

A-Level Chemistry Practice Test 19

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 an element X contains two isotopes, ^{69}X and ^{71}X , with percentage abundances of 60.0% and 40.0% respectively. What is the relative atomic mass of X?

- (A) 69.5
- (B) 69.8
- (C) 70.0
- (D) 70.4

Q2. Which element has the highest second ionisation energy?

- (A) sodium
- (B) magnesium
- (C) potassium
- (D) calcium

Q3. Which species is isoelectronic with an argon atom?

- (A) Mg^{2+}
- (B) S
- (C) Cl^-
- (D) Na^+

Q4. Which atom has the largest atomic radius?

- (A) Na
- (B) Mg
- (C) Ca
- (D) K

Q5. The first ionisation energy of sulfur is lower than that of phosphorus, even though sulfur has a greater nuclear charge. This is because in sulfur...

- (A) the electron removed is paired in a 3p orbital and is repelled by the other electron in that orbital
- (B) the electron removed comes from a 3s orbital
- (C) the 3p subshell is completely full
- (D) the nuclear charge is actually smaller than in phosphorus

Amount of Substance

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

- (A) 5.61 dm^3
- (B) 5.98 dm^3
- (C) 6.23 dm^3
- (D) 62.3 dm^3

Q7. What is the mass of sodium chloride in 250 cm^3 of a $0.200 \text{ mol dm}^{-3}$ solution? (M_r of NaCl = 58.5)

- (A) 1.17 g
- (B) 1.46 g
- (C) 2.34 g
- (D) 2.93 g

Q8. In a preparation, the theoretical yield of a product was 8.00 g but only 6.40 g was obtained. What is the percentage yield?

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

Q9. Calcium carbonate is heated to form calcium oxide: $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$. What is the atom economy for the production of calcium oxide? (M_r : $\text{CaCO}_3 = 100$, $\text{CaO} = 56$)

- (A) 44%
- (B) 100%
- (C) 56%
- (D) 64%

Q10. A 25.0 cm^3 sample of $0.100 \text{ mol dm}^{-3}$ sodium hydroxide solution was neutralised by 20.0 cm^3 of hydrochloric acid. What is the concentration of the hydrochloric acid?

- (A) $0.125 \text{ mol dm}^{-3}$
- (B) $0.0800 \text{ mol dm}^{-3}$
- (C) $0.100 \text{ mol dm}^{-3}$
- (D) $0.250 \text{ mol dm}^{-3}$

Q11. A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass. What is its empirical formula?

- (A) CHO
- (B) CH₄O
- (C) C₂H₄O₂
- (D) CH₂O

Bonding & Structure

Q12. What is the shape of an ammonia molecule and its H-N-H bond angle?

- (A) trigonal planar, 120°
- (B) tetrahedral, 109.5°
- (C) trigonal pyramidal, 107°
- (D) linear, 180°

Q13. Which molecule is polar (has a permanent dipole)?

- (A) CO₂
- (B) NH₃
- (C) BF₃
- (D) CH₄

Q14. The lattice enthalpy of an ionic compound is the enthalpy change when...

- (A) one mole of the ionic solid is broken up into its constituent elements
- (B) one mole of the ionic solid dissolves in water
- (C) one mole of the ionic solid is converted into its aqueous ions
- (D) one mole of the ionic solid is formed from its gaseous ions

Q15. Which substance has hydrogen bonding between its molecules?

- (A) CH₃OH
- (B) CH₄
- (C) H₂S
- (D) PH₃

Q16. Which compound has the greatest ionic character?

- (A) NaCl
- (B) MgO
- (C) CsF
- (D) AlCl₃

Q17. What is the shape of the XeF₄ molecule?

- (A) tetrahedral
- (B) square planar
- (C) octahedral
- (D) trigonal bipyramidal

Energetics & Thermodynamics

Q18. When a fuel was burned, the temperature of 50.0 g of water in a calorimeter rose by 8.00 K. How much heat energy was released? ($c = 4.18 \text{ J g}^{-1} \text{ K}^{-1}$)

- (A) 0.209 kJ
- (B) 0.836 kJ
- (C) 3.34 kJ
- (D) 1.67 kJ

Q19. Enthalpies of combustion are: C = -393 , H₂ = -286 and CH₄ = -890 kJ mol^{-1} . What is the enthalpy of formation of methane?

- (A) -75 kJ mol^{-1}
- (B) $+75 \text{ kJ mol}^{-1}$
- (C) -211 kJ mol^{-1}
- (D) -965 kJ mol^{-1}

Q20. For the reaction $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$, the entropy change, ΔS , is...

- (A) negative, because the reaction is endothermic
- (B) zero, because solids are involved on both sides
- (C) positive, because a gas is formed from a solid
- (D) negative, because solids have low entropy

Q21. A reaction has $\Delta H = -100 \text{ kJ mol}^{-1}$ and $\Delta S = -200 \text{ J K}^{-1} \text{ mol}^{-1}$. What is ΔG at 400 K?

- (A) $+20 \text{ kJ mol}^{-1}$
- (B) -180 kJ mol^{-1}
- (C) -100 kJ mol^{-1}
- (D) -20 kJ mol^{-1}

Q22. Using bond enthalpies $\text{H-H} = 436$, $\text{Cl-Cl} = 242$ and $\text{H-Cl} = 431 \text{ kJ mol}^{-1}$, what is ΔH for the reaction $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$?

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

Q23. 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) 200 K
- (C) 1000 K
- (D) 50 K

Kinetics & Rate Equations

Q24. For a reaction with rate $= k[\text{A}]^2[\text{B}]$, what happens to the rate when the concentration of A is doubled and the concentration of B is halved?

- (A) The rate is unchanged
- (B) The rate halves
- (C) The rate doubles
- (D) The rate increases by a factor of 8

Q25. What are the units of the rate constant for a reaction that is second order overall?

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

Q26. In an experiment, doubling the concentration of X (with Y unchanged) doubles the rate, but doubling the concentration of Y (with X unchanged) has no effect on the rate. What is the rate equation?

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

Q27. According to the Arrhenius equation, raising the temperature increases the rate constant mainly because...

- (A) a greater proportion of molecules have energy at least equal to the activation energy
- (B) the activation energy is lowered
- (C) the frequency factor A decreases
- (D) the molecules move more slowly

Q28. A reaction has a constant half-life of 40 s, which does not change as the reaction proceeds. The reaction must be...

- (A) zero order
- (B) second order
- (C) first order
- (D) third order

Equilibria (K_c & K_p)

Q29. For the equilibrium $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, which expression gives K_c ?

- (A) $[NH_3] / ([N_2][H_2])$
- (B) $([N_2][H_2]^3) / [NH_3]^2$
- (C) $[NH_3]^2 / ([N_2] + 3[H_2])$
- (D) $[NH_3]^2 / ([N_2][H_2]^3)$

Q30. For the equilibrium $A(aq) \rightleftharpoons 2B(aq)$, 0.800 mol of A was dissolved in a 1.00 dm³ flask. At equilibrium, 0.600 mol of A remained. What is the value of K_c ?

- (A) 0.267 mol dm⁻³
- (B) 0.167 mol dm⁻³
- (C) 0.444 mol dm⁻³
- (D) 3.75 mol dm⁻³

Q31. For the equilibrium $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, which statement about K_p and K_c is correct?

- (A) $K_p = K_c(RT)^2$
- (B) $K_p = K_c$
- (C) $K_p = K_c(RT)$
- (D) $K_p = K_c/(RT)$

Q32. The equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ is exothermic in the forward direction. Which change increases the equilibrium yield of SO_3 ?

- (A) increasing the temperature
- (B) decreasing the pressure
- (C) increasing the pressure
- (D) adding a catalyst

Q33. What is the effect of adding a catalyst on the value of the equilibrium constant, K_c , for a reaction?

- (A) It increases the value of K_c
- (B) It decreases the value of K_c
- (C) It changes K_c only if the reaction is exothermic
- (D) It has no effect on the value of K_c

Redox & Electrode Potentials

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

- (A) +6
- (B) +3
- (C) +7
- (D) +12

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

- (A) Cu
- (B) Zn
- (C) Fe
- (D) they are all equally strong

Q36. What is the EMF, under standard conditions, of a cell combining the half-cells $\text{Zn}^{2+}/\text{Zn} (-0.76 \text{ V})$ and $\text{Cu}^{2+}/\text{Cu} (+0.34 \text{ V})$?

- (A) $+0.42 \text{ V}$
- (B) -1.10 V
- (C) $+1.10 \text{ V}$
- (D) $+0.76 \text{ V}$

Q37. A current of 0.500 A is passed through aqueous copper(II) sulfate for 1930 s . What mass of copper is deposited at the cathode? ($F = 96500 \text{ C mol}^{-1}$; Mr of Cu = 63.5)

- (A) 0.159 g
- (B) 0.635 g
- (C) 1.27 g
- (D) 0.318 g

Q38. E for $\text{Fe}^{3+}/\text{Fe}^{2+}$ is $+0.77 \text{ V}$ and E for I_2/I^- is $+0.54 \text{ V}$. What is the EMF for the reaction of Fe^{3+} ions with I^- ions, and is it feasible?

- (A) $+0.23 \text{ V}$, feasible
- (B) $+1.31 \text{ V}$, feasible
- (C) -0.23 V , not feasible
- (D) $+0.54 \text{ V}$, feasible

Acids, Bases & Buffers

Q39. What is the pH of $0.0100 \text{ mol dm}^{-3}$ hydrochloric acid?

- (A) 1.00
- (B) 2.00
- (C) 12.00
- (D) 0.00

Q40. What is the pH of a $0.100 \text{ mol dm}^{-3}$ solution of a weak acid with $K_a = 1.00 \times 10^{-5} \text{ mol dm}^{-3}$?

- (A) 1.00
- (B) 5.00
- (C) 3.00
- (D) 2.50

Q41. What is the pH of $0.0500 \text{ mol dm}^{-3}$ sodium hydroxide solution? ($K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$)

- (A) 1.30
- (B) 12.30
- (C) 13.30
- (D) 12.70

Q42. A buffer solution contains ethanoic acid ($pK_a = 4.74$) and sodium ethanoate, both at a concentration of $0.100 \text{ mol dm}^{-3}$. What is the pH of the buffer?

- (A) 4.74
- (B) 4.44
- (C) 5.04
- (D) 9.26

Q43. A solution of a weak acid is exactly half-neutralised by sodium hydroxide. At this point in the titration...

- (A) the pH is 7.00
- (B) the pH equals the pK_a of the acid
- (C) the acid has been completely neutralised
- (D) $[H^+] = K_w$

Inorganic Chemistry

Q44. Which statement about Group 2 elements and their compounds is correct?

- (A) Magnesium reacts rapidly with cold water
- (B) Barium hydroxide is more soluble in water than magnesium hydroxide
- (C) The solubility of the Group 2 hydroxides decreases down the group
- (D) Strontium is less reactive than magnesium

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

- (A) sodium chloride and hydrogen
- (B) sodium chlorate(V) and hydrogen
- (C) sodium and chlorine
- (D) sodium chloride, sodium chlorate(I) and water

Q46. When excess concentrated ammonia solution is added to aqueous copper(II) sulfate, what is the colour of the resulting solution?

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

Q47. Which reagents are used to test a solution for the presence of sulfate ions?

- (A) dilute nitric acid followed by silver nitrate solution
- (B) sodium hydroxide solution followed by warming
- (C) dilute hydrochloric acid followed by barium chloride solution
- (D) limewater

Q48. When dilute sodium hydroxide solution is added dropwise to a solution containing Fe^{3+} ions, what is observed?

- (A) a green precipitate
- (B) a red-brown precipitate
- (C) a blue precipitate
- (D) a white precipitate that dissolves in excess alkali

Organic Chemistry I

Q49. In the free-radical substitution of methane by chlorine in ultraviolet light, the initiation step involves...

- (A) heterolytic fission of a C-H bond
- (B) electrophilic attack on methane by $\text{Cl}^\cdot$
- (C) homolytic fission of a C-H bond
- (D) homolytic fission of a Cl-Cl bond

Q50. Which halogenoalkane reacts fastest with aqueous sodium hydroxide?

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

Q51. Propene reacts with hydrogen bromide. The major product of this electrophilic addition is...

- (A) 1-bromopropane
- (B) 1,2-dibromopropane
- (C) 2-bromopropane
- (D) 1-bromopropene

Q52. Propan-1-ol is heated under reflux with excess acidified potassium dichromate(VI). What is the organic product?

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

Q53. 2-Bromopropane is heated with potassium hydroxide dissolved in ethanol. What is the main organic product?

- (A) propan-2-ol
- (B) propane
- (C) propanal
- (D) propene

Q54. Which equation represents a cracking reaction?

- (A) $\text{C}_{10}\text{H}_{22} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_2\text{H}_4$
- (B) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$
- (C) $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- (D) $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$

Organic Chemistry II & Analysis

Q55. Which reagent gives a silver mirror with an aldehyde but does not react with a ketone?

- (A) 2,4-dinitrophenylhydrazine
- (B) bromine water
- (C) Tollens' reagent
- (D) sodium hydrogencarbonate solution

Q56. Ethyl ethanoate is boiled with aqueous sodium hydroxide. What are the products?

- (A) ethanoic acid and ethanol
- (B) sodium ethanoate and ethanol
- (C) sodium ethanoate and methanol
- (D) ethene and water

Q57. In the nitration of benzene, the attacking electrophile is...

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

Q58. Phenylamine is a much weaker base than ethylamine because...

- (A) the lone pair on the nitrogen atom in phenylamine is delocalised into the benzene ring
- (B) phenylamine has no lone pair on its nitrogen atom
- (C) ethylamine is insoluble in water
- (D) phenylamine has a much smaller relative molecular mass

Q59. Glycine, $\text{H}_2\text{NCH}_2\text{COOH}$, is dissolved in a solution of very low pH. The predominant form of glycine is...

- (A) $\text{H}_2\text{NCH}_2\text{COOH}$
- (B) $\text{H}_2\text{NCH}_2\text{COO}^-$
- (C) $^+\text{NH}_3\text{CH}_2\text{COOH}$
- (D) $^+\text{NH}_3\text{CH}_2\text{COO}^-$

Q60. In a thin-layer chromatography experiment, a spot moved 4.2 cm from the baseline while the solvent front moved 6.0 cm. What is the R_f value of the substance?

- (A) 0.43
- (B) 0.70
- (C) 1.43
- (D) 0.30

Answer Key

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

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