

A-Level Chemistry Practice Test 3

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. An element X has two isotopes, ^{69}X with 60.0% abundance and ^{71}X with 40.0% abundance. What is the relative atomic mass of X?

- (A) 70.0
- (B) 69.8
- (C) 69.4
- (D) 70.2

Q2. Which Period 3 element has the highest first ionisation energy?

- (A) Mg
- (B) Al
- (C) P
- (D) Si

Q3. What is the electronic configuration of an Fe^{2+} ion?

- (A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$
- (B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$
- (C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
- (D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$

Q4. In a time of flight mass spectrometer, an ion of a sample with mass 64 g mol^{-1} is given a kinetic energy of $8.5 \times 10^{-17} \text{ J}$. The flight tube is 1.20 m long. What is the time of flight of this ion? (Avogadro constant = $6.02 \times 10^{23} \text{ mol}^{-1}$)

- (A) $1.5 \times 10^{-5} \text{ s}$
- (B) $6.0 \times 10^{-5} \text{ s}$
- (C) $3.0 \times 10^{-4} \text{ s}$
- (D) $3.0 \times 10^{-5} \text{ s}$

Q5. Which Period 3 element has the highest melting point?

- (A) Na
- (B) S
- (C) Si
- (D) Ar

Amount of Substance

Q6. What is the volume occupied by 0.250 mol of a gas at 300 K and 100 kPa? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (A) 2.49 dm^3
- (B) 12.5 dm^3
- (C) 4.99 dm^3
- (D) 6.23 dm^3

Q7. A 25.0 cm³ sample of 0.100 mol dm⁻³ sodium hydroxide solution is exactly neutralised by 20.0 cm³ of hydrochloric acid. What is the concentration of the acid?

- (A) 0.125 mol dm⁻³
- (B) 0.0800 mol dm⁻³
- (C) 0.100 mol dm⁻³
- (D) 0.160 mol dm⁻³

Q8. In a preparation, the theoretical yield of a product is 8.00 g and the actual yield obtained is 6.40 g. What is the percentage yield?

- (A) 75%
- (B) 80%
- (C) 125%
- (D) 64%

Q9. A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass. What is its empirical formula?

- (A) CHO
- (B) C₂H₄O₂
- (C) CH₂O
- (D) CH₃O

Q10. How many sulfate ions are present in 0.0500 mol of Al₂(SO₄)₃?

- (A) 9.03×10^{22}
- (B) 3.01×10^{22}
- (C) 6.02×10^{22}
- (D) 1.51×10^{23}

Q11. Ethanoic acid (Mr = 60) reacts with ethanol (Mr = 46) to form ethyl ethanoate (Mr = 88) and water. What is the atom economy for the formation of the ester?

- (A) 73%
- (B) 88%
- (C) 66%
- (D) 83%

Bonding & Structure

Q12. What is the shape of an SF₆ molecule?

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

Q13. For sodium chloride: enthalpy of formation = -411 kJ mol⁻¹; enthalpy of atomisation of Na = +108 kJ mol⁻¹; first ionisation energy of Na = +496 kJ mol⁻¹; enthalpy of atomisation of chlorine (per mole of Cl atoms) = +121 kJ mol⁻¹; electron affinity of Cl = -349 kJ mol⁻¹. What is the lattice enthalpy of NaCl?

- (A) -349 kJ mol⁻¹
- (B) -642 kJ mol⁻¹
- (C) -787 kJ mol⁻¹
- (D) -936 kJ mol⁻¹

Q14. Which compound has the highest boiling point?

- (A) CH₃OH
- (B) CH₄
- (C) CH₃Cl
- (D) CH₃SH

Q15. Which bond is the most polar?

- (A) H-Cl
- (B) H-Br
- (C) C-H
- (D) H-F

Q16. Which oxide has the highest melting point?

- (A) SiCl₄
- (B) MgO
- (C) NaCl
- (D) P₄O₁₀

Q17. Which ion has the most exothermic enthalpy of hydration?

- (A) Li⁺
- (B) Na⁺
- (C) K⁺
- (D) Rb⁺

Energetics & Thermodynamics

Q18. Burning 0.0200 mol of a fuel raises the temperature of 100 g of water by 15.0 K. The specific heat capacity of water is 4.18 J g⁻¹ K⁻¹. What is the enthalpy of combustion of the fuel?

- (A) -31.4 kJ mol⁻¹
- (B) -157 kJ mol⁻¹
- (C) -314 kJ mol⁻¹
- (D) -627 kJ mol⁻¹

Q19. Standard enthalpies of formation: CH₄ = -75 kJ mol⁻¹, CO₂ = -394 kJ mol⁻¹, H₂O = -286 kJ mol⁻¹. What is the enthalpy of combustion of methane?

- (A) -605 kJ mol⁻¹
- (B) -750 kJ mol⁻¹
- (C) -1041 kJ mol⁻¹
- (D) -891 kJ mol⁻¹

Q20. In which process does the entropy of the system increase?

- (A) H₂O(l) → H₂O(s)
- (B) CaCO₃(s) → CaO(s) + CO₂(g)
- (C) N₂(g) + 3H₂(g) → 2NH₃(g)
- (D) H₂O(g) → H₂O(l)

Q21. A reaction has $\Delta H = +50.0 \text{ kJ mol}^{-1}$ and $\Delta S = +100 \text{ J K}^{-1} \text{ mol}^{-1}$. Above what temperature does the reaction become feasible?

- (A) 500 K
- (B) 298 K
- (C) 5000 K
- (D) 50 K

Q22. Entropy values: $\text{N}_2 = 192 \text{ J K}^{-1} \text{ mol}^{-1}$, $\text{H}_2 = 131 \text{ J K}^{-1} \text{ mol}^{-1}$, $\text{NH}_3 = 193 \text{ J K}^{-1} \text{ mol}^{-1}$. What is ΔS for the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$?

- (A) $+199 \text{ J K}^{-1} \text{ mol}^{-1}$
- (B) $-98 \text{ J K}^{-1} \text{ mol}^{-1}$
- (C) $-199 \text{ J K}^{-1} \text{ mol}^{-1}$
- (D) $+98 \text{ J K}^{-1} \text{ mol}^{-1}$

Q23. Bond enthalpies: $\text{H-H} = 436$, $\text{Cl-Cl} = 242$, $\text{H-Cl} = 431 \text{ kJ mol}^{-1}$. What is the enthalpy change for the reaction $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$?

- (A) $+184 \text{ kJ mol}^{-1}$
- (B) -184 kJ mol^{-1}
- (C) -862 kJ mol^{-1}
- (D) -92 kJ mol^{-1}

Kinetics & Rate Equations

Q24. In a series of experiments at constant temperature, doubling [A] doubles the rate of reaction, and doubling [B] increases the rate by a factor of 4. What is the overall order of the reaction?

- (A) 1
- (B) 2
- (C) 4
- (D) 3

Q25. What are the units of the rate constant for a second-order reaction?

- (A) $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$
- (B) $\text{mol dm}^{-3} \text{ s}^{-1}$
- (C) s^{-1}
- (D) $\text{mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$

Q26. A first-order reaction has a constant half-life of 20 s. The initial concentration of the reactant is 0.80 mol dm^{-3} . What is the concentration after 60 s?

- (A) 0.40 mol dm^{-3}
- (B) 0.20 mol dm^{-3}
- (C) 0.10 mol dm^{-3}
- (D) $0.050 \text{ mol dm}^{-3}$

Q27. A rate constant doubles when the temperature is raised from 300 K to 310 K. What is the activation energy of the reaction? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (A) 27 kJ mol^{-1}
- (B) 54 kJ mol^{-1}
- (C) 108 kJ mol^{-1}
- (D) 5.4 kJ mol^{-1}

Q28. When the temperature of a gaseous reaction mixture is increased, the Maxwell-Boltzmann distribution of molecular energies changes so that

- (A) the peak moves to the right and becomes higher
- (B) the total area under the curve increases
- (C) the peak moves to the left and becomes higher
- (D) the peak moves to the right and becomes lower, and the area stays the same

Equilibria (K_c & K_p)

Q29. The reaction $A + B \rightleftharpoons 2C$ is studied in a 1.0 dm^3 flask. At equilibrium the amounts present are $A = 0.60 \text{ mol}$, $B = 0.60 \text{ mol}$ and $C = 0.80 \text{ mol}$. What is the value of K_c ?

- (A) 1.78
- (B) 0.56
- (C) 2.22
- (D) 1.33

Q30. At equilibrium in the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, the partial pressure of N_2O_4 is 60 kPa and the partial pressure of NO_2 is 40 kPa. What is the value of K_p ?

- (A) 0.67 kPa
- (B) 1.5 kPa
- (C) 26.7 kPa
- (D) 106.7 kPa

Q31. For an exothermic reaction at equilibrium, what happens to the value of K_c when the temperature is increased?

- (A) It increases
- (B) It decreases
- (C) It stays the same
- (D) It becomes zero

Q32. What are the units of K_c for the equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$?

- (A) mol dm^{-3}
- (B) No units
- (C) $\text{mol}^2 \text{ dm}^{-6}$
- (D) $\text{mol}^{-1} \text{ dm}^3$

Q33. For the exothermic equilibrium $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, which change increases the value of K_p ?

- (A) Decreasing the temperature
- (B) Increasing the pressure
- (C) Adding a catalyst
- (D) Increasing the temperature

Redox & Electrode Potentials

Q34. What is the oxidation state of chromium in $K_2Cr_2O_7$?

- (A) +3
- (B) +7
- (C) +6
- (D) +2

Q35. E° values: $Zn^{2+}/Zn = -0.76\text{ V}$; $Cu^{2+}/Cu = +0.34\text{ V}$. What is the standard cell potential of the cell $Zn | Zn^{2+} || Cu^{2+} | Cu$?

- (A) +0.42 V
- (B) +1.10 V
- (C) -1.10 V
- (D) +0.34 V

Q36. Standard electrode potentials: $Fe^{3+}/Fe^{2+} = +0.77\text{ V}$; $I_2/I^- = +0.54\text{ V}$; $Sn^{4+}/Sn^{2+} = +0.15\text{ V}$; $Zn^{2+}/Zn = -0.76\text{ V}$. Which species is the strongest oxidising agent?

- (A) I_2
- (B) Sn^{4+}
- (C) Fe^{2+}
- (D) Fe^{3+}

Q37. $E^\circ(Fe^{3+}/Fe^{2+}) = +0.77\text{ V}$ and $E^\circ(I_2/I^-) = +0.54\text{ V}$. Which statement about the reaction of Fe^{3+} ions with I^- ions is correct?

- (A) The reaction is feasible, with $E^\circ_{cell} = +0.23\text{ V}$
- (B) The reaction is not feasible because $E^\circ_{cell} = -0.23\text{ V}$
- (C) The reaction is not feasible because Fe^{3+} is a reducing agent
- (D) The reaction is feasible, with $E^\circ_{cell} = +1.31\text{ V}$

Q38. A current of 2.00 A is passed for 4825 s through copper(II) sulfate solution using inert electrodes. What mass of copper is deposited at the cathode? ($F = 96500\text{ C mol}^{-1}$; Ar of Cu = 63.5)

- (A) 1.59 g
- (B) 6.35 g
- (C) 3.18 g
- (D) 0.79 g

Acids, Bases & Buffers

Q39. What is the pH of a 0.100 mol dm^{-3} solution of ethanoic acid? ($K_a = 1.7 \times 10^{-5}\text{ mol dm}^{-3}$)

- (A) 2.41
- (B) 2.88
- (C) 3.38
- (D) 1.00

Q40. What is the pH of a $0.0200\text{ mol dm}^{-3}$ solution of sodium hydroxide at 298 K? ($K_w = 1.0 \times 10^{-14}\text{ mol}^2\text{ dm}^{-6}$)

- (A) 1.70
- (B) 11.70
- (C) 12.70
- (D) 12.30

Q41. A buffer solution contains 0.200 mol of ethanoic acid and 0.100 mol of sodium ethanoate in the same volume of solution. The pKa of ethanoic acid is 4.77. What is the pH of the buffer?

- (A) 4.47
- (B) 5.07
- (C) 4.77
- (D) 4.17

Q42. A 0.100 mol dm⁻³ solution of a weak acid has a pH of 3.00. What is the value of Ka for the acid?

- (A) $1.0 \times 10^{-3} \text{ mol dm}^{-3}$
- (B) $1.0 \times 10^{-6} \text{ mol dm}^{-3}$
- (C) $1.0 \times 10^{-5} \text{ mol dm}^{-3}$
- (D) $1.0 \times 10^{-4} \text{ mol dm}^{-3}$

Q43. During the titration of a weak acid with sodium hydroxide solution, the pH at the half-neutralisation point is 4.50. What is Ka of the weak acid?

- (A) $3.16 \times 10^{-4} \text{ mol dm}^{-3}$
- (B) $3.16 \times 10^{-5} \text{ mol dm}^{-3}$
- (C) $4.50 \times 10^{-5} \text{ mol dm}^{-3}$
- (D) $2.00 \times 10^{-5} \text{ mol dm}^{-3}$

Inorganic Chemistry

Q44. Which Group 2 sulfate is the least soluble in water?

- (A) MgSO₄
- (B) CaSO₄
- (C) SrSO₄
- (D) BaSO₄

Q45. Which reaction occurs when the halogen is added to the halide solution?

- (A) $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$
- (B) $\text{Br}_2 + 2\text{Cl}^- \rightarrow 2\text{Br}^- + \text{Cl}_2$
- (C) $\text{I}_2 + 2\text{Br}^- \rightarrow 2\text{I}^- + \text{Br}_2$
- (D) $\text{Br}_2 + 2\text{F}^- \rightarrow 2\text{Br}^- + \text{F}_2$

Q46. What is the colour of the aqueous vanadium(IV) species VO²⁺?

- (A) Yellow
- (B) Green
- (C) Blue
- (D) Violet

Q47. An excess of concentrated ammonia solution is added to a pale blue solution containing [Cu(H₂O)₆]²⁺ ions. What is observed?

- (A) The solution becomes colourless
- (B) A deep blue solution containing [Cu(NH₃)₄(H₂O)₂]²⁺ forms
- (C) A green precipitate forms and stays
- (D) A black precipitate forms

Q48. Sodium hydroxide solution is added to a solution containing Fe^{3+} ions. What is observed?

- (A) A green precipitate
- (B) A white precipitate
- (C) No precipitate
- (D) An orange-brown precipitate

Organic Chemistry I

Q49. What is the initiation step in the free-radical chlorination of methane?

- (A) $\text{Cl}_2 \rightarrow 2\text{Cl}\cdot$ (in ultraviolet light)
- (B) $\text{CH}_4 + \text{Cl}\cdot \rightarrow \text{CH}_3\cdot + \text{HCl}$
- (C) $\text{CH}_3\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$
- (D) $\text{CH}_3\cdot + \text{Cl}\cdot \rightarrow \text{CH}_3\text{Cl}$

Q50. Which halogenoalkane is hydrolysed fastest by aqueous silver nitrate solution?

- (A) $\text{CH}_3\text{CH}_2\text{F}$
- (B) $\text{CH}_3\text{CH}_2\text{Cl}$
- (C) $\text{CH}_3\text{CH}_2\text{I}$
- (D) $\text{CH}_3\text{CH}_2\text{Br}$

Q51. 2-Bromopropane is heated with a concentrated solution of potassium hydroxide in ethanol. What is the main organic product?

- (A) Propan-2-ol
- (B) Propene
- (C) Propan-1-ol
- (D) Propane

Q52. Hydrogen bromide is added to propene. What is the major product?

- (A) 1-Bromopropane
- (B) 1,2-Dibromopropane
- (C) 2-Bromopropene
- (D) 2-Bromopropane

Q53. Propan-2-ol is heated with acidified potassium dichromate(VI) solution. What is the organic product?

- (A) Propanone
- (B) Propanoic acid
- (C) Propanal
- (D) No reaction occurs

Q54. Which alcohol cannot be oxidised by acidified potassium dichromate(VI)?

- (A) Propan-1-ol
- (B) Propan-2-ol
- (C) 2-Methylpropan-2-ol
- (D) Ethanol

Organic Chemistry II & Analysis

Q55. Which compound gives a silver mirror when warmed with Tollens' reagent?

- (A) Propanone
- (B) Propanal
- (C) Propanoic acid
- (D) Propene

Q56. Ethanoyl chloride is added to ethanol. What are the products?

- (A) Ethyl ethanoate and water
- (B) Diethyl ether and HCl
- (C) Ethanoic acid and chloroethane
- (D) Ethyl ethanoate and HCl

Q57. In the nitration of benzene using concentrated nitric acid and concentrated sulfuric acid, what is the electrophile?

- (A) NO_2^+
- (B) NO_2
- (C) HNO_3
- (D) NO^+

Q58. Which is the strongest base?

- (A) Phenylamine
- (B) Ammonia
- (C) Ethylamine
- (D) Ethanamide

Q59. In solid glycine, which exists as a zwitterion, the groups present are

- (A) -NH_2 and -COOH
- (B) -NH_3^+ and -COO^-
- (C) -NH_3^+ and -COOH
- (D) -NH_2 and -COO^-

Q60. How many peaks are there in the proton NMR spectrum of ethyl ethanoate, $\text{CH}_3\text{COOCH}_2\text{CH}_3$?

- (A) 1
- (B) 4
- (C) 2
- (D) 3

Answer Key

Q1: B	Q11: D	Q21: A	Q31: B	Q41: A	Q51: B
Q2: C	Q12: B	Q22: C	Q32: D	Q42: C	Q52: D
Q3: A	Q13: C	Q23: B	Q33: A	Q43: B	Q53: A
Q4: D	Q14: A	Q24: D	Q34: C	Q44: D	Q54: C
Q5: C	Q15: D	Q25: A	Q35: B	Q45: A	Q55: B
Q6: D	Q16: B	Q26: C	Q36: D	Q46: C	Q56: D
Q7: A	Q17: A	Q27: B	Q37: A	Q47: B	Q57: A

Q8: B	Q18: C	Q28: D	Q38: C	Q48: D	Q58: C
Q9: C	Q19: D	Q29: A	Q39: B	Q49: A	Q59: B
Q10: A	Q20: B	Q30: C	Q40: D	Q50: C	Q60: D

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