

### **CHEMISTRY** DEPARTMENT OF SCIENCE

Name:	 (	)	Class:	SEC 3

## CHEMICAL CALCULATIONS – ASSIGNMENT

## Multiple-Choice Questions [20 Marks]

TOTAL SCORE / 30

Write in your selected answer for the multiple-choice questions in the boxes provided.



- 1. Which of the following statements about relative atomic mass is the **least correct**?
  - **A** It is measured in grams.
  - **B** It is compared to one-twelfth the mass of a carbon-12 atom.
  - **C** It is the average number of protons and neutrons in an element.
  - **D** It measures the average relative mass *per atom*.
- 2. The Avogadro constant is the number of
  - **A** atoms in 6 g of graphite molecules in 1 g of hydrogen gas С **B** electrons in 10 g of neon
    - protons in 2 g of helium D
- 3. If the number of similar particles in one mole is  $\mathbf{x}$ , the number of chlorine molecules in 35.5 g of gaseous chlorine is

Α	0.5 <b>x</b>	Вх	<b>C</b> 2 <b>x</b>	<b>D</b> 35.5 <b>x</b>

- 4. The chloride of an unknown element **E** has a relative atomic mass of 136. Which of the following is most likely to be the formula for this chloride?
  - A ECI **B**  $E_2Cl$ **C**  $ECl_2$ D ECl<sub>3</sub>
- 5. What is the mass of one mole of anhydrous aluminium sulfate?

A	123 grams	В	170 grams	С	278 grams	D	342 grams
---	-----------	---	-----------	---	-----------	---	-----------

6. What is the relative molecular mass of copper(II) sulfate crystals, CuSO<sub>4</sub>.5H<sub>2</sub>O?

<b>A</b> 16	60	В	178	С	234	D	250
-------------	----	---	-----	---	-----	---	-----

7.	When two moles of magnesium metal becomes ions,								
	A B	two moles of electro two moles of electro	are gained. are lost.	C D	four moles of electrons are gained. four moles of electrons are lost.				
8.	Wh	ich of the following	cont	ains 2 moles of <b>aton</b>	ns?				
	A	12 g of carbon	В	12 g of helium	С	12 g of methane	D	12 g of water	
9.	0.2 the	mol of an unknown compound <b>M</b> Cl <sub>n</sub> . W	eler hat	nent <b>M</b> combines wi is the value of <b>n</b> ?	th 7.	.2 dm <sup>3</sup> of chlorine (m	neas	ured at r.t.p.) to form	
	Α	1	В	2	С	3	D	4	
10.	In !	50 grams of calcium	cart	oonate, there are <b>x</b> o	xyg	en atoms present. W	hat	is <b>x</b> ?	
	A	0.5 mol	В	1.5 mol	С	2.5 mol	D	3.0 mol	
11.	In 3	33 grams of $(NH_4)_2S_1$	04, t	here are <b>y</b> ions pres	ent.	What is <b>y</b> ?			
	A	0.75 mol	В	2.3 mol	С	3.0 mol	D	3.8 mol	

12. When ethanol is combusted in excess oxygen, the following reaction takes place:

# $C_2H_5OH(I) + 3 O_2(g) \longrightarrow 2 CO_2(g) + 3 H_2O(g)$

What volume of water vapour is formed, at r.t.p., when 1.0 kilogram of ethanol is combusted?

**A** 
$$\frac{46 \times 3 \times 24}{1000}$$
 dm<sup>3</sup> **B**  $\frac{46 \times 24}{1000 \times 3}$  dm<sup>3</sup> **C**  $\frac{1000 \times 3 \times 24}{46}$  dm<sup>3</sup> **D**  $\frac{1000 \times 24}{46 \times 3}$  dm<sup>3</sup>

13. In the equation below, methane reacts with steam to form hydrogen and carbon monoxide:

 $CH_4(g) + H_2O(g) \longrightarrow CO(g) + 3 H_2(g)$ 

The volume of hydrogen that can be obtained from 100 cm<sup>3</sup> of methane at r.t.p. is

- **A** 100 cm<sup>3</sup>. **B** 150 cm<sup>3</sup>. **C** 200 cm<sup>3</sup>. **D** 300 cm<sup>3</sup>.
- 14. What volume of oxygen gas, measured under room conditions, is needed to completely combust 3.60 grams of carbon into carbon dioxide?
  - **A** 2,700 cm<sup>3</sup> **B** 3,600 cm<sup>3</sup> **C** 7,200 cm<sup>3</sup> **D** 14,400 cm<sup>3</sup>
- 15. What volume of 0.120 mol dm<sup>-3</sup> hydrochloric acid is need to completely react with 0.60 grams of magnesium metal?
  - **A** 208 cm<sup>3</sup> **B** 417 cm<sup>3</sup> **C** 600 cm<sup>3</sup> **D** 820 cm<sup>3</sup>

- 16. What is the concentration of ions, in mol/dm<sup>3</sup>, in 39.2 g/dm<sup>3</sup> sulfuric acid?
  - **A** 0.400 **B** 1.20 **C** 1.64 **D** 13.0
- 17. What is the minimum volume of 0.100 mol dm<sup>-3</sup> sodium hydroxide needed to completely neutralise 22.50 cm<sup>3</sup> of 0.250 mol dm<sup>-3</sup> sulfuric acid in the reaction below?

2 NaOH (aq) + 
$$H_2SO_4$$
 (aq)  $\longrightarrow$  Na<sub>2</sub>SO<sub>4</sub> (aq) + 2 H2O (I)

**A** 1.13 cm<sup>3</sup> **B** 9.00 cm<sup>3</sup> **C** 45.0 cm<sup>3</sup> **D** 113 cm<sup>3</sup>

18. In an industrial process, 42.5 g of ammonia was allowed to react with 72 dm<sup>3</sup> of oxygen (measured at room conditions) to form nitrogen monoxide and water vapour.

$$4 \text{ NH}_3(g) + 5 \text{ O}_2(g) \longrightarrow 4 \text{ NO}(g) + 6 \text{ H}_2\text{O}(g)$$

Which is the limiting reagent in the above reaction?

- 19. Iron metal, when burnt in dry chlorine, forms iron(III) chloride.

Suppose if 1.8 dm<sup>3</sup> of chlorine is allowed to react with 1.4 grams of iron, what is the maximum mass of iron(III) chloride that can be formed?

Α	4.1 grams	В	8.1 grams	С	12.2 grams	D	16.3 grams
			5		5		5

- 20. If 36 dm<sup>3</sup> of hydrogen were allowed to react with 32 grams of oxygen, what is the maximum mass of water that can be produced?
  - **A** 27 grams **B** 32 grams **C** 36 grams **D** 72 grams

### Structured Questions [10 Marks]

- 21. A 4.00 g sample of copper(II) carbonate was allowed to react with 0.750 mol dm<sup>-3</sup> nitric acid.
  - (a) Construct a chemical equation, including state symbols, for the reaction. [1]
  - (b) Find the number of moles of copper(II) carbonate present in the 4.00 g sample. [1]

(c) Hence find the volume of nitric acid needed.

22. When solutions of iron(II) nitrate and sodium hydroxide are mixed, a green precipitate of iron(II) hydroxide is formed. In an experiment, a student mixes a 5.0 cm<sup>3</sup> sample of 0.250 mol dm<sup>-3</sup> iron(II) nitrate with a 10 cm<sup>3</sup> sample of 0.200 mol dm<sup>-3</sup> sodium hydroxide.

(a)	Construct a chemical equation, including state symbols, for the reaction.	[1]
(b)	By showing the relevant working, identify the limiting reagent.	[3]

(c) Hence calculate the mass of precipitate formed.

[2]

END