Advanced Biochemistry Calculation Questions

Essay / Calculation Type Questions

Questions:

1. Calculate the number of grams of NaCl required to prepare 250 mL of a 0.5 M NaCl solution. (MW NaCl = 58.44 g/mol).

2. How many moles of KCl are present in 300 mL of a 0.75 M solution?

3. Prepare 100 mL of 10% (w/v) glucose solution. How many grams of glucose are needed?

4. How many milliliters of a 5 M HCl stock solution are required to prepare 250 mL of 0.5 M HCl?

5. Calculate the molarity of a solution prepared by dissolving 11.7 g NaCl in 500 mL solution. (MW NaCl = 58.5 g/mol).

6. Calculate the normality of a 1 M H2SO4 solution.

7. Calculate the molarity of a 0.5 N H2SO4 solution.

8. How many grams of NaCl are required to prepare 50 mL of a 20% (w/v) solution?

9. How many milliliters of 10X buffer are required to prepare 40 mL of 1X buffer?

10. How many grams of KCl are required to prepare 1 L of 0.2 M KCl? (MW = 74.55 g/mol).

11. You dilute 5 mL of a 10% solution to a final volume of 25 mL. What is the final concentration?

12. Convert 150 mM solution to molarity (M).

13. Calculate the number of moles in 200 mL of a 3 M solution.

14. A 1 mg/mL stock solution is diluted 1:1000. What is the final concentration?

15. How much stock solution (50X) is required to prepare 200 mL of 1X buffer?

Answer Key with Detailed Solutions

1. Volume = 250 mL = 0.25 L.
Moles = M × V = 0.5 × 0.25 = 0.125 mol.
Mass = moles × molecular weight = 0.125 × 58.44 = 7.305 g.
Final answer: approximately 7.31 g NaCl.

2. Volume = 300 mL = 0.3 L.
Moles = M × V = 0.75 × 0.3 = 0.225 mol.
Final answer: 0.225 mol KCl.

3. A 10% (w/v) solution means 10 g solute per 100 mL solution.
Therefore for 100 mL:
Required mass = 10 g.
Final answer: 10 g glucose.

4. Use dilution formula C1V1 = C2V2.
5 × V1 = 0.5 × 250
5V1 = 125
V1 = 25 mL stock.
Diluent required = 250 − 25 = 225 mL.
Final answer: 25 mL stock + 225 mL water.

5. Moles = mass / molecular weight = 11.7 / 58.5 = 0.2 mol.
Volume = 500 mL = 0.5 L.
Molarity = moles / volume = 0.2 / 0.5 = 0.4 M.
Final answer: 0.4 M.

6. For H_2SO_4 the number of replaceable H^+ ions (n) = 2.
Normality formula: N = n × M.
N = 2 × 1 = 2 N.
Final answer: 2 N.

7. Use formula N = n × M.
0.5 = 2 × M
M = 0.25 M.
Final answer: 0.25 M.

8. 20% (w/v) means 20 g per 100 mL.
For 50 mL:
(20 / 100) × 50 = 10 g.
Final answer: 10 g NaCl.

9. Use dilution equation:
10 × V1 = 1 × 40
V1 = 4 mL.
Diluent = 40 − 4 = 36 mL.
Final answer: 4 mL stock + 36 mL water.

10. Moles = M × V = 0.2 × 1 = 0.2 mol.
Mass = moles × MW = 0.2 × 74.55 = 14.91 g.
Final answer: 14.91 g KCl.

11. Use C1V1 = C2V2.
10 × 5 = C2 × 25
50 = 25C2
C2 = 2%.
Final answer: 2%.

12. 1 mM = 10^-3 M.
150 mM = 150 × 10^-3 = 0.150 M.
Final answer: 0.150 M.

13. Volume = 200 mL = 0.2 L.
Moles = M × V = 3 × 0.2 = 0.6 mol.
Final answer: 0.6 mol.

14. 1 mg/mL diluted 1:1000 means concentration decreases by factor 1000.
1 mg/mL ÷ 1000 = 0.001 mg/mL.
0.001 mg/mL = 1 µg/mL.
Final answer: 1 µg/mL.

15. Use dilution equation:
50 × V1 = 1 × 200
V1 = 4 mL stock.
Diluent = 200 − 4 = 196 mL.
Final answer: 4 mL stock + 196 mL diluent.