

A-Level Chemistry Practice Test 8

60 original multiple-choice questions in AQA / Edexcel / OCR exam style (AS + A2). Choose one answer for each question. The full answer key is on the last page — worked explanations for every question are free at QuaidianPoint.com.

Name: _____ Class: _____ Score: _____ / 60

Atomic Structure & Periodicity

Q1. A sample of magnesium contains 79.0% of ^{24}Mg , 10.0% of ^{25}Mg and 11.0% of ^{26}Mg . What is the relative atomic mass of magnesium in this sample?

- (A) 24.0
- (B) 25.0
- (C) 24.8
- (D) 24.3

Q2. The first ionisation energy of aluminium is lower than that of magnesium, even though aluminium has a greater nuclear charge. This is because in aluminium...

- (A) the outer electron is removed from a 3p orbital, which is higher in energy than the 3s orbital
- (B) there are more electron shells shielding the outer electron
- (C) the nuclear charge is actually smaller
- (D) the outer electron is paired, and electron–electron repulsion lowers the ionisation energy

Q3. How many unpaired electrons are there in a chromium atom? (Cr has the electron configuration $[\text{Ar}] 3d^5 4s^1$)

- (A) 4
- (B) 5
- (C) 6
- (D) 3

Q4. Which element shows the largest increase between its first and second ionisation energies?

- (A) Magnesium
- (B) Sodium
- (C) Aluminium
- (D) Calcium

Q5. In a time-of-flight mass spectrometer, singly charged ions are accelerated and travel along a flight tube. Which ion reaches the detector last?

- (A) An ion with $m/z = 28$
- (B) An ion with $m/z = 32$
- (C) An ion with $m/z = 40$
- (D) An ion with $m/z = 44$

Amount of Substance

Q6. What amount of gas is present in 480 cm³ of a gas measured at room temperature and pressure? (Molar volume of a gas at r.t.p. = 24.0 dm³ mol⁻¹)

- (A) 0.0200 mol
- (B) 0.500 mol
- (C) 0.00200 mol
- (D) 20.0 mol

Q7. A volume of 20.0 cm³ of 0.125 mol dm⁻³ sodium hydroxide solution is needed to neutralise 25.0 cm³ of hydrochloric acid. What is the concentration of the acid?

- (A) 0.0800 mol dm⁻³
- (B) 0.100 mol dm⁻³
- (C) 0.125 mol dm⁻³
- (D) 0.156 mol dm⁻³

Q8. What is the percentage by mass of nitrogen in ammonium nitrate, NH₄NO₃? (Mr of NH₄NO₃ = 80)

- (A) 17.5%
- (B) 70.0%
- (C) 35.0%
- (D) 28.0%

Q9. A gas sample contains 0.500 mol of gas in a volume of 10.0 dm³ at 300 K. What is the pressure of the gas? (R = 8.31 J K⁻¹ mol⁻¹)

- (A) 12.5 kPa
- (B) 250 kPa
- (C) 62.5 kPa
- (D) 125 kPa

Q10. Magnesium reacts with hydrochloric acid: Mg(s) + 2HCl(aq) → MgCl₂(aq) + H₂(g). A mixture contains 0.200 mol of Mg and 0.300 mol of HCl. How many moles of hydrogen are formed?

- (A) 0.150 mol
- (B) 0.200 mol
- (C) 0.300 mol
- (D) 0.100 mol

Q11. A solution is made by dissolving 5.85 g of sodium chloride (Mr = 58.5) in water and making the volume up to 500 cm³. What is the concentration of the solution?

- (A) 0.100 mol dm⁻³
- (B) 0.400 mol dm⁻³
- (C) 0.200 mol dm⁻³
- (D) 0.0500 mol dm⁻³

Bonding & Structure

Q12. What are the shape and H–N–H bond angle in an ammonia molecule, NH₃?

- (A) Trigonal planar, 120°
- (B) Trigonal pyramidal, 107°
- (C) Tetrahedral, 109.5°
- (D) Bent, 104.5°

Q13. Which substance has the highest melting point?

- (A) Carbon dioxide
- (B) Water
- (C) Methane
- (D) Sodium chloride

Q14. Which ionic compound has the most exothermic lattice enthalpy?

- (A) MgO
- (B) NaCl
- (C) KBr
- (D) NaF

Q15. Which intermolecular forces exist between molecules of iodine, I₂?

- (A) Hydrogen bonds
- (B) Permanent dipole–dipole forces
- (C) Van der Waals forces
- (D) Ionic attractions

Q16. What is the shape of an SF₆ molecule?

- (A) Tetrahedral
- (B) Octahedral
- (C) Square planar
- (D) Trigonal bipyramidal

Q17. Ice is less dense than liquid water because...

- (A) the covalent bonds in water molecules are longer in ice
- (B) air is trapped between the molecules in ice
- (C) water molecules contract when they freeze
- (D) hydrogen bonding holds the molecules in an open lattice structure

Energetics & Thermodynamics

Q18. A student burns 0.500 g of ethanol (Mr = 46.0) and uses the energy released to heat 200 g of water, raising its temperature by 11.0 K. What is the enthalpy of combustion calculated from these results? (Specific heat capacity of water = 4.18 J g⁻¹ K⁻¹)

- (A) –1370 kJ mol⁻¹
- (B) –423 kJ mol⁻¹
- (C) –846 kJ mol⁻¹
- (D) –92 kJ mol⁻¹

Q19. Use mean bond enthalpies to calculate the enthalpy change for $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$. (Bond enthalpies / kJ mol^{-1} : $\text{N}\equiv\text{N} = 945$, $\text{H}-\text{H} = 436$, $\text{N}-\text{H} = 391$)

- (A) -93 kJ mol^{-1}
- (B) $+93 \text{ kJ mol}^{-1}$
- (C) $-46.5 \text{ kJ mol}^{-1}$
- (D) $-1119 \text{ kJ mol}^{-1}$

Q20. Which sample has the greatest entropy?

- (A) 1 mol of $\text{H}_2\text{O}(\text{s})$
- (B) 1 mol of $\text{H}_2\text{O}(\text{g})$
- (C) 1 mol of $\text{H}_2\text{O}(\text{l})$
- (D) 1 mol of $\text{NaCl}(\text{s})$

Q21. A reaction has $\Delta H = +50 \text{ kJ mol}^{-1}$ and $\Delta S = +200 \text{ J K}^{-1} \text{ mol}^{-1}$. At which temperatures is the reaction feasible?

- (A) Below 250 K
- (B) At no temperature
- (C) At all temperatures
- (D) Above 250 K

Q22. Equal volumes (25.0 cm^3) of 2.00 mol dm^{-3} hydrochloric acid and 2.00 mol dm^{-3} sodium hydroxide are mixed in a polystyrene cup. What is the temperature rise? (Enthalpy of neutralisation = $-57.0 \text{ kJ mol}^{-1}$; specific heat capacity of the mixture = $4.18 \text{ J g}^{-1} \text{ K}^{-1}$; density = 1.00 g cm^{-3})

- (A) 6.9 K
- (B) 27.4 K
- (C) 13.7 K
- (D) 57.0 K

Q23. Which statement correctly describes the standard enthalpy of combustion of a substance?

- (A) The enthalpy change when 1 mol of the substance burns completely in oxygen under standard conditions
- (B) The enthalpy change when 1 mol of the substance is formed from its elements under standard conditions
- (C) The enthalpy change when 1 mol of gaseous atoms is formed from the substance
- (D) The enthalpy change when an acid and an alkali react to form 1 mol of water

Kinetics & Rate Equations

Q24. In a kinetics experiment, tripling the concentration of reactant A (with all other concentrations constant) increased the initial rate by a factor of 9. What is the order of reaction with respect to A?

- (A) Zero
- (B) Second
- (C) First
- (D) Third

Q25. In the Arrhenius equation, $k = A e^{(-E_a/RT)}$. Which change will decrease the value of the rate constant k ?

- (A) Increasing the temperature
- (B) Increasing the pre-exponential factor A
- (C) Decreasing the activation energy
- (D) Increasing the activation energy

Q26. A first-order reaction has a rate constant $k = 0.0231 \text{ s}^{-1}$. What is the half-life of the reaction?

- (A) 3.0 s
- (B) 43 s
- (C) 30 s
- (D) 0.033 s

Q27. For a zero-order reaction, rate = k . What are the units of k ?

- (A) $\text{mol dm}^{-3} \text{ s}^{-1}$
- (B) s^{-1}
- (C) $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$
- (D) It has no units

Q28. A Maxwell–Boltzmann distribution curve is drawn for a gas at a higher temperature. Compared with the original curve, the new curve has...

- (A) a higher peak shifted to the left
- (B) a lower peak shifted to the right, with the same total area
- (C) a larger total area under the curve
- (D) the same peak position but a lower activation energy

Equilibria (K_c & K_p)

Q29. For the equilibrium $\text{P(g)} \rightleftharpoons 2\text{Q(g)}$, the equilibrium concentrations are $[\text{P}] = 0.50 \text{ mol dm}^{-3}$ and $[\text{Q}] = 1.00 \text{ mol dm}^{-3}$. What is the value of K_c ?

- (A) 0.50 mol dm^{-3}
- (B) 1.00 mol dm^{-3}
- (C) 4.00 mol dm^{-3}
- (D) 2.00 mol dm^{-3}

Q30. The synthesis of ammonia is exothermic: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$. What is the effect of increasing the temperature on the value of K_c ?

- (A) K_c increases
- (B) K_c does not change
- (C) K_c decreases
- (D) K_c changes only if a catalyst is present

Q31. An equilibrium mixture at a total pressure of 200 kPa contains ammonia with a mole fraction of 0.40. What is the partial pressure of ammonia in the mixture?

- (A) 40 kPa
- (B) 80 kPa
- (C) 120 kPa
- (D) 500 kPa

Q32. The Haber process is operated at about 450 °C and 200 atm with an iron catalyst, even though a lower temperature would give a higher equilibrium yield of ammonia. Why is 450 °C used?

- (A) It is a compromise temperature that gives an acceptable yield in a reasonable time
- (B) It gives the maximum possible equilibrium yield
- (C) The iron catalyst only works at exactly 450 °C
- (D) It is the cheapest temperature to maintain

Q33. What are the units of K_p for the equilibrium $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$?

- (A) kPa
- (B) No units
- (C) kPa^2
- (D) kPa^{-1}

Redox & Electrode Potentials

Q34. What is the oxidation state of sulfur in H_2SO_4 ?

- (A) +6
- (B) +4
- (C) -2
- (D) +2

Q35. The standard electrode potentials are: $\text{Fe}^{3+}/\text{Fe}^{2+} = +0.77 \text{ V}$; $\text{Br}_2/\text{Br}^- = +1.09 \text{ V}$; $\text{Cl}_2/\text{Cl}^- = +1.36 \text{ V}$; $\text{I}_2/\text{I}^- = +0.54 \text{ V}$. Which is the strongest oxidising agent?

- (A) Fe^{3+}
- (B) Br_2
- (C) Cl_2
- (D) I_2

Q36. What is the EMF of a cell combining a magnesium electrode with a copper electrode? ($E: \text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}$; $\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$)

- (A) 2.03 V
- (B) 2.71 V
- (C) -2.71 V
- (D) 2.37 V

Q37. Concentrated sodium chloride solution is electrolysed using inert electrodes. What is the gas given off at the cathode?

- (A) Sodium vapour
- (B) Chlorine
- (C) Oxygen
- (D) Hydrogen

Q38. In which reaction does disproportionation occur?

- (A) $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaClO} + \text{H}_2\text{O}$
- (B) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
- (C) $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
- (D) $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

Acids, Bases & Buffers

Q39. What is the pH of a $0.200 \text{ mol dm}^{-3}$ solution of hydrochloric acid?

- (A) 1.70
- (B) 0.20
- (C) 0.70
- (D) 13.30

Q40. A $0.0500 \text{ mol dm}^{-3}$ solution of propanoic acid has $K_a = 1.3 \times 10^{-5} \text{ mol dm}^{-3}$. What is the pH of the solution?

- (A) 1.30
- (B) 3.09
- (C) 4.89
- (D) 2.79

Q41. A buffer solution contains $0.300 \text{ mol dm}^{-3}$ ethanoic acid and $0.100 \text{ mol dm}^{-3}$ sodium ethanoate. K_a for ethanoic acid = $1.8 \times 10^{-5} \text{ mol dm}^{-3}$ ($pK_a = 4.74$). What is the pH of the buffer?

- (A) 4.74
- (B) 5.22
- (C) 3.26
- (D) 4.26

Q42. At 50°C , $K_w = 5.5 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$. What is the pH of neutral water at this temperature?

- (A) 6.63
- (B) 7.00
- (C) 7.37
- (D) 6.30

Q43. During the titration of a weak acid with sodium hydroxide, the pH at the half-neutralisation point is 5.00. What is the pK_a of the weak acid?

- (A) 2.50
- (B) 10.0
- (C) 5.00
- (D) 7.00

Inorganic Chemistry

Q44. The hydroxides of the Group 2 elements become more soluble down the group. Which hydroxide is the most soluble?

- (A) $\text{Mg}(\text{OH})_2$
- (B) $\text{Ba}(\text{OH})_2$
- (C) $\text{Ca}(\text{OH})_2$
- (D) $\text{Be}(\text{OH})_2$

Q45. Chlorine is passed into cold, dilute sodium hydroxide solution. What are the products?

- (A) NaCl and H_2O only
- (B) NaClO_3 and H_2O
- (C) NaCl and NaClO_3
- (D) NaCl , NaClO and H_2O

Q46. Which transition metal ion is colourless in aqueous solution?

- (A) Zn^{2+}
- (B) Cu^{2+}
- (C) Fe^{3+}
- (D) Cr^{3+}

Q47. Which reagent is used to test for chloride ions in solution?

- (A) Barium chloride solution
- (B) Limewater
- (C) Acidified silver nitrate solution
- (D) Sodium hydroxide solution

Q48. Aqueous aluminium ions are treated with sodium hydroxide solution until the hydroxide is in excess. What is the final observation?

- (A) The white precipitate remains undissolved
- (B) The white precipitate dissolves to form a colourless solution
- (C) A green precipitate forms
- (D) A gas is given off rapidly

Organic Chemistry I

Q49. Decane, $\text{C}_{10}\text{H}_{22}$, is cracked. Which pair of products could be formed in this cracking reaction?

- (A) $\text{C}_{10}\text{H}_{20}$ and H_2
- (B) Carbon dioxide and water
- (C) C_5H_{12} only
- (D) C_8H_{18} and C_2H_4

Q50. Bromine is added to ethene at room temperature and the orange colour is discharged. By what mechanism does bromine react with ethene?

- (A) Electrophilic addition
- (B) Nucleophilic substitution
- (C) Free-radical substitution
- (D) Elimination

Q51. Butan-2-ol is oxidised by warming with acidified potassium dichromate(VI). What is the organic product?

- (A) Butanal
- (B) Butanoic acid
- (C) Butanone
- (D) But-2-ene

Q52. Which halogenoalkane is hydrolysed most rapidly by aqueous sodium hydroxide?

- (A) 1-Bromobutane
- (B) 2-Bromo-2-methylpropane
- (C) Bromoethane
- (D) 1-Bromopropane

Q53. In the free-radical substitution of methane by chlorine, which step is a propagation step?

- (A) $\text{Cl}_2 \rightarrow 2\text{Cl}\cdot$
- (B) $\text{CH}_3\cdot + \text{CH}_3\cdot \rightarrow \text{C}_2\text{H}_6$
- (C) $\text{Cl}\cdot + \text{Cl}\cdot \rightarrow \text{Cl}_2$
- (D) $\text{CH}_3\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$

Q54. Propan-2-ol is heated with concentrated phosphoric acid. What is the main organic product?

- (A) Propene
- (B) Propane
- (C) Propanal
- (D) Propanone

Organic Chemistry II & Analysis

Q55. Which reagent distinguishes propanal from propanone?

- (A) 2,4-Dinitrophenylhydrazine
- (B) Bromine water
- (C) Fehling's solution
- (D) Sodium metal

Q56. Ethyl ethanoate is heated with dilute hydrochloric acid. What are the organic products of this hydrolysis?

- (A) Methanoic acid and ethanol
- (B) Ethanoic acid and ethanol
- (C) Ethanol and ethanoyl chloride
- (D) Ethanoic acid and ethane

Q57. Phenol is shaken with bromine water. What is observed?

- (A) No reaction takes place
- (B) The solution stays orange
- (C) A single bromine atom is substituted into the ring only if a catalyst is used
- (D) The bromine water is decolourised and a white precipitate forms

Q58. Nylon-6,6 is a polyamide. By what type of polymerisation is it formed?

- (A) Condensation polymerisation
- (B) Addition polymerisation
- (C) Free-radical polymerisation
- (D) Cracking

Q59. How many peaks are there in the ^1H NMR spectrum of propanone, CH_3COCH_3 ?

- (A) 2
- (B) 1
- (C) 3
- (D) 6

Q60. In a chromatography experiment, a spot moves 4.8 cm from the baseline while the solvent front moves 8.0 cm. What is the R_f value of the substance?

- (A) 1.67
- (B) 0.48
- (C) 0.60
- (D) 3.2

Answer Key

Q1: D	Q11: C	Q21: D	Q31: B	Q41: D	Q51: C
Q2: A	Q12: B	Q22: C	Q32: A	Q42: A	Q52: B
Q3: C	Q13: D	Q23: A	Q33: D	Q43: C	Q53: D
Q4: B	Q14: A	Q24: B	Q34: A	Q44: B	Q54: A
Q5: D	Q15: C	Q25: D	Q35: C	Q45: D	Q55: C
Q6: A	Q16: B	Q26: C	Q36: B	Q46: A	Q56: B
Q7: B	Q17: D	Q27: A	Q37: D	Q47: C	Q57: D
Q8: C	Q18: C	Q28: B	Q38: A	Q48: B	Q58: A
Q9: D	Q19: A	Q29: D	Q39: C	Q49: D	Q59: B
Q10: A	Q20: B	Q30: C	Q40: B	Q50: A	Q60: C

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