**Year 11 ATAR Chemistry**

Task 5: Reactions & Stoichiometry Test

Weighting: 5% of Year Grade

**SECTION A: MULTIPLE CHOICE SECTION (10 marks)**

1. Which of these chemical equations represents an exothermic reaction?
2. CO + H2O 🡪 H2 + CO2 + 41 kJ
3. CH4 + H2O 🡪 CO + 3H2 ΔH = +206 kJ
4. N2O3 + 40 kJ 🡪 NO + NO2
5. **(i) only**
6. (ii) only
7. (i) and (ii)
8. (ii) and (iii)
9. What are the coefficients in this equation once correctly balanced?

\_\_\_ NH3(g) + \_\_\_ O2(g) 🡪 \_\_\_ NO(g) + \_\_\_ H2O(l)

1. 2, 2, 2, 3
2. 1, 3, 1, 2
3. 4, 2, 3, 5
4. **4, 5, 4, 6**
5. According to the Law of Conservation of Mass, the total mass of the reacting substances is:
6. always more than the total mass of the products
7. always less than the total mass of the products
8. sometimes more and sometimes less than the total mass of the products
9. **always equal to the total mass of the products**
10. Which substance is classified as the precipitate in the reaction below?

BaCl2(aq) + K2CrO4(aq) → BaCrO4(s) + 2KCl(aq)

1. Barium Chloride
2. Potassium Chloride
3. **Barium Chromate**
4. Potassium Chromate
5. Which of these is closest to the molar mass of Zn(HSO4)2?
6. 162.5g
7. 94.5g
8. 227.8
9. **259g**
10. The neutralization reaction between hydrochloric acid and sodium hydroxide may be represented as:

**HCl(aq) + NaOH(aq) 🡪 NaCl(aq) + H2O(l) + 57.2kJ**

In this reaction, you would expect the temperature of the resulting solution to:

1. increase, due to the reaction being endothermic.
2. **increase, due to the reaction being exothermic.**
3. decrease, due to the reaction being endothermic.
4. decrease, due to the reaction being exothermic.
5. The molar mass of 2,3-dimethylhexane is closest to:
6. 112 gmol-1
7. **114 gmol-1**
8. 100 gmol-1
9. 142 gmol-1
10. Propane is commonly used as a fuel for portable stoves. It combusts to produce carbon dioxide and water. The reaction is commonly represented as:

**C3H8 (g) + 5O2 (g) 🡪 3CO2 (g) + 4H2O (g)**

Which of the following alternative does NOT accurately represent a correct mole relationship for the above reaction?

1. n(CO2) = 3/5 x n(O2)
2. n(H2O) = 4/5 x n(O2)
3. **n(CO2) = 5/3 x n(O2)**
4. n(H2O) = 4/3 x n(CO2)
5. A solution of copper sulfate that has a volume of 125 mL and a molarity of 0.05 molL-1 contains:
   1. 6.25 moles
   2. 0.0004 moles
   3. **0.00625 moles**
   4. 0.4 moles
6. Avogadro’s number is:
   1. The number of molecules in one mole of a covalent compound
   2. 6.02 x1023
   3. The number of atoms in one mole of an element
   4. **All of the above**

**SECTION B: SHORT ANSWER SECTION (30 marks)**

1. Balance the following chemical equations:

|  |
| --- |
| **1**MnO2 + **4**HCl 🡪 **1**MnCl2 + **2**H2O + **1**Cl2 |
| **2**CH3COOH + **1**Ca(OH)2 🡪 **1**Ca(CH3COO)2 + **2**H2O |
| **5**C + **2**SO2 🡪 **1**CS2 + **4**CO |
| **4**Al + **3**O2 🡪 **2**Al2O3 |

(4 marks)

1. Which of the four types of chemical reactions are represented by the following chemical equations?

Cu + 2HNO3 🡪 Cu(NO3)2 + H2

Type of chemical reaction: **Single Replacement (Displacement)**

C6H12O6 🡪 2C2H5OH + 2CO2

Type of chemical reaction: **Decomposition**

FeCl3 + Na2SO4 🡪 Fe2(SO4)3 + NaCl

Type of chemical reaction: **Double Replacement (Displacement)**

(3 marks)

1. Write a definition for the following categories of chemical reactions:

|  |  |
| --- | --- |
| **Chemical Reaction:** | **Definition:** |
| Condensation | A chemical reaction that results in the production of water |
| Neutralisation | A chemical reaction between an acid and a base |
| Hydrolysis | A chemical reaction when something reacts with water |
| Precipitation | A chemical reaction that results in the production of an insoluble solid |

(4 marks)

1. Draw a typical energy profile diagram which represents a typical exothermic reaction. Label the diagram with:
   1. The change in enthalpy
   2. The position of the reactants
   3. The position of the products
   4. The activation energy (5 marks)

|  |
| --- |
|  |

1. Write chemical formulae and calculate the molar mass of the following: (8 marks)

|  |  |  |
| --- | --- | --- |
| **Name of compound:** | **Chemical formula:** | **Molar mass:** |
| Calcium bromide | **CaBr2** | **(40.1 + (2 x 79.9)) = 199.9 gmol-1** |
| Sodium carbonate | **Na2CO3** | **((23 x 2) + 12 + (3 x 16)) = 106.2 gmol-1** |
| Aluminium oxide | **Al2O3** | **((27 x 2) + (3 x 16)) = 102 gmol-1** |
| Copper(II) sulfide | **CuS** | **((63.55) + (32.1)) = 95.65 gmol-1** |

1. Complete and balance the following chemical equations: (6 marks)

|  |  |  |
| --- | --- | --- |
| a. | 2AgNO3 + Mg 🡪 | Mg(NO3)2 + 2Ag |
| b. | 2C2H6 + 7O2 🡪 | 4CO2 + 6H2O |
| c. | Pb(NO3)2 + 2NaI 🡪 | PbI2 + 2NaNO3 |

**SECTION B: CALCULATION SECTION (12 marks)**

1. Calculate the percentage elemental composition of oxygen in iron(III) sulfate. (3 marks)

**Formula of iron (III) sulfate = Fe2(SO4)3 (1)**

**Formula mass of iron(III) sulfate = (2 x Fe) + (3 x S) + (12 x O)**

**= (2 x 55.85) + (3 x 32.07) + (12 x 16)**

**= 399.88 gmol-1 (1)**

**% O in Fe2(SO4)3 = ((16 x 12) / 399.88) x 100 (1)**

**= (192 / 399.88) x 100**

**= 48.01% (1)**

1. The preparation of iron metal from iron oxide ore can be represented by the equation:

Fe2O3(s) + 3C(s) 🡪 2Fe(s) + 3CO(g)

Each mill pour produces 602kg of pure iron. Calculate:

1. the mass of iron oxide (Fe2O3) ore needed for the pour. (4 marks)

**(Fe) = 55.85 gmol-1**

**n(Fe) = m/M = 602000/55.85 = 10778.9 mol**

**n(Fe2O3) = n(Fe) x ½ = 5389.4 mol**

**m(Fe2O3) = n x M = 5389.4 x 159.69 = 860639.6g or 860.64 kg**

1. the mass of carbon monoxide gas produced each pour. (2 marks)

**n(CO) = n(Fe) x 3/2 = 16168.35 mol**

**m(CO) = n x M = 16168.35 x 28 = 452713.8g or 452.71kg**

1. Calculate the number of molecules in 22.5 grams of pentane. (3 marks)

**M(C5H12) = 72.15 gmol-1**

**n(C5H12) = m / M = 22.5 / 72.15 = 0.3118 mol**

**N(C5H12) = 0.3118 x (6.02 x 1023) = 1.88 x 1023 molecules**

**END OF TEST**