A periodic table needed to complete the test. You have one in your planner.

**1**

**a)** How many moles of nitrogen atoms are there in 14 g? (1)

**b)** How many moles of oxygen atoms are there in 32 g? (1)

**c)** What is the mass of 3 moles of hydrogen atoms? (1)

**d)** What is the mass of 5 moles of oxygen atoms? (1)

**e)** What is the mass of 5 moles of hydrogen molecules? (1)

**2** What is the relative formula mass of the following compounds?

**a)** HCl (1)

**b)** KCl (1)

**c)** NaI (1)

**d)** CH4 (2)

**e)** CaCO3 (2)

**3** How many moles are in each of the following substances?

**a)** 36 g of water (H2O) (2)

**b)** 29 g of magnesium hydroxide (Mg(OH)2) (2)

**4** How many significant figures are the following given to:

**a)** 1.25 g (1)

**b)** 2.567 cm3 (1)

**c)** 0.0001 kg (1)

**d)** 0.7845 m3 (1)

**5** Copper is obtained from the ore malachite (CuCO3) in two stages. First the malachite is heated strongly to form copper oxide and carbon dioxide.

**a)** Write the *word* equation for this reaction. (1)

**b)** What type of reaction is this? (2)

**c)** Write the *balanced* chemical equation for this reaction. (3)

**6** Magnesium burns in oxygen as shown by the equation below:

2Mg(s) + O2 → 2MgO(s)

**a)** What mass of magnesium oxide should be produced if 12 g of Mg burns completely in oxygen? (3)

**b)** If only 5 g of MgO were produced, what is the % yield? (3)

**7** Hydrogen can be made on a large scale by the reaction below:

CH4(g) + H2O(g) → CO(g) + 3H2(g)

**a)** If 2 tonnes of hydrogen is made form 8 tonnes of methane, what is the % yield? (4)

**b)** What is the atom economy of this reaction? (1)

**8** The following is the reaction of sulfur dioxide with oxygen to produce sulfur trioxide:

2SO2(g) + O2(g) → 2SO3(g)

**a)** If 32 g of sulfur dioxide is reacted with oxygen. What volume of oxygen would be needed? (1 mole of a gas occupies 24 dm3). (2)

**b)** If 100 cm3 of sulfur dioxide is used, how much sulfur trioxide is produced? (1)

**9** The volume of an unknown concentration hydrochloric acid solution needed to neutralise 25 cm3 of 0.125 M sodium hydroxide solution can be found by carrying out a titration. Below is a table of results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Rough** | **Titration 1** | **Titration 2** | **Titration 3** |
| First reading (cm3) | 0.15 | 23.05 | 0.00 | 22.10 |
| Second reading (cm3) | 23.20 | 43.15 | 22.10 | 42.25 |
| Volume added (cm3) | 23.05 | 20.10 | 22.10 | 20.15 |

**a)** The average volume added was 20.125 cm3. Why was the second titration ignored when working out the average volume added? (1)

**b)** What is the concentration of the hydrochloric acid? Give your answer to 3 significant figures. (3)

**c)** Describe how you would carry out the titration. You should mention the names of the equipment used. (6)

Total = 50

**Answers**

**1**

**a)** 1 mole (1)

**b)** 2 moles (1)

**c)** 3 g (1)

**d)** 80 g (1)

**e)** 10 g (1)

**2**

**a)** 36.5 (1)

**b)** 74.5 (1)

**c)** 150 (1)

**d)** 16 (2)

**e)** 100 (2)

**3**

**a)** 2 moles (2)

**b)** 0.5 moles (2)

**4**

**a)** 3 significant figures (1)

**b)** 4 significant figures (1)

**c)** 1 significant figure (1)

**d)** 4 significant figures (1)

**5**

**a)** Malachite (copper carbonate) → copper oxide + carbon dioxide (1)

**b)** Thermal decomposition (2)

**c)** CuCO3 → CO2 + CuO (LHS = 1, RHS = 1, rest = 1)

**6**

**a)**  = 0.5 moles (1); therefore 0.5 moles of MgO produced (1) = 20 g (1)

**b)**  = 0.25 (1); 0.25 × 100 (1) = 25% (1)

**7**

**a)**  = 0.5 moles of methane (1) produces 3 × 0.5 = 1.5 moles of hydrogen (1)

1.5 moles of H2 = 3 tonnes (1); 5 yield =  × 100 = 66% (1)

**b)**  = 0.17647; 0.17647 × 100 = 17.65% (1)

**8**

**a)**  = 0.5 moles of SO2; need  = 0.25 moles of O2 (1); 0.25 × 24 = 6 dm3 (2)

**b)** 100 cm3 (1)

**9**

**a)** It is far away from the other two readings and treated as an outlier/rough/guide. (1)

**b)** 0.125 × 25 = Conc × 20.125 (1)

X =  (1) = 0.155 M HCl (1)

**c)**

|  |  |
| --- | --- |
| Marks |  |
| 6–5 | At least three different points well expressed |
| 4–3 | A couple of points mentioned |
| 2–1 | Not much detail |

* The HCl is placed into a burette.
* A reading is taken.
* The sodium hydroxide is measured into a conical flask using a pipette.
* A suitable indicator will change colour when the alkali has been neutralised.
* The acid is then dropped into the base.
* The flask should be gently swirled to mix the solutions.
* The acid should stop being added when the solution in the flask has changed showing that all the base has been neutralised.
* A reading is then taken.
* Rough titration is repeated until two close readings are obtained.

Total = 50