S5 Chemistry Practice Paper | mole and concentration, acid-base titration, electrolysis and charge, reaction rate, neutralisation enthalpy, molar volume

Senior Secondary Chemistry

S5 Chemistry practice paper with answers: molar mass, titration, electrolysis and charge, reaction rate and temperature, neutralisation enthalpy and molar gas volume.

Question 1 Molar mass and concentration

5.30 g of anhydrous sodium carbonate (Na2CO3) is dissolved in distilled water and made up to 250 cm3 in a volumetric flask. (Relative atomic masses: Na = 23.0, C = 12.0, O = 16.0)

#	Question
1	(a) Find the molar mass of Na2CO3 and the number of moles in 5.30 g.
2	(b) Find the concentration of the solution in mol/dm3.
3	(c) 25.0 cm3 of the solution is taken. Find the number of moles of sodium ions.
4	(d) To prepare 500 cm3 of 0.100 mol/dm3 solution, what mass of Na2CO3 is needed? State one key step when making up to the mark.

Question 2 Titration with sodium carbonate

25.0 cm3 of 0.100 mol/dm3 sodium carbonate standard solution is titrated with hydrochloric acid of unknown concentration; 24.0 cm3 of the acid is needed for complete neutralisation. Na2CO3 + 2HCl gives 2NaCl + H2O + CO2.

#	Question
5	(a) Find the moles of sodium carbonate and the concentration of the acid.
6	(b) If 0.150 mol/dm3 acid is used instead, what volume is needed for the same aliquot?
7	(c) If the acid is added only to the first equivalence point (forming NaHCO3), what volume is needed?
8	(d) If the pipette is rinsed with distilled water but not with the carbonate solution, how is the calculated acid concentration affected?

Question 3 Electrolysis and quantity of charge

A current of 2.00 A is passed through copper(II) sulphate solution for 30.0 minutes. (Faraday constant 96500 C/mol, Cu = 63.5, Ag = 108)

#	Question
9	(a) Find the quantity of charge passed and the moles of electrons.
10	(b) The cathode reaction is Cu2+ + 2e- gives Cu. Find the mass of copper deposited.
11	(c) With the same charge, what mass of silver is deposited from silver nitrate solution?
12	(d) At 3.00 A, how long is needed to deposit 3.175 g of copper?

Question 4 Rate of reaction and temperature

Magnesium reacts with dilute hydrochloric acid and the hydrogen is collected. 48.0 cm3 is collected in the first 40 s; the reaction finishes in 120 s with 168 cm3 in total.

#	Question
13	(a) Find the average rate over the first 40 s in cm3/s.
14	(b) Find the average rate for the whole reaction and explain the higher initial rate.
15	(c) Replacing the magnesium ribbon with the same mass of magnesium powder, how does the rate change? Explain.
16	(d) The rate roughly doubles for every 10 C rise. From 20 C to 40 C, by what factor does the rate increase and what is the new completion time?

Question 5 Enthalpy of neutralisation

50.0 cm3 of 1.00 mol/dm3 hydrochloric acid is mixed with 50.0 cm3 of 1.00 mol/dm3 sodium hydroxide in a polystyrene cup; the temperature rises from 25.0 C to 31.8 C. Assume a density of 1.00 g/cm3 and a specific heat capacity of 4.2 J/(g C).

#	Question
17	(a) Find the heat released in kJ.
18	(b) Find the molar enthalpy change of neutralisation.
19	(c) If 0.50 mol/dm3 acid and alkali are used instead, what temperature rise is expected?
20	(d) Replacing the acid with ethanoic acid of the same concentration and volume, would the magnitude of the enthalpy change be larger or smaller? Explain.

Question 6 Molar volume of gases

At room temperature and pressure the molar volume of a gas is 24.0 dm3/mol. (C = 12.0, O = 16.0, Mg = 24.0)

#	Question
21	(a) Find the moles and mass of 4.80 dm3 of carbon dioxide at room conditions.
22	(b) 6.00 g of magnesium reacts completely with excess dilute acid. Find the volume of hydrogen at room conditions.
23	(c) 2.00 mol of nitrogen is mixed with 3.00 mol of oxygen. Find the total volume at room conditions and the mole fraction of nitrogen.
24	(d) What volume would the same 0.200 mol of gas occupy at s.t.p., where the molar volume is 22.4 dm3/mol?