

A-Level Chemistry Practice Test 11

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, X-63 with 69% abundance and X-65 with 31% abundance. What is the relative atomic mass of X?

- (A) 63.0
- (B) 64.4
- (C) 64.0
- (D) 63.6

Q2. The first four ionisation energies of an element are 590, 1145, 4912 and 6474 kJ mol⁻¹. The large increase between the second and third values shows that this element is in

- (A) Group 1
- (B) Group 2
- (C) Group 3
- (D) Group 13

Q3. What is the electronic configuration of an Fe²⁺ ion? (Fe: atomic number 26)

- (A) 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁴ 4s²
- (B) 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁵ 4s¹
- (C) 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁸
- (D) 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁶

Q4. In the mass spectrum of chlorine gas, Cl₂, peaks are seen at m/z 70, 72 and 74 in an approximate ratio of 9:6:1. This pattern arises because

- (A) chlorine has isotopes of mass 70, 72 and 74
- (B) Cl₂ molecules contain different combinations of Cl-35 and Cl-37 atoms
- (C) the molecules fragment into single atoms in the spectrometer
- (D) chlorine has three isotopes in equal abundance

Q5. Which statement about the elements Na to Ar (Period 3) is correct?

- (A) The melting point increases steadily across the period
- (B) Argon has a higher melting point than sulfur
- (C) Silicon has the highest melting point because of its giant covalent structure
- (D) Aluminium has a lower melting point than sodium because it has more electrons

Amount of Substance

Q6. What volume, in dm^3 , is occupied by 0.250 mol of a gas at 100 kPa pressure and 300 K? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (A) 6.23 dm^3
- (B) 0.623 dm^3
- (C) 62.3 dm^3
- (D) 2.49 dm^3

Q7. A 25.0 cm^3 sample of sodium hydroxide solution of concentration $0.100 \text{ mol dm}^{-3}$ required 20.0 cm^3 of sulfuric acid for complete neutralisation. What is the concentration of the sulfuric acid?

- (A) $0.125 \text{ mol dm}^{-3}$
- (B) $0.250 \text{ mol dm}^{-3}$
- (C) $0.0625 \text{ mol dm}^{-3}$
- (D) $0.0313 \text{ mol dm}^{-3}$

Q8. In a preparation, the theoretical yield of a product is 8.00 g but only 6.40 g of pure product is obtained. The percentage yield is

- (A) 125%
- (B) 80.0%
- (C) 64.0%
- (D) 20.0%

Q9. Calcium carbonate is heated to produce calcium oxide: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$. (Mr: $\text{CaCO}_3 = 100$, $\text{CaO} = 56$, $\text{CO}_2 = 44$.) The atom economy for the production of CaO is

- (A) 44%
- (B) 100%
- (C) 56%
- (D) 36%

Q10. A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass. Its empirical formula is

- (A) $\text{C}_2\text{H}_4\text{O}_2$
- (B) CHO
- (C) CH_3O
- (D) CH_2O

Q11. What mass of sodium chloride is needed to make 250 cm^3 of a $0.200 \text{ mol dm}^{-3}$ solution? (Mr $\text{NaCl} = 58.5$)

- (A) 11.7 g
- (B) 2.93 g
- (C) 1.17 g
- (D) 29.3 g

Bonding & Structure

Q12. What is the bond angle in an NH_4^+ ion?

- (A) 107°
- (B) 120°
- (C) 180°
- (D) 109.5°

Q13. Which substance has the highest boiling point?

- (A) CH₄
- (B) CH₃CH₃
- (C) CH₃OH
- (D) CH₃Cl

Q14. Given: $\Delta H_f(\text{NaCl}) = -411 \text{ kJ mol}^{-1}$; atomisation of Na = $+107 \text{ kJ mol}^{-1}$; first ionisation energy of Na = $+496 \text{ kJ mol}^{-1}$; atomisation of Cl (per mol of Cl atoms) = $+121 \text{ kJ mol}^{-1}$; electron affinity of Cl = -349 kJ mol^{-1} . The lattice enthalpy of formation of NaCl is

- (A) -376 kJ mol^{-1}
- (B) -411 kJ mol^{-1}
- (C) $-1572 \text{ kJ mol}^{-1}$
- (D) -786 kJ mol^{-1}

Q15. Which molecule is polar overall?

- (A) CCl₄
- (B) CHCl₃
- (C) CO₂
- (D) BF₃

Q16. Which of these ions has the largest ionic radius? (All are isoelectronic.)

- (A) Ca²⁺
- (B) K⁺
- (C) Cl⁻
- (D) S²⁻

Q17. Graphite conducts electricity whereas diamond does not, because in graphite

- (A) the atoms are arranged in a giant ionic lattice
- (B) each carbon atom has one delocalised electron that can move along the layers
- (C) the covalent bonds are weaker than in diamond
- (D) there are no covalent bonds between the layers

Energetics & Thermodynamics

Q18. Burning 0.0200 mol of a fuel raised the temperature of 50.0 g of water by 12.0 K. (Specific heat capacity of water = $4.18 \text{ J g}^{-1} \text{ K}^{-1}$.) The enthalpy change of combustion of the fuel is approximately

- (A) -2508 J mol^{-1}
- (B) $-50.2 \text{ kJ mol}^{-1}$
- (C) -125 kJ mol^{-1}
- (D) $-12.5 \text{ kJ mol}^{-1}$

Q19. Using standard enthalpies of formation (kJ mol^{-1}): CH₄ = -75 , CO₂ = -394 , H₂O = -286 , the enthalpy change for $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ is

- (A) -605 kJ mol^{-1}
- (B) $-1041 \text{ kJ mol}^{-1}$
- (C) -891 kJ mol^{-1}
- (D) -819 kJ mol^{-1}

Q20. Using bond enthalpies (kJ mol^{-1}): $\text{H-H} = 436$, $\text{Cl-Cl} = 242$, $\text{H-Cl} = 431$, the enthalpy change for $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ is

- (A) -184 kJ mol^{-1}
- (B) $+184 \text{ kJ mol}^{-1}$
- (C) -247 kJ mol^{-1}
- (D) -862 kJ mol^{-1}

Q21. Which process is accompanied by an increase in entropy?

- (A) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- (B) $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{s})$
- (C) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- (D) $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$

Q22. A reaction has $\Delta H = -100 \text{ kJ mol}^{-1}$ and $\Delta S = -200 \text{ J K}^{-1} \text{ mol}^{-1}$. The value of ΔG at 298 K is

- (A) $-159.6 \text{ kJ mol}^{-1}$
- (B) $-40.4 \text{ kJ mol}^{-1}$
- (C) $+40.4 \text{ kJ mol}^{-1}$
- (D) $-99.4 \text{ kJ mol}^{-1}$

Q23. Using standard entropies ($\text{J K}^{-1} \text{ mol}^{-1}$): $\text{N}_2 = 192$, $\text{H}_2 = 131$, $\text{NH}_3 = 193$, the entropy change for $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ is

- (A) $-199 \text{ J K}^{-1} \text{ mol}^{-1}$
- (B) $+199 \text{ J K}^{-1} \text{ mol}^{-1}$
- (C) $-1 \text{ J K}^{-1} \text{ mol}^{-1}$
- (D) $-587 \text{ J K}^{-1} \text{ mol}^{-1}$

Kinetics & Rate Equations

Q24. In a series of experiments, doubling the concentration of A (with B constant) increased the rate by a factor of 4, and doubling the concentration of B (with A constant) doubled the rate. The rate equation is

- (A) $\text{rate} = k[\text{A}][\text{B}]$
- (B) $\text{rate} = k[\text{A}]^2[\text{B}]^2$
- (C) $\text{rate} = k[\text{A}][\text{B}]^2$
- (D) $\text{rate} = k[\text{A}]^2[\text{B}]$

Q25. For the reaction in Q24, when $[\text{A}] = 0.100 \text{ mol dm}^{-3}$ and $[\text{B}] = 0.200 \text{ mol dm}^{-3}$ the rate is $2.00 \times 10^{-3} \text{ mol dm}^{-3} \text{ s}^{-1}$. The value of the rate constant k is

- (A) $1.00 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (B) $0.100 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (C) $10.0 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (D) $1.00 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$

Q26. A first-order reaction has a half-life of 693 s . Its rate constant is

- (A) $1.44 \times 10^{-3} \text{ s}^{-1}$
- (B) $1.00 \times 10^{-3} \text{ s}^{-1}$
- (C) 0.693 s^{-1}
- (D) $9.63 \times 10^{-6} \text{ s}^{-1}$

Q27. Raising the temperature of a reaction mixture increases the rate mainly because

- (A) the activation energy decreases
- (B) the particles collide less often but with more energy
- (C) a greater proportion of collisions have energy at least equal to the activation energy
- (D) the rate constant decreases

Q28. A graph of initial rate against concentration of a reactant is a straight line passing through the origin. The reaction is which order with respect to this reactant?

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

Equilibria (K_c & K_p)

Q29. At equilibrium in a 1.00 dm^3 vessel for $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, there are 0.200 mol of N_2O_4 and 0.400 mol of NO_2 . The value of K_c is

- (A) $0.800 \text{ mol dm}^{-3}$
- (B) $0.400 \text{ mol dm}^{-3}$
- (C) 2.00 mol dm^{-3}
- (D) $0.200 \text{ mol dm}^{-3}$

Q30. For the equilibrium $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$, which expression gives K_p ?

- (A) $K_p = p(\text{SO}_3)^2 / (p(\text{SO}_2)^2 \times p(\text{O}_2))$
- (B) $K_p = p(\text{SO}_2)^2 \times p(\text{O}_2) / p(\text{SO}_3)^2$
- (C) $K_p = p(\text{SO}_3) / (p(\text{SO}_2) \times p(\text{O}_2))$
- (D) $K_p = p(\text{SO}_3)^2 / (p(\text{SO}_2) \times p(\text{O}_2))$

Q31. For an exothermic equilibrium, increasing the temperature will

- (A) increase the yield of products
- (B) have no effect on the position of equilibrium
- (C) increase the value of K_c
- (D) decrease the yield of products

Q32. Hydrogen and iodine react: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$. Starting with 1.00 mol of each reactant in a 1.00 dm^3 vessel, 1.60 mol of HI is present at equilibrium. K_c is

- (A) 2.56
- (B) 64
- (C) 16
- (D) 6.4

Q33. Adding a catalyst to a system at equilibrium will

- (A) increase the value of K_c
- (B) shift the position of equilibrium to the right
- (C) increase the yield of products
- (D) have no effect on the position of equilibrium or on K_c

Redox & Electrode Potentials

Q34. What is the (average) oxidation state of sulfur in $\text{Na}_2\text{S}_2\text{O}_3$?

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

Q35. Standard electrode potentials: $\text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$, $\text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$, $\text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$, $\text{Ag}^+/\text{Ag} = +0.80 \text{ V}$. The strongest reducing agent is

- (A) Ag
- (B) Cu
- (C) Fe
- (D) Zn

Q36. The EMF of a cell combining the Zn^{2+}/Zn and Cu^{2+}/Cu half-cells is

- (A) +1.10 V
- (B) -1.10 V
- (C) +0.42 V
- (D) +1.56 V

Q37. When aqueous copper(II) sulfate is electrolysed using inert graphite electrodes, the products are

- (A) copper at the cathode and hydrogen at the anode
- (B) hydrogen at the cathode and oxygen at the anode
- (C) copper at the cathode and oxygen at the anode
- (D) copper at both electrodes

Q38. Given $\text{Fe}^{3+}/\text{Fe}^{2+} = +0.77 \text{ V}$ and $\text{Cl}_2/\text{Cl}^- = +1.36 \text{ V}$, which statement is correct?

- (A) Chlorine cannot oxidise Fe^{2+} ions
- (B) Chlorine will oxidise Fe^{2+} ions to Fe^{3+} , with EMF +0.59 V
- (C) Fe^{3+} ions will oxidise Cl^- ions to chlorine
- (D) The reaction of chlorine with Fe^{2+} has EMF -0.59 V

Acids, Bases & Buffers

Q39. The pH of a $0.0500 \text{ mol dm}^{-3}$ solution of hydrochloric acid is

- (A) 0.50
- (B) 1.30
- (C) 2.00
- (D) 1.70

Q40. The pH of a $0.0100 \text{ mol dm}^{-3}$ solution of sodium hydroxide is ($K_w = 1.00 \times 10^{-14}$ at 298 K)

- (A) 2.00
- (B) 11.00
- (C) 12.00
- (D) 13.00

Q41. An ethanoic acid solution has concentration $0.100 \text{ mol dm}^{-3}$ and $K_a = 1.80 \times 10^{-5} \text{ mol dm}^{-3}$. Its pH is approximately

- (A) 2.87
- (B) 4.74
- (C) 1.87
- (D) 3.37

Q42. A buffer solution contains $0.200 \text{ mol dm}^{-3}$ ethanoic acid and $0.100 \text{ mol dm}^{-3}$ sodium ethanoate. (K_a of ethanoic acid = 1.74×10^{-5} , $pK_a = 4.76$.) The pH of the buffer is

- (A) 4.76
- (B) 5.06
- (C) 4.16
- (D) 4.46

Q43. At 50°C , $K_w = 5.48 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$. The pH of pure water at this temperature is

- (A) 7.00
- (B) 6.63
- (C) 7.37
- (D) 6.26

Inorganic Chemistry

Q44. Which statement about the Group 2 elements is correct?

- (A) The reactivity with water increases down the group
- (B) Barium reacts less vigorously with water than magnesium
- (C) Magnesium hydroxide is more soluble than barium hydroxide
- (D) Strontium does not react with cold water

Q45. Chlorine gas is bubbled through aqueous potassium bromide. What is observed?

- (A) No reaction occurs
- (B) A yellow-green gas is given off
- (C) The solution turns orange as bromine is formed
- (D) A white precipitate forms

Q46. When excess aqueous ammonia is added to aqueous copper(II) sulfate, the final colour of the solution is

- (A) pale blue
- (B) deep blue
- (C) green
- (D) colourless

Q47. To test for sulfate ions in solution, the reagents used are

- (A) silver nitrate solution and dilute nitric acid, giving a white precipitate
- (B) barium chloride solution and dilute hydrochloric acid, giving a white precipitate
- (C) sodium hydroxide solution, giving a white precipitate
- (D) limewater, giving a cloudy solution

Q48. Which aqueous ion is colourless?

- (A) $\text{Fe}^{3+}(\text{aq})$
- (B) $\text{Cu}^{2+}(\text{aq})$
- (C) $\text{Cr}^{3+}(\text{aq})$
- (D) $\text{Sc}^{3+}(\text{aq})$

Organic Chemistry I

Q49. In the free-radical substitution of methane by chlorine, the propagation steps involve

- (A) $\text{Cl}^\bullet$ radicals only
- (B) bond fission of C–H bonds in the initiation step
- (C) $\text{Cl}^\bullet$ and $\text{CH}_3^\bullet$ radicals reacting alternately with Cl_2 and CH_4
- (D) ions formed by heterolytic fission

Q50. Which halogenoalkane is hydrolysed most rapidly by aqueous sodium hydroxide?

- (A) 1-chlorobutane
- (B) 1-bromobutane
- (C) 1-fluorobutane
- (D) 1-iodobutane

Q51. The major product of the reaction of propene with hydrogen bromide is

- (A) 2-bromopropane
- (B) 1-bromopropane
- (C) 1,2-dibromopropane
- (D) propyl hydrogen sulfate

Q52. When propan-1-ol is heated with acidified potassium dichromate(VI) under distillation conditions, the main organic product is

- (A) propanal
- (B) propanoic acid
- (C) propene
- (D) propanone

Q53. Which alcohol cannot be oxidised by acidified potassium dichromate(VI)?

- (A) butan-1-ol
- (B) butan-2-ol
- (C) propan-1-ol
- (D) 2-methylpropan-2-ol

Q54. Ethanol vapour passed over heated aluminium oxide, or ethanol heated with concentrated sulfuric acid at 170°C , gives mainly

- (A) ethanoic acid
- (B) ethene
- (C) diethyl ether only
- (D) ethane

Organic Chemistry II & Analysis

Q55. Tollens' reagent (ammoniacal silver nitrate) will give a silver mirror with

- (A) propanone but not propanal
- (B) both propanal and propanone
- (C) propanal but not propanone
- (D) neither propanal nor propanone

Q56. Propanone reacts with HCN, in the presence of a little alkali, to form

- (A) 2-hydroxy-2-methylpropanenitrile
- (B) 2-hydroxypropanenitrile
- (C) propanenitrile
- (D) 2-aminopropanoic acid

Q57. When ethanoic acid is warmed with ethanol in the presence of concentrated sulfuric acid, the ester formed is

- (A) methyl ethanoate
- (B) ethyl methanoate
- (C) ethyl ethanoate
- (D) propyl ethanoate

Q58. In the nitration of benzene, the electrophile that attacks the ring is

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

Q59. Which amine is the strongest base?

- (A) phenylamine
- (B) ammonia
- (C) ethylamine
- (D) they are all equally basic

Q60. A spot on a TLC plate moves 3.2 cm while the solvent front moves 8.0 cm. The R_f value of the spot is

- (A) 0.40
- (B) 2.5
- (C) 0.25
- (D) 4.8

Answer Key

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

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

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