AS LEVEL CHEMISTRY EXAM

Q120

Which substance contains polar molecules?

A C_2H_4

B CO_2

C NCl_3

D SF_6

Q320

Which statement explains why ice is less dense than water?

A Hydrogen bonds are stronger in ice than in water.

B Hydrogen bonds hold H_2O molecules apart in ice.

C Ice is a solid but water is a liquid.

D Ice contains hydrogen bonds, but water does not contain hydrogen bonds.

Q420

Some Group 2 compounds can be used to neutralise acid soils and to treat acid indigestion.

Which Group 2 compound would **not** be suitable for either use?

A $BaSO_4$

B $CaCO_3$

C $Ca(OH)_2$

D $Mg(OH)_2$

Q620

The equation for a redox reaction is shown below.

$$2HClO_3 + 2HCl \rightarrow 2ClO_2 + Cl_2 + 2H_2O$$

Which statement is correct?

A Cl is both oxidised and reduced.

B Cl is oxidised and O is reduced.

C O is both oxidised and reduced.

D O is oxidised and Cl is reduced.

Q820

The unbalanced equation for the reaction of copper with concentrated nitric acid is shown belov

.....Cu + ...HNO_3 → .....$Cu(NO_3)_2$ + ...NO_2 + ...H_2O

What is the number of moles of HNO_3 that react with 1 mole of Cu?

A 2

B 3

C 4

D 6

Q1020

Which sample contains the greatest number of molecules?

A 1 g of methanol, CH_3OH

B 2 g of nitrogen dioxide, NO_2

C 3 g of phosphorus, P_4

D 4 g of iodine, I_2

Q1120

Hydrogen and oxygen react as shown below.

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ $\Delta_r H = -486\,kJ\,mol^{-1}$

Bond enthalpies are shown in the table.

Bond	H–H	O=O
Bond enthalpy /kJ mol^{-1}	+436	+498

What is the bond enthalpy, in kJ mol^{-1}, for the O–H bond?

A +221

B +355

C +464

D +928

Q1520

Which property explains the low reactivity of alkanes?

A Electron pair repulsion between σ-bonds

B Free rotation about σ-bonds

C High C–C bond enthalpy

D High polarity of the C–H bonds

Q1820

A student reacts 24.24 g of 2-bromobutane in the reaction below.

$CH_3CH_2CHBrCH_3 + NaOH \rightarrow CH_3CH_2CHOHCH_3 + NaBr$

$M_r = 136.9$ $M_r = 74.0$

The reaction produces 4.81 g of $CH_3CH_2CHOHCH_3$.

What is the percentage yield of $CH_3CH_2CHOHCH_3$?

A 10.7%

B 19.8%

C 36.7%

D 54.1%

Q221

Pauling electronegativity values for the halogens F to I and some elements in period 2 of the periodic table are shown below.

B 2.04	C 2.55	N 3.04	O 3.44	F 3.98
				Cl 3.16
				Br 2.96
				I 2.66

Which bond has the correct polarity?

A	B	C	D
$^{\delta-}$ N—I $^{\delta+}$	$^{\delta-}$ C—F $^{\delta+}$	$^{\delta-}$ B—Cl $^{\delta+}$	$^{\delta-}$ Br—Cl $^{\delta+}$

Q621

A student mixes 250.0 cm^3 of 0.100 mol dm^{-3} KOH with 750.0 cm^3 of 0.100 mol dm^{-3} $Ca(OH)_2$.
What is the OH^- concentration, in mol dm^{-3}, in the resulting mixture?

A 0.0250

B 0.100

C 0.150

D 0.175

Q1021

The equation for the complete combustion of propene, C_3H_6, is shown below.

$C_3H_6(g) + 4½O_2(g) \rightarrow 3CO_2(g) + 3H_2O(l)$

Standard enthalpy changes of formation, $\Delta_f H^{\ominus}$, are shown in the table.

Compound	$\Delta_f H^{\ominus}$ / kJ mol^{-1}
$C_3H_6(g)$	+20
$O_2(g)$	0
$CO_2(g)$	–394
$H_2O(l)$	–286

What is the standard enthalpy change of combustion of $C_3H_6(g)$, in kJ mol^{-1}?

A –2060

B –700

C +700

D +2060

Q1221

Which statement about dynamic equilibrium is **not** correct?

A A catalyst increases the rate of both forward and reverse reactions by the same amount.

B Dynamic equilibrium exists only in a closed system.

C The concentrations of the reactants and products are equal.

D The rate of the forward reaction is equal to the rate of the reverse reaction.

Q1521

Which structural isomer of C_7H_{16} has the weakest induced dipole–dipole interactions (London forces)?

A 2,3-dimethylpentane

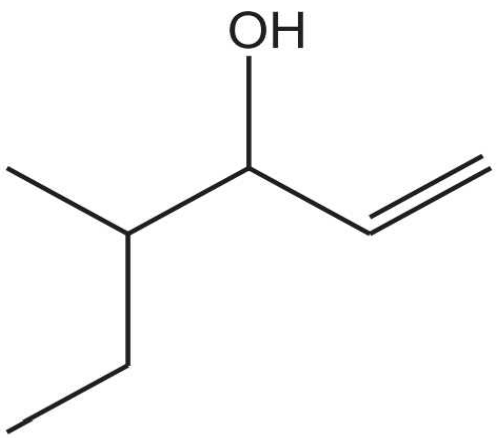
B 3-ethylpentane

C 2-methylhexane

D 2,2,3-trimethylbutane

Q1721

What is the systematic name of the compound below?



A 3-methylhex-5-en-4-ol

B 4-methylhex-1-en-3-ol

C 2-ethylpent-4-en-3-ol

D 4-ethylpent-1-en-3-ol

Q1821

The ‘dienes’ are a homologous series of non-cyclic compounds with two double bonds.

The simplest diene is shown below.

What is the general formula of the dienes homologous series?

A C_nH_{2n+2}

B C_nH_{2n}

C C_nH_{2n-2}

D C_nH_{2n-4}

Q122

Which substance has a giant covalent lattice structure in its solid state?

A potassium

B silicon

C sodium chloride

D water

Q222

What is the meaning of the term electronegativity?

A The ability of an atom to attract the electrons in a covalent bond.

B The ability of an atom to gain an electron.

C The electrostatic attraction between a negative ion and a positive ion.

D The size of the charge on a negative ion.

Q622

The first four ionisation energies of a Period 3 element **X** are shown in the table.

Ionisation energy / kJ mol^{-1}			
1st	**2nd**	**3rd**	**4th**
738	1451	7733	10541

Element **X** is reacted with chlorine.

What is the formula of the chloride formed?

A **X**Cl

B **X**Cl_2

C **X**Cl_3

D **X**Cl_4

Q722

A sample of lead(II) sulfate (M = 303.3 g mol^{-1}) is decomposed by heat, as shown in the equation below.

$2PbSO_4(s) \rightarrow 2PbSO_3(s) + O_2(g)$

The reaction forms 2.40 g of $O_2(g)$.

What is the mass of lead(II) sulfate that has been heated? Assume a 100% yield.

A 22.7 g

B 30.3 g

C 45.5 g

D 60.7 g

Q1022

What is the correct explanation for the trend in the boiling points of chlorine, bromine, and iodine down the group?

A Bond enthalpy increases.

B Chemical reactivity decreases.

C Electronegativity decreases.

D London forces increase.

Q1322

Four equilibrium reactions are set up.

The concentration of each gas in the equilibrium mixtures is $0.1\,\text{mol}\,\text{dm}^{-3}$.

Which equilibrium has a numerical K_c value of 0.01?

A $CH_4(g) + 2H_2O(g) \rightleftharpoons CO_2(g) + 4H_2(g)$

B $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

C $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

D $2NO_2(g) \rightleftharpoons N_2O_4(g)$

Q1422

What is the number of σ-bonds in the molecule below?

A 1

B 3

C 7

D 9

Q1822

When heated with NaOH(aq), 1-chlorobutane is hydrolysed at a slower rate than 1-bromobutane.

Which statement explains the different rates?

A The C–Br bond enthalpy is greater than the C–Cl bond enthalpy.

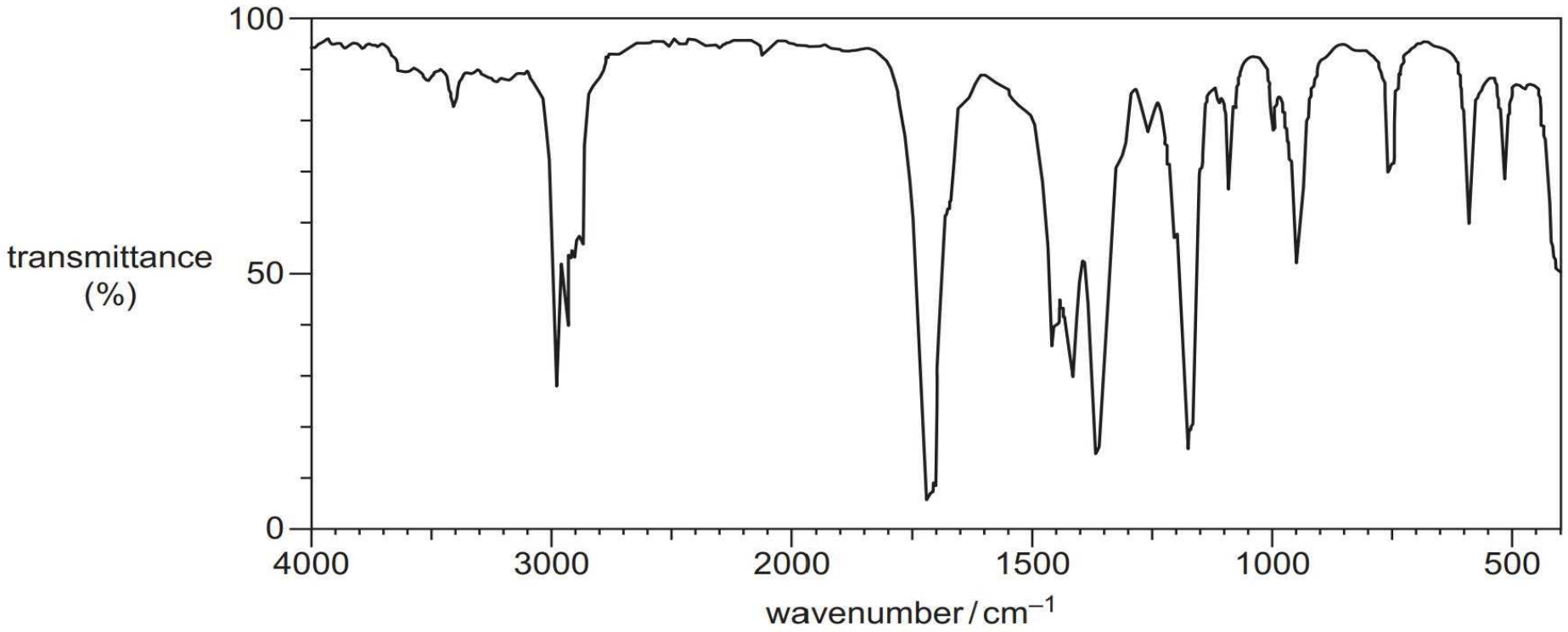
B The C–Br bond enthalpy is less than the C–Cl bond enthalpy.

C The C–Br bond is less polar than the C–Cl bond.

D The C–Br bond is more polar than the C–Cl bond.

Q1922

Which organic compound could have produced the infrared spectrum below?



A $CH_3COCH_2CH_3$

B $CH_3CH_2CHOHCH_3$

C $CH_3COCH_2CH_2OH$

D CH_3CH_2COOH

Q123

Which statement explains the trend in boiling points down the halogens group?

A Covalent bonds become stronger.

B Induced dipole–dipole interactions (London forces) become stronger.

C Ionic bonds become stronger.

D Permanent dipole–dipole interactions become stronger.

Q323

Hydrogen can be prepared industrially by the reaction of methane with steam. The equation is shown below.

$$CH_4(g) + 2H_2O(g) \rightarrow 4H_2(g) + CO_2(g)$$

What is the atom economy of hydrogen for this process?

A 3.8%

B 4.3%

C 15.4%

D 17.4%

Q623

Successive ionisation energies, in $kJ\,mol^{-1}$, of an element in Period 3 of the periodic table are shown below.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th
578	1817	2745	11578	14831	18378	23296	27460	31862

What is the formula of the oxide of the Period 3 element?

A Na_2O

B MgO

C Al_2O_3

D SiO_2

Q823

Magnesium nitrate, $Mg(NO_3)_2$, decomposes when heated:

$Mg(NO_3)_2(s) \rightarrow MgO(s) + 2NO_2(g) + \frac{1}{2}O_2(g)$

0.00250 mol of $Mg(NO_3)_2$ is decomposed.

What is the volume of gas produced, measured at RTP?

A $30\,cm^3$

B $60\,cm^3$

C $120\,cm^3$

D $150\,cm^3$

Q923

Zinc reacts with aqueous silver nitrate, as shown in the equation:

$$Zn(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Zn(NO_3)_2(aq)$$

0.10 g of zinc is added to 15 cm^3 of 0.25 mol dm^{-3} aqueous silver nitrate.

What is the mass of silver metal that would be formed?

A 0.16 g

B 0.20 g

C 0.33 g

D 0.40 g

Q1123

The standard enthalpy change of formation of water is $-286\,kJ\,mol^{-1}$.

Which statement or equation is correct?

A $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\quad \Delta H^{\ominus} = -143\,kJ\,mol^{-1}$

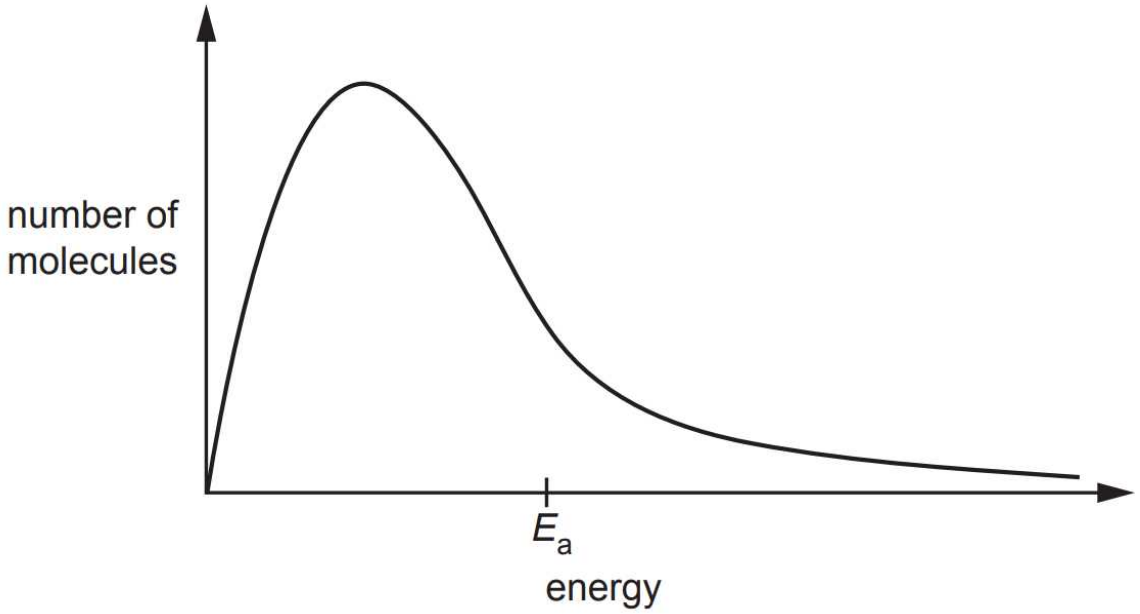
B $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\quad \Delta H^{\ominus} = -286\,kJ\,mol^{-1}$

C The O–H bond enthalpy is $-143\,kJ\,mol^{-1}$.

D The standard enthalpy change of combustion of hydrogen is $-286\,kJ\,mol^{-1}$.

Q1323

The Boltzmann distribution showing the activation energy, E_a, for an uncatalysed reaction is shown below.



What is the difference for the **catalysed** reaction?

A The activation energy shifts to the left.

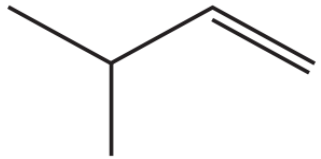
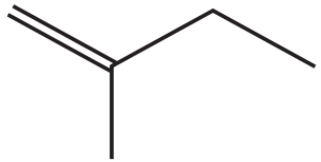
B The activation energy shifts to the right.

C The curve flattens.

D The curve shifts to the right.

Q1523

Which formula does **not** represent 3-methylbut-1-ene?

A	$CH_3CHCH_3CHCH_2$
B	$CH_2CHCH(CH_3)_2$
C	
D	

Q2023

Pentan-2-ol and pentan-3-ol are structural isomers with the molecular formula $C_5H_{12}O$ and $M_r = 88$.

The isomers can be distinguished from the fragment ions in their mass spectra.

Which fragment ion would you expect to be present in only **one** of these isomers?

A $m/z = 29$

B $m/z = 45$

C $m/z = 59$

D $m/z = 73$