

Chemistry
Standard level
Paper 1A

Practice paper

Topic: Stoichiometric Relationships (Topic 1)

1. What is the number of hydrogen atoms in 0.5 moles of CH_4 ?
 - A. 3.01×10^{23}
 - B. 6.02×10^{23}
 - C. 1.20×10^{24}
 - D. 2.41×10^{24}

2. Which of the following contains the greatest amount of oxygen atoms?
 - A. 1 mole of CO_2
 - B. 1 mole of H_2O
 - C. 1 mole of O_3
 - D. 2 moles of NO

3. What is the molar mass of $\text{Mg}_3(\text{PO}_4)_2$ in g mol^{-1} ?
(Mg=24.31, P=30.97, O=16.00)
 - A. 262.87
 - B. 119.28
 - C. 214.24
 - D. 182.90

4. Which of the following is an empirical formula?
 - A. C_2H_4
 - B. $\text{C}_6\text{H}_{12}\text{O}_6$
 - C. CH_2O
 - D. H_2O_2

5. A compound has an empirical formula of CH_2 and a molar mass of 56 g mol^{-1} . What is its molecular formula?
 - A. CH_2
 - B. C_2H_4
 - C. C_3H_6
 - D. C_4H_8

6. 2.0 g of hydrogen gas reacts with 16.0 g of oxygen gas to form water. Which reactant is in excess and by how much?
 - A. H_2 is in excess by 1.0 g
 - B. O_2 is in excess by 4.0 g
 - C. H_2 is in excess by 0.5 g
 - D. O_2 is in excess by 2.0 g

7. What volume, in dm^3 , does 0.25 moles of an ideal gas occupy at STP?
(Standard molar volume = $22.7 \text{ dm}^3 \text{ mol}^{-1}$)
- A. 5.68
 - B. 5.60
 - C. 11.35
 - D. 22.7
8. Which expression represents the percentage yield of a reaction?
- A. $(\text{Actual Yield} / \text{Theoretical Yield}) \times 100$
 - B. $(\text{Theoretical Yield} / \text{Actual Yield}) \times 100$
 - C. $(\text{Theoretical Yield} - \text{Actual Yield}) \times 100$
 - D. $(\text{Actual Yield} / \text{Molar Mass}) \times 100$
9. What is the concentration, in mol dm^{-3} , of a solution made by dissolving 5.85 g of NaCl in 500 cm^3 of water?
(Na=22.99, Cl=35.45)
- A. 0.01
 - B. 0.10
 - C. 0.20
 - D. 0.50
10. Which statements about the ideal gas law ($PV = nRT$) are correct?
- I. P must be in kPa
 - II. V must be in dm^3
 - III. T must be in Kelvin
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
11. 10.0 cm^3 of 0.10 mol dm^{-3} HCl reacts with 20.0 cm^3 of 0.05 mol dm^{-3} NaOH. What is the pH of the resulting solution?
- A. 1
 - B. 7
 - C. 14
 - D. 4
12. What mass of anhydrous Na_2CO_3 (M=106) is needed to prepare 250 cm^3 of a $0.100 \text{ mol dm}^{-3}$ solution?
- A. 2.65 g
 - B. 10.6 g

- C. 26.5 g
- D. 1.06 g

13. Which of the following gas samples would have the highest pressure at constant volume and temperature?

- A. 1 g of H₂
- B. 1 g of He
- C. 1 g of N₂
- D. 1 g of O₂

14. What is the empirical formula of a hydrocarbon containing 80% carbon and 20% hydrogen by mass?

- A. CH
- B. CH₂
- C. CH₃
- D. C₂H₃

15. Avogadro's law states that equal volumes of gases at the same temperature and pressure contain equal numbers of:

- A. Atoms
- B. Ions
- C. Molecules
- D. Protons

16. Which value is the molar volume of a gas at 273 K and 100 kPa?

- A. 22.4 dm³ mol⁻¹
- B. 22.7 dm³ mol⁻¹
- C. 24.8 dm³ mol⁻¹
- D. 1.00 dm³ mol⁻¹

17. How many moles of solute are present in 25.0 cm³ of 2.0 mol dm⁻³ sulfuric acid?

- A. 0.025
- B. 0.050
- C. 0.50
- D. 50.0

18. Which statement is true for the reaction: $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g})$?

- A. 2 dm³ of CO reacts with 2 dm³ of O₂
- B. 1 dm³ of O₂ produce 2 dm³ of CO₂
- C. 1 mole of reactants produce 1 mole of products

D. The total mass of gas decreases

19. What is the percentage by mass of nitrogen in urea, $(\text{NH}_2)_2\text{CO}$? (N=14, H=1, C=12, O=16)

- A. 23.3%
- B. 46.7%
- C. 33.3%
- D. 28.0%

20. Which of the following represents the correct unit for the ideal gas constant R when P is in Pa and V is in m^3 ?

- A. $\text{J K}^{-1} \text{mol}^{-1}$
- B. $\text{dm}^3 \text{kPa K}^{-1} \text{mol}^{-1}$
- C. $\text{dm}^3 \text{atm K}^{-1} \text{mol}^{-1}$
- D. $\text{L bar K}^{-1} \text{mol}^{-1}$

21. Which factors affect the molar volume of an ideal gas?

- I. Temperature
 - II. Pressure
 - III. The identity of the gas
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

22. If the pressure of a fixed mass of gas is doubled and the absolute temperature is halved, what happens to the volume?

- A. It stays the same
- B. It increases by a factor of 4
- C. It decreases by a factor of 4
- D. It doubles

23. 5.0 g of a hydrated salt is heated until the mass is constant at 3.2 g. What was the percentage of water in the original salt?

- A. 32%
- B. 18%
- C. 36%
- D. 64%

24. Which of the following contains the same number of atoms as 12.01 g of Carbon-12?

- A. 1.01 g of H₂
- B. 4.00 g of He
- C. 23.00 g of Na
- D. 32.00 g of O₂

25. What is the atom economy for the production of hydrogen in the reaction: CH₄ + H₂O → CO + 3H₂?

(C=12, H=1, O=16)

- A. 18.2%
- B. 17.6%
- C. 50.0%
- D. 33.3%

26. A 0.500 g sample of a hydrate of MgSO₄ containing 7 molecules of water (M=246) is heated. Which mass of anhydrous salt remains?

- A. 0.244 g
- B. 0.500 g
- C. 0.122 g
- D. 0.350 g

27. What volume of CO₂(g) is produced when 10 g of CaCO₃ is decomposed at STP?

(CaCO₃ = 100 g/mol)

- A. 2.27 dm³
- B. 1.00 dm³
- C. 22.7 dm³
- D. 0.10 dm³

28. Standard solution preparation requires which piece of glassware for the highest precision?

- A. Beaker
- B. Graduated cylinder
- C. Volumetric flask
- D. Erlenmeyer flask

29. Which of the following is true for an ideal gas?

- I. Particles have negligible volume
 - II. No intermolecular forces exist
 - III. Collisions are perfectly elastic
- A. I and II only
 - B. I and III only

- C. II and III only
- D. I, II and III

30. Which solution has the highest concentration of Cl^- ions?

- A. 100 cm^3 of $0.10 \text{ mol dm}^{-3} \text{ NaCl}$
- B. 50 cm^3 of $0.10 \text{ mol dm}^{-3} \text{ CaCl}_2$
- C. 200 cm^3 of $0.05 \text{ mol dm}^{-3} \text{ AlCl}_3$
- D. 10 cm^3 of $0.50 \text{ mol dm}^{-3} \text{ HCl}$