

A-Level Chemistry Practice Test 10

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 neon contains 90.5% of the isotope ^{20}Ne , 0.27% of the isotope ^{21}Ne and 9.25% of the isotope ^{22}Ne . What is the relative atomic mass of neon?

- (A) 20.0
- (B) 20.2
- (C) 21.0
- (D) 20.9

Q2. The first ionisation energy of potassium (419 kJ mol^{-1}) is lower than that of sodium (496 kJ mol^{-1}). The main reason is that in potassium

- (A) the nuclear charge is smaller
- (B) there are fewer occupied electron shells
- (C) the outer electron is further from the nucleus and more shielded, so it is less strongly attracted
- (D) the outer electron is in a p orbital

Q3. In a time-of-flight mass spectrometer, a $^{39}\text{K}^+$ ion travels along a 1.20 m flight tube in $4.40 \times 10^{-5} \text{ s}$. What is the kinetic energy of the ion? (Mass of one $^{39}\text{K}^+$ ion = $39 \times 1.66 \times 10^{-27} \text{ kg}$)

- (A) $2.41 \times 10^{-17} \text{ J}$
- (B) $1.20 \times 10^{-17} \text{ J}$
- (C) $4.82 \times 10^{-17} \text{ J}$
- (D) $6.47 \times 10^{-26} \text{ J}$

Q4. Which Period 3 oxide is acidic?

- (A) Na_2O
- (B) MgO
- (C) Al_2O_3
- (D) SO_2

Q5. A chromium atom has the electron configuration $[\text{Ar}] 3d^5 4s^1$. How many electrons does it have in s orbitals?

- (A) 6
- (B) 7
- (C) 8
- (D) 11

Amount of Substance

- Q6. What volume is occupied by 0.500 mol of a gas at a pressure of 200 kPa and a temperature of 300 K? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)**
- (A) 6.23 dm^3
(B) 3.12 dm^3
(C) 12.5 dm^3
(D) 62.3 dm^3
- Q7. 22.5 cm^3 of $0.100 \text{ mol dm}^{-3}$ hydrochloric acid exactly neutralises 25.0 cm^3 of calcium hydroxide solution. What is the concentration of the calcium hydroxide solution?**
- (A) $0.0900 \text{ mol dm}^{-3}$
(B) $0.0225 \text{ mol dm}^{-3}$
(C) $0.180 \text{ mol dm}^{-3}$
(D) $0.0450 \text{ mol dm}^{-3}$
- Q8. 5.30 g of benzene ($M_r = 78.0$) is nitrated and 4.92 g of nitrobenzene ($M_r = 123$) is obtained. What is the percentage yield?**
- (A) 49.2%
(B) 92.8%
(C) 58.9%
(D) 65.6%
- Q9. Ethanol can be made by the reaction $\text{C}_2\text{H}_5\text{Br} + \text{KOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{KBr}$. What is the atom economy for the production of ethanol? (M_r : $\text{C}_2\text{H}_5\text{Br} = 109$, $\text{KOH} = 56.1$, $\text{C}_2\text{H}_5\text{OH} = 46.0$)**
- (A) 42.2%
(B) 27.9%
(C) 72.1%
(D) 100%
- Q10. Complete combustion of 0.460 g of a compound containing only carbon, hydrogen and oxygen gives 0.880 g of carbon dioxide and 0.540 g of water. What is the empirical formula of the compound?**
- (A) $\text{C}_2\text{H}_6\text{O}$
(B) CH_2O
(C) $\text{C}_2\text{H}_4\text{O}$
(D) CH_4O
- Q11. How many moles of chloride ions are present in 250 cm^3 of $0.200 \text{ mol dm}^{-3}$ magnesium chloride solution?**
- (A) 0.0500 mol
(B) 0.0250 mol
(C) 0.400 mol
(D) 0.100 mol
- Bonding & Structure**
-

Q12. What are the shape and bond angle of a water molecule?

- (A) Linear, 180°
- (B) Trigonal planar, 120°
- (C) Bent (non-linear), 104.5°
- (D) Tetrahedral, 109.5°

Q13. Which substance has the highest boiling point?

- (A) Ethanol
- (B) Methoxymethane
- (C) Ethanal
- (D) Propane

Q14. The lattice enthalpy of magnesium oxide is much more exothermic than that of sodium chloride, mainly because

- (A) MgO has a giant covalent structure
- (B) Mg^{2+} and O^{2-} ions are relatively small and carry double charges, giving very strong electrostatic attractions
- (C) MgO contains more ions per formula unit than NaCl
- (D) Oxygen is more electronegative than chlorine

Q15. Which species contains a dative (coordinate) covalent bond?

- (A) CH_4
- (B) CO_2
- (C) Cl_2
- (D) NH_4^+

Q16. Which molecule is polar overall?

- (A) BF_3
- (B) CO_2
- (C) CH_2Cl_2
- (D) CCl_4

Q17. Which substance has the highest melting point?

- (A) Diamond
- (B) Magnesium oxide
- (C) Sodium chloride
- (D) Ice

Energetics & Thermodynamics

Q18. When 1.00 g of ethanol is burned, it raises the temperature of 500 g of water by 11.5 K. What value of the enthalpy of combustion of ethanol is calculated from this experiment? ($c = 4.18 \text{ J g}^{-1} \text{ K}^{-1}$; Mr of ethanol = 46.0)

- (A) -553 kJ mol^{-1}
- (B) $-1106 \text{ kJ mol}^{-1}$
- (C) $-1367 \text{ kJ mol}^{-1}$
- (D) $-2212 \text{ kJ mol}^{-1}$

Q19. Use these enthalpies of formation: $\text{N}_2\text{H}_4(\text{l}) = +51 \text{ kJ mol}^{-1}$ and $\text{H}_2\text{O}(\text{l}) = -286 \text{ kJ mol}^{-1}$. What is the enthalpy change for the reaction $\text{N}_2\text{H}_4 + \text{O}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$?

- (A) -235 kJ mol^{-1}
- (B) $+623 \text{ kJ mol}^{-1}$
- (C) -337 kJ mol^{-1}
- (D) -623 kJ mol^{-1}

Q20. The standard entropies are: $\text{N}_2 = 192 \text{ J K}^{-1} \text{ mol}^{-1}$, $\text{H}_2 = 131 \text{ J K}^{-1} \text{ mol}^{-1}$ and $\text{NH}_3 = 193 \text{ J K}^{-1} \text{ mol}^{-1}$. What is the entropy change for the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$?

- (A) $-394 \text{ J K}^{-1} \text{ mol}^{-1}$
- (B) $-97 \text{ J K}^{-1} \text{ mol}^{-1}$
- (C) $-199 \text{ J K}^{-1} \text{ mol}^{-1}$
- (D) $+199 \text{ J K}^{-1} \text{ mol}^{-1}$

Q21. A reaction has $\Delta H = -95.0 \text{ kJ mol}^{-1}$ and $\Delta S = -210 \text{ J K}^{-1} \text{ mol}^{-1}$. Above what temperature does this reaction cease to be feasible?

- (A) 226 K
- (B) 452 K
- (C) 500 K
- (D) 905 K

Q22. Use these bond enthalpies: $\text{H-H} = 436$, $\text{Br-Br} = 193$ and $\text{H-Br} = 366 \text{ kJ mol}^{-1}$. What is the enthalpy change for the reaction $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$?

- (A) -103 kJ mol^{-1}
- (B) $+103 \text{ kJ mol}^{-1}$
- (C) $-51.5 \text{ kJ mol}^{-1}$
- (D) -629 kJ mol^{-1}

Q23. Potassium chloride has an endothermic enthalpy of solution ($+17 \text{ kJ mol}^{-1}$), yet it dissolves spontaneously in water at room temperature. This is because

- (A) dissolving produces a gas, which escapes
- (B) the enthalpy change must have been measured wrongly
- (C) the heat absorbed comes from the laboratory air, not the solution
- (D) the entropy of the system increases on dissolving, making ΔG negative

Kinetics & Rate Equations

Q24. Initial rates were measured for a reaction between A and B: $[\text{A}] = 0.20$, $[\text{B}] = 0.20$, rate = 4.0×10^{-4} ; $[\text{A}] = 0.40$, $[\text{B}] = 0.20$, rate = 4.0×10^{-4} ; $[\text{A}] = 0.20$, $[\text{B}] = 0.40$, rate = 1.6×10^{-3} (concentrations in mol dm^{-3} , rates in $\text{mol dm}^{-3} \text{ s}^{-1}$). What is the rate equation?

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

Q25. A reaction has the rate equation $\text{rate} = k[\text{A}]^2[\text{B}]$. When $[\text{A}] = [\text{B}] = 0.100 \text{ mol dm}^{-3}$, the rate is $8.00 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}$. What is the value of the rate constant, k ?

- (A) $8.00 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (B) $0.0800 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (C) $80.0 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
- (D) $0.800 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$

Q26. A plot of $\ln k$ against $1/T$ for a reaction is a straight line with a gradient of -6500 K . What is the activation energy of the reaction? ($R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (A) 54.0 kJ mol^{-1}
- (B) 5.40 kJ mol^{-1}
- (C) 782 kJ mol^{-1}
- (D) 65.0 kJ mol^{-1}

Q27. In a first-order reaction, the concentration of the reactant falls from $0.800 \text{ mol dm}^{-3}$ to $0.200 \text{ mol dm}^{-3}$ in 30.0 s . What is the half-life of the reaction?

- (A) 7.5 s
- (B) 15.0 s
- (C) 10.0 s
- (D) 20.0 s

Q28. Raising the temperature of a reaction mixture by about 10 K often roughly doubles the rate of reaction. This is mainly because

- (A) the activation energy of the reaction decreases
- (B) the particles collide exactly twice as often
- (C) a much larger proportion of the particles have energy greater than or equal to the activation energy
- (D) the rate constant changes its units

Equilibria (K_c & K_p)

Q29. An equilibrium mixture for the reaction $\text{Fe}^{3+}(\text{aq}) + \text{SCN}^{-}(\text{aq}) \rightleftharpoons \text{FeSCN}^{2+}(\text{aq})$ contains these concentrations: $\text{Fe}^{3+} = 0.0200$, $\text{SCN}^{-} = 0.0200$ and $\text{FeSCN}^{2+} = 0.0800 \text{ mol dm}^{-3}$. What is the value of K_c ?

- (A) $200 \text{ mol}^{-1} \text{ dm}^3$
- (B) $5.00 \times 10^{-3} \text{ mol}^{-1} \text{ dm}^3$
- (C) $4.00 \text{ mol}^{-1} \text{ dm}^3$
- (D) 200 mol dm^{-3}

Q30. For the equilibrium $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$, the equilibrium partial pressures are $\text{SO}_2 = 20 \text{ kPa}$, $\text{O}_2 = 10 \text{ kPa}$ and $\text{SO}_3 = 60 \text{ kPa}$. What is the value of K_p ?

- (A) 9.00 kPa^{-1}
- (B) 1.11 kPa
- (C) 0.090 kPa^{-1}
- (D) 0.900 kPa^{-1}

Q31. Argon is added to a gaseous equilibrium mixture in a sealed vessel, keeping the volume constant. What happens to the position of equilibrium?

- (A) It does not change
- (B) It shifts to the right
- (C) It shifts to the left
- (D) K_p increases

Q32. For the equilibrium $\text{Fe}^{3+}(\text{aq}) + \text{SCN}^{-}(\text{aq}) \rightleftharpoons \text{FeSCN}^{2+}(\text{aq})$, what are the units of K_c ?

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

Q33. In the equilibrium $2\text{NO}_2(\text{g})$ (dark brown) $\rightleftharpoons \text{N}_2\text{O}_4(\text{g})$ (colourless), the forward reaction is exothermic. What is observed when the equilibrium mixture is cooled?

- (A) It becomes darker brown
- (B) It becomes paler
- (C) There is no visible change
- (D) The pressure rises sharply

Redox & Electrode Potentials

Q34. What is the oxidation state of chromium in $\text{K}_2\text{Cr}_2\text{O}_7$?

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

Q35. The standard electrode potentials are $E^\circ(\text{Ag}^+/\text{Ag}) = +0.80 \text{ V}$ and $E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44 \text{ V}$. What is the standard EMF of the cell $\text{Fe}(\text{s})|\text{Fe}^{2+}(\text{aq})||\text{Ag}^+(\text{aq})|\text{Ag}(\text{s})$?

- (A) +1.24 V
- (B) +0.36 V
- (C) -1.24 V
- (D) +0.80 V

Q36. Which of the following is the strongest reducing agent?

- (A) Cl_2
- (B) Zn
- (C) Fe^{3+}
- (D) Cu^{2+}

Q37. Which of these reactions is a disproportionation reaction?

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

Q38. Dilute sulfuric acid is electrolysed using inert electrodes. What is the ratio of the volumes of gas produced at the cathode and at the anode (cathode gas : anode gas)?

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

Acids, Bases & Buffers

Q39. What is the pH of a $0.00100 \text{ mol dm}^{-3}$ sodium hydroxide solution at 298 K? ($K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$)

- (A) 3.00
- (B) 11.00
- (C) 10.70
- (D) 11.30

Q40. A $0.0500 \text{ mol dm}^{-3}$ solution of a weak acid, HX, has a pH of 3.00. What is the value of K_a for HX?

- (A) $2.00 \times 10^{-5} \text{ mol dm}^{-3}$
- (B) $1.00 \times 10^{-6} \text{ mol dm}^{-3}$
- (C) $2.50 \times 10^{-5} \text{ mol dm}^{-3}$
- (D) $4.00 \times 10^{-4} \text{ mol dm}^{-3}$

Q41. A buffer solution is made from 0.100 mol of ethanoic acid and 0.100 mol of sodium ethanoate in 1.00 dm^3 of solution ($K_a = 1.80 \times 10^{-5} \text{ mol dm}^{-3}$). Then 0.0100 mol of hydrochloric acid is added and the volume stays at 1.00 dm^3 . What is the pH of the resulting buffer?

- (A) 4.52
- (B) 4.74
- (C) 4.92
- (D) 4.66

Q42. Dilute hydrochloric acid is titrated against aqueous ammonia. Which indicator is most suitable for this titration?

- (A) Phenolphthalein (pH range 8.3-10.0)
- (B) Universal indicator
- (C) Methyl orange (pH range 3.1-4.4)
- (D) Litmus

Q43. Which salt forms a solution with a pH less than 7?

- (A) NH_4Cl
- (B) CH_3COONa
- (C) KNO_3
- (D) Na_2CO_3

Inorganic Chemistry

Q44. Which Group 2 metal reacts most vigorously with cold water?

- (A) Magnesium
- (B) Barium
- (C) Calcium
- (D) Strontium

Q45. Which halide ion is the strongest reducing agent?

- (A) F^-
- (B) Cl^-
- (C) I^-
- (D) Br^-

Q46. Which complex ion is square planar?

- (A) $[Fe(H_2O)_6]^{3+}$
- (B) $[Zn(NH_3)_4]^{2+}$
- (C) $[Ag(NH_3)_2]^+$
- (D) $[Pt(NH_3)_2Cl_2]$

Q47. Sodium hydroxide solution is added dropwise to a solution containing copper(II) ions. What is observed?

- (A) A green precipitate forms
- (B) A brown precipitate forms
- (C) A blue precipitate forms, which does not dissolve in excess sodium hydroxide
- (D) A white precipitate forms, which dissolves in excess sodium hydroxide

Q48. When concentrated sulfuric acid is added to sodium bromide, the products include

- (A) hydrogen bromide only
- (B) bromine and sulfur dioxide
- (C) hydrogen and bromine
- (D) hydrogen bromide and oxygen

Organic Chemistry I

Q49. What is the initiation step in the free-radical substitution of ethane by bromine?

- (A) $Br_2 \rightarrow 2Br^\bullet$ in the presence of ultraviolet light
- (B) $Br^\bullet + C_2H_6 \rightarrow C_2H_5^\bullet + HBr$
- (C) $C_2H_5^\bullet + Br_2 \rightarrow C_2H_5Br + Br^\bullet$
- (D) $C_2H_5^\bullet + Br^\bullet \rightarrow C_2H_5Br$

Q50. Which halogenoalkane is hydrolysed most rapidly by aqueous alkali?

- (A) 1-chlorobutane
- (B) 2-bromobutane
- (C) 1-iodobutane
- (D) 2-iodo-2-methylpropane

Q51. 2-bromobutane is heated with ethanolic potassium hydroxide. What is the major organic product?

- (A) Butan-2-ol
- (B) But-1-ene
- (C) But-2-ene
- (D) Butane

Q52. Propene can be converted into propan-2-ol by

- (A) heating with steam alone at room temperature
- (B) reaction with water in the presence of a concentrated phosphoric acid catalyst
- (C) hydrogenation with a nickel catalyst
- (D) oxidation with potassium manganate(VII)

Q53. Which alcohol is not oxidised by acidified potassium dichromate(VI) on heating?

- (A) Butan-1-ol
- (B) Butan-2-ol
- (C) Ethanol
- (D) 2-methylpropan-2-ol

Q54. Which alkene can exist as E-Z isomers?

- (A) Pent-2-ene
- (B) Pent-1-ene
- (C) 2-methylbut-2-ene
- (D) Ethene

Organic Chemistry II & Analysis

Q55. Ethanoic acid can be reduced to ethanol. Which reagent will carry out this reduction?

- (A) NaBH₄ in methanol
- (B) Acidified K₂Cr₂O₇
- (C) LiAlH₄ in dry ether
- (D) H₂ with a nickel catalyst at room temperature

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

- (A) Ethanoic acid and ethanol
- (B) Sodium ethanoate and ethanol
- (C) Sodium ethanoate and ethane
- (D) Ethanoic acid and methanol

Q57. Benzene reacts with ethanoyl chloride in the presence of an aluminium chloride catalyst to form phenylethanone. This reaction is an example of

- (A) nucleophilic substitution
- (B) electrophilic addition
- (C) free-radical substitution
- (D) electrophilic substitution

Q58. When aqueous bromine is added to phenylamine, what is observed?

- (A) The bromine is decolourised and a white precipitate of 2,4,6-tribromophenylamine forms
- (B) There is no reaction unless an iron(III) bromide catalyst is used
- (C) An orange solution of 4-bromophenylamine forms slowly
- (D) A yellow precipitate of nitrobenzene forms

Q59. Which statement about amino acids is correct?

- (A) They have low melting points, typical of simple molecular substances
- (B) They cannot react with either acids or alkalis
- (C) In the solid state they exist as zwitterions, which is why they have high melting points
- (D) They are insoluble in water in all forms

Q60. How many signals appear in the proton NMR spectrum of ethyl ethanoate, CH₃COOCH₂CH₃, and in what intensity (integration) ratio?

- (A) 3 signals, ratio 1 : 1 : 1
- (B) 3 signals, ratio 3 : 2 : 3
- (C) 4 signals, ratio 3 : 2 : 2 : 3
- (D) 2 signals, ratio 1 : 1

Answer Key

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

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