

A-Level Chemistry Practice Test 6

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. The first two ionisation energies of an element X are 520 kJ mol^{-1} and 7300 kJ mol^{-1} . In which group of the Periodic Table is X?

- (A) Group 2
- (B) Group 1
- (C) Group 13
- (D) Group 18

Q2. A sample of magnesium contains the isotopes ^{24}Mg (79.0%), ^{25}Mg (10.0%) and ^{26}Mg (11.0%). What is the relative atomic mass of magnesium in this sample?

- (A) 24.0
- (B) 25.0
- (C) 24.5
- (D) 24.3

Q3. What is the electronic configuration of a copper atom? (Cu has atomic number 29.)

- (A) $[\text{Ar}] 4s^1 3d^{10}$
- (B) $[\text{Ar}] 4s^2 3d^9$
- (C) $[\text{Ar}] 4s^0 3d^{11}$
- (D) $[\text{Ar}] 4s^2 3d^{10}$

Q4. Which Period 3 element has the highest melting point?

- (A) Sodium
- (B) Aluminium
- (C) Silicon
- (D) Sulfur

Q5. Which statement is the correct definition of the first ionisation energy of an element?

- (A) The energy released when one mole of gaseous atoms each gain an electron.
- (B) The energy required to remove an electron from each atom in one mole of atoms in the solid state.
- (C) The energy required to remove one mole of electrons from one mole of gaseous ions.
- (D) The energy required to remove one electron from each atom in one mole of gaseous atoms, forming one mole of gaseous $1+$ ions.

Amount of Substance

Q6. A gas occupies a volume of 500 cm^3 at a pressure of 100 kPa and a temperature of 300 K . How many moles of gas are present? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (A) 0.0201 mol
- (B) 0.200 mol
- (C) 2.01 mol
- (D) 0.00201 mol

Q7. The theoretical yield of an ester preparation is 7.00 g , but the actual yield obtained is 4.55 g . What is the percentage yield?

- (A) 45.0%
- (B) 154%
- (C) 65.0%
- (D) 35.0%

Q8. What volume of $0.150 \text{ mol dm}^{-3}$ sodium hydroxide solution is needed to neutralise 25.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ hydrochloric acid?

- (A) 25.0 cm^3
- (B) 16.7 cm^3
- (C) 37.5 cm^3
- (D) 375 cm^3

Q9. Magnesium reacts with sulfuric acid: $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$. Magnesium sulfate is the required product. What is the atom economy of this reaction? ($\text{Mr: Mg} = 24.0$, $\text{H}_2\text{SO}_4 = 98.0$, $\text{MgSO}_4 = 120.0$)

- (A) 24.6%
- (B) 75.4%
- (C) 80.3%
- (D) 98.4%

Q10. A compound contains 52.2% carbon, 13.0% hydrogen and 34.8% oxygen by mass. What is its empirical formula?

- (A) $\text{C}_2\text{H}_6\text{O}$
- (B) CH_3O
- (C) $\text{C}_2\text{H}_6\text{O}_2$
- (D) $\text{C}_3\text{H}_8\text{O}$

Q11. A standard solution is prepared by dissolving 1.06 g of sodium carbonate ($\text{Mr} = 106$) in water and making the volume up to 250 cm^3 . What is its concentration?

- (A) $0.0100 \text{ mol dm}^{-3}$
- (B) $0.00400 \text{ mol dm}^{-3}$
- (C) $0.0400 \text{ mol dm}^{-3}$
- (D) 4.00 mol dm^{-3}

Bonding & Structure

Q12. What is the shape of a boron trifluoride molecule and its bond angle?

- (A) Tetrahedral, 109.5°
- (B) Trigonal planar, 120°
- (C) Trigonal pyramidal, 107°
- (D) Linear, 180°

Q13. Which species contains a coordinate (dative covalent) bond?

- (A) CH₄
- (B) H₂O
- (C) CO₂
- (D) NH₄⁺

Q14. Which compound has the most exothermic lattice enthalpy?

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

Q15. Which bond is the most polar?

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

Q16. Diamond has a very high melting point. What is the main reason for this?

- (A) Diamond contains strong ionic bonds.
- (B) Each carbon atom forms four strong covalent bonds in a giant structure, so a very large amount of energy is needed to break the bonds.
- (C) There are strong van der Waals forces between the carbon atoms.
- (D) Diamond contains delocalised electrons that hold the atoms together.

Q17. Bromine is a liquid at room temperature but chlorine is a gas. What is the main reason for this difference?

- (A) The Br-Br covalent bond is stronger than the Cl-Cl bond.
- (B) Bromine molecules form hydrogen bonds but chlorine molecules do not.
- (C) Bromine atoms have more protons than chlorine atoms.
- (D) Bromine molecules have more electrons, so the van der Waals forces between them are stronger.

Energetics & Thermodynamics

Q18. Use these enthalpies of combustion (kJ mol⁻¹): C(s) = -394; H₂(g) = -286; CH₄(g) = -891. What is the enthalpy of formation of methane?

- (A) -75 kJ mol⁻¹
- (B) +75 kJ mol⁻¹
- (C) -1857 kJ mol⁻¹
- (D) +1857 kJ mol⁻¹

Q19. Burning 0.100 mol of a fuel raises the temperature of 100 g of water by 20.0 K. What is the enthalpy change of combustion of the fuel? (c = 4.18 J g⁻¹ K⁻¹)

- (A) -8.36 kJ mol⁻¹
- (B) -41.8 kJ mol⁻¹
- (C) -83.6 kJ mol⁻¹
- (D) -836 kJ mol⁻¹

Q20. A reaction has $\Delta H = -200 \text{ kJ mol}^{-1}$ and $\Delta S = -100 \text{ J K}^{-1} \text{ mol}^{-1}$. What is ΔG for this reaction at 400 K?

- (A) -240 kJ mol^{-1}
- (B) -160 kJ mol^{-1}
- (C) -200 kJ mol^{-1}
- (D) $+160 \text{ kJ mol}^{-1}$

Q21. Which process is accompanied by a decrease in entropy?

- (A) Boiling of water
- (B) Dissolving ammonium nitrate in water
- (C) Sublimation of iodine
- (D) Freezing of water

Q22. Use these bond enthalpies (kJ mol^{-1}): $\text{N}\equiv\text{N} = 945$; $\text{H}-\text{H} = 436$; $\text{N}-\text{H} = 391$. What is the enthalpy change for the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$?

- (A) -93 kJ mol^{-1}
- (B) $+93 \text{ kJ mol}^{-1}$
- (C) -46 kJ mol^{-1}
- (D) $-2346 \text{ kJ mol}^{-1}$

Q23. Which equation represents the standard enthalpy of formation of water?

- (A) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
- (B) $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
- (C) $\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$
- (D) $\text{H}_2(\text{g}) + \text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$

Kinetics & Rate Equations

Q24. A first-order reaction has a half-life of 20 s. How long will it take for the concentration of the reactant to fall to one eighth of its original value?

- (A) 40 s
- (B) 60 s
- (C) 80 s
- (D) 160 s

Q25. In a reaction between X and Y, doubling the concentration of X has no effect on the rate, but doubling the concentration of Y doubles the rate. What is the rate equation?

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

Q26. In the Arrhenius equation $k = Ae^{(-E_a/RT)}$, the term $e^{(-E_a/RT)}$ represents...

- (A) the fraction of colliding particles that have energy equal to or greater than the activation energy
- (B) the total number of collisions per second between the particles
- (C) the fraction of particles that are in the gas phase
- (D) the probability that a collision has the correct orientation

Q27. A reaction is first order with respect to A. When $[A] = 0.200 \text{ mol dm}^{-3}$, the rate is $4.00 \times 10^{-3} \text{ mol dm}^{-3} \text{ s}^{-1}$. What is the rate constant, k ?

- (A) $8.00 \times 10^{-4} \text{ s}^{-1}$
- (B) 0.800 s^{-1}
- (C) 0.0200 s^{-1}
- (D) 50.0 s^{-1}

Q28. A catalyst is added to a reacting mixture. Which statement best explains the increase in the rate of reaction?

- (A) The catalyst increases the frequency of collisions between the particles.
- (B) The catalyst provides an alternative route with a lower activation energy, so a greater proportion of collisions are successful.
- (C) The catalyst increases the average kinetic energy of the particles.
- (D) The catalyst increases the activation energy so that the particles react more vigorously.

Equilibria (K_c & K_p)

Q29. For the equilibrium $2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$, the initial concentration of HI is 1.00 mol dm^{-3} . At equilibrium the concentration of HI is 0.80 mol dm^{-3} . What is the value of K_c ?

- (A) 0.0625
- (B) 0.156
- (C) 1.56
- (D) 0.0156

Q30. For the equilibrium $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, what are the units of K_p ?

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

Q31. For the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$, $\Delta H = -197 \text{ kJ mol}^{-1}$. What happens to the equilibrium yield of SO_3 and to the value of K_c when the temperature is increased?

- (A) The yield increases and K_c increases.
- (B) The yield increases and K_c is unchanged.
- (C) The yield decreases and K_c decreases.
- (D) The yield decreases and K_c increases.

Q32. Ethanoic acid reacts with ethanol in a reversible reaction: $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$. Which expression is correct for K_c ?

- (A) $K_c = [\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}]/([\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}])$
- (B) $K_c = [\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]/([\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}])$
- (C) $K_c = [\text{CH}_3\text{COOC}_2\text{H}_5]/([\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}])$
- (D) $K_c = [\text{CH}_3\text{COOH}]/([\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}])$

Q33. For the equilibrium $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, the equilibrium partial pressures are $\text{HI} = 80 \text{ kPa}$, $\text{H}_2 = 10 \text{ kPa}$ and $\text{I}_2 = 10 \text{ kPa}$. What is the value of K_p ?

- (A) 0.64
- (B) 6.4
- (C) 640
- (D) 64

Redox & Electrode Potentials

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

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

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

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

Q36. What is the EMF of a cell combining $\text{Mg}^{2+}(\text{aq})/\text{Mg}(\text{s})$, $E^\circ = -2.37 \text{ V}$, with $\text{Cu}^{2+}(\text{aq})/\text{Cu}(\text{s})$, $E^\circ = +0.34 \text{ V}$?

- (A) +2.03 V
- (B) +2.71 V
- (C) -2.71 V
- (D) +1.37 V

Q37. Aluminium is extracted by electrolysis ($\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$). What quantity of electricity is needed to produce 0.0100 mol of aluminium? ($F = 96500 \text{ C mol}^{-1}$)

- (A) 965 C
- (B) 96500 C
- (C) 290 C
- (D) 2895 C

Q38. Which statement about a hydrogen fuel cell is correct?

- (A) The overall reaction is $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$.
- (B) The cell must be recharged from the mains when it runs down.
- (C) Water is split into hydrogen and oxygen inside the cell.
- (D) Carbon dioxide is one of the products.

Acids, Bases & Buffers

Q39. A solution is made by mixing 25.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ hydrochloric acid with 25.0 cm^3 of $0.0500 \text{ mol dm}^{-3}$ sodium hydroxide. What is the pH of the mixture?

- (A) 1.00
- (B) 2.00
- (C) 1.60
- (D) 1.30

Q40. The K_a of an acid is $3.2 \times 10^{-4} \text{ mol dm}^{-3}$. What is the pK_a of this acid?

- (A) 4.49
- (B) 3.49
- (C) 3.20
- (D) -3.49

Q41. A buffer solution is made from ethanoic acid and sodium ethanoate. Why does its pH change only slightly when a small amount of alkali is added?

- (A) The OH^- ions react with the ethanoate ions in the buffer.
- (B) The OH^- ions are diluted by the buffer solution.
- (C) The salt in the buffer neutralises the ethanoic acid.
- (D) The OH^- ions react with ethanoic acid molecules to form ethanoate ions and water, so very few OH^- ions remain free.

Q42. A solution has a pH of 2.50. What is the concentration of hydrogen ions in this solution?

- (A) $3.16 \times 10^{-3} \text{ mol dm}^{-3}$
- (B) $2.50 \times 10^{-3} \text{ mol dm}^{-3}$
- (C) $3.16 \times 10^{-2} \text{ mol dm}^{-3}$
- (D) $1.00 \times 10^{-2} \text{ mol dm}^{-3}$

Q43. Which indicator is the most suitable for the titration of a weak acid, such as ethanoic acid, with a strong base, such as sodium hydroxide?

- (A) Methyl orange
- (B) Litmus
- (C) Phenolphthalein
- (D) Universal indicator

Inorganic Chemistry

Q44. Which Group 2 hydroxide is the most soluble in water?

- (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. A solution of a halide gives a cream precipitate when acidified silver nitrate solution is added. Which halide ion is present?

- (A) Chloride
- (B) Fluoride
- (C) Iodide
- (D) Bromide

Q46. In the Contact process, vanadium(V) oxide catalyses the oxidation of sulfur dioxide. In the first step, the V_2O_5 is reduced to an oxide of vanadium in which vanadium has oxidation state +4. What is this oxide?

- (A) VO_2
- (B) V_2O_3
- (C) VO
- (D) V_2O_5

Q47. Excess concentrated ammonia solution is added to a pale blue solution containing Cu^{2+} ions. What is observed?

- (A) A green precipitate remains undissolved.
- (B) A white precipitate forms.
- (C) A deep blue solution forms.
- (D) The solution becomes colourless.

Q48. What are the products when chlorine is passed into hot, concentrated sodium hydroxide solution?

- (A) NaCl and NaClO
- (B) NaCl and NaClO_3
- (C) NaClO and H_2O only
- (D) NaClO_3 and H_2

Organic Chemistry I

Q49. Bromoethane is warmed with aqueous sodium hydroxide. What is the main organic product?

- (A) Ethene
- (B) Ethane
- (C) Ethanal
- (D) Ethanol

Q50. Propene is reacted with concentrated sulfuric acid, and the product is then warmed with water. What is the final organic product?

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

Q51. Decane, $\text{C}_{10}\text{H}_{22}$, is cracked to form ethene and one other hydrocarbon product. What is the other product?

- (A) C_8H_{16}
- (B) C_8H_{20}
- (C) C_8H_{18}
- (D) C_6H_{12}

Q52. Which alcohol is oxidised to a ketone by acidified potassium dichromate(VI)?

- (A) Propan-1-ol
- (B) Propan-2-ol
- (C) Methanol
- (D) 2-methylpropan-2-ol

Q53. Ethene is manufactured by passing ethanol vapour over a heated catalyst. What is the catalyst?

- (A) Iron
- (B) Vanadium(V) oxide
- (C) Nickel
- (D) Aluminium oxide

Q54. Which species acts as a nucleophile?

- (A) OH^-
- (B) H^+
- (C) NO_2^+
- (D) Br^+

Organic Chemistry II & Analysis

Q55. Propanal is tested with 2,4-dinitrophenylhydrazine solution. What is observed?

- (A) A silver mirror forms.
- (B) A brick-red precipitate forms on heating.
- (C) An orange precipitate forms.
- (D) The solution turns from orange to green.

Q56. Proteins are hydrolysed by heating with aqueous sodium hydroxide. What are the products?

- (A) Esters and water
- (B) The sodium salts of the amino acids
- (C) Alkenes and ammonia
- (D) Amines and carbon dioxide

Q57. In the Friedel-Crafts methylation of benzene, using chloromethane and an aluminium chloride catalyst, what is the electrophile?

- (A) CH_3Cl
- (B) CH_3^-
- (C) AlCl_3
- (D) CH_3^+

Q58. The infrared spectrum of a compound shows a very broad absorption between 2500 and 3300 cm^{-1} and a strong absorption at about 1720 cm^{-1} . Which compound is it most likely to be?

- (A) Propanoic acid
- (B) Propan-1-ol
- (C) Propanal
- (D) Propane

Q59. In a paper chromatography experiment, a spot moves 4.5 cm from the baseline while the solvent front moves 9.0 cm . What is the R_f value of the substance?

- (A) 2.0
- (B) 0.25
- (C) 0.50
- (D) 4.5

Q60. Which polymer is formed by condensation polymerisation?

- (A) Poly(ethene)
- (B) Nylon-6,6
- (C) Poly(chloroethene)
- (D) Poly(propene)

Answer Key

Q1: B	Q11: C	Q21: D	Q31: C	Q41: D	Q51: C
Q2: D	Q12: B	Q22: A	Q32: B	Q42: A	Q52: B
Q3: A	Q13: D	Q23: C	Q33: D	Q43: C	Q53: D
Q4: C	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: A	Q36: B	Q46: A	Q56: B
Q7: C	Q17: D	Q27: C	Q37: D	Q47: C	Q57: D
Q8: B	Q18: A	Q28: B	Q38: A	Q48: B	Q58: A
Q9: D	Q19: C	Q29: D	Q39: C	Q49: D	Q59: C
Q10: A	Q20: B	Q30: A	Q40: B	Q50: A	Q60: B

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