **ii**. determine the mass of oxygen in the oxide 0.51 g 1 mark

 **iii**. 0.9/24.3 : 0.51/16 = 0.037 : 0.032 MgO 2 marks

 **iv**. Being experimental data, the ratio is unlikely to be a perfect 1:1. Loss of MgO ash often leads to a low oxygen

 mass. 1 mark

**b**. MgO expected as Mg should lose 2 electrons to form Mg2+ while O should gain 2 electrons to form O2-

 2 marks

**c**. brittle, high MP, non-conductor as solid but conduct electricity as liquid 3 marks

**Question 4** (8 marks)

**a**. **i**. Ba(OH)2 barium hydroxide **ii**. AgBrO4 silver bromate

 **iii**. NH4Cl ammonium chloride **iv**. Na2CO3 sodium carbonate

**b**. **i**. sodium oxide Na2O **ii**. sodium hydroxide NaOH

 iii. aluminium carbonate Al2(CO3)3 **iv**. calcium iodide CaI2

**Question 5** (11 marks)

**a**. 2 marks

**b**. *A*r = 

 = 24.3 2 marks

**c**. Orderly arrangement of Mg2+ ions 3 marks

 surrounded by a sea of electrons.

 The outer shell electrons are delocalised.

**d**. **i**. n = 80/58.3 = 1.37 mol 2 marks

 **ii**. 2.74 1 mark

 **iii**. 2.74 x 6.023 x 1023 =1.65 x 1024 1 mark

**Question 6** (8 marks)

|  |  |  |
| --- | --- | --- |
| Category | molecule | Electron dot diagram |
| V-shape | Water  |  |
| Tetrahedral | Carbon tetrachloride |  |
| Linear | Carbon dioxide |  |
| Pyramidal | Ammonia  |  |

**Question 7** (9 marks)

**a. i**. 1 mark

 **ii**. CH2 1 mark

 **iii**. Ethene is an alkene. Alkenes are an example of a homologous series where the members all have

 similar structures except a -CH2- is added to make the next member. 2 marks



**b**.

 **i**.

 1 mark

 **ii**. LDPE: very branched structure – molecules cannot pack tightly: low density, transparent, soft

 HDPE: linear structure – molecules pack well: higher density, higher MP, opaque, more rigid

 4 marks

**Question 8** (6 marks)

**a**. **i**. graphite : covalent and dispersion 1 mark

 **ii**. diamond : covalent 1 mark

**b**. Graphite: each carbon atom is bonded to 3 others leaving a delocalised electron to carry a current.

 Diamond: no delocalised electrons. 2 marks

**c**. Diamond has a very rigid structure and cannot flex when struck. The very reason for its hardness leads

 to its brittleness. 1 mark

**d**. The forces between each layer of graphite are weak dispersion forces. The layers can slide over each other easily.. 1 mark