A Level OCR Chemistry

Chapter 10 – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	A compound made up of hydrogen and carbon only.		1	AO1 4.1.1a
1(b)	Because it is an alkane it has the general formula C_nH_{2n+2}. Its molecular formula is C_5H_{12}. Relative molecular mass = $5 \times 12 + 12 \times 1 = 72$		1 1 1	AO2 2.1.1e
1(c)	Isomers have the same molecular formula but different structural formulae.		1	AO1 4.1.1e
1(d)	$CH_3CH_2CH_2CH_2CH_3$ pentane $CH_3CH(CH_3)CH_2CH_3$ 2-methylbutane $C(CH_3)_4$ or $(CH_3)_4C$ 2,2-dimethylpropane	Both formula and name required for each mark.	1 1 1	AO2 4.1.1a
1(e)	0.36 g = 0.36/72 mol = 5×10^{-3} mol Number of molecules = $5\times10^{-3} \times 6.022\times10^{23} = 3.01 \times 10^{21}$ In each molecule there are 17 atoms. Total number of atoms = $3.01\times10^{21} \times 17 = 5.12\times10^{22}$	Just the answer with no reasoning shown is **1** mark	1 1 1	AO2 2.3.1a 2.3.1a AO3 2.3.1a
2(a)	I pent-1-ene II 2-methylbut-2-ene III pent-2-ene	Do not allow pentene	1 1 1	AO2 4.1.1a
2(b)(i)	Stereoisomers have the same structural formula Have different arrangement of bonds in space		1 1	AO1 4.1.3c

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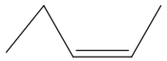
2(b)(ii)	Isomer III 		1 1	AO2 4.1.3c
2(b)(iii)	There is no free rotation about the C═C double bond. On each carbon of the C═C bond there are 2 different atoms or groups		1 1	AO1 4.1.3c
2(c)	Methylcyclobutane		1	AO2 4.1.1c(v)
3(a)	Use the ideal gas equation $n = \frac{pV}{RT}$ $n = \frac{1.01\times10^{5} \times 85\times10^{-6}}{8.31 \times 450}$ $= 2.30\times10^{-3}$ mol $M_r = m/n = 0.20/2.30 \times 10^{-3} = 87(.1)\ g\ mol^{-1}$	Some evidence of using the equation is required	1 1 1 1	AO2 4.2.4f 2.1.3f
3(b)	The last /highest value significant peak		1	AO1 4.2.4f
3(c)	Error = 100% × |88–87|/88 1.14%		1 1	AO2 1.1.4d

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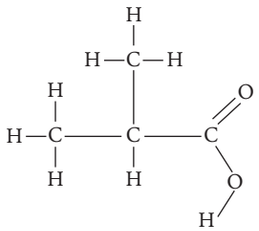
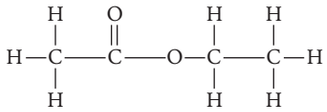
3(d)(i)	2 marks for 1st (left-hand) diagram  1 mark for 2nd diagram 	Give both marks if as shown Lose 1 mark if give CH_3 on CH but does not show all hydrogens All bonds must be shown	2 1	AO3 4.1.1b
3(d)ii)	a = 109.5 b = 104.5°		1 1	AO1 4.1.1b
4(a)	Chlorine is more electronegative than carbon electrons are not shared equally / the electrons are attracted more by the chlorine atom electron cloud distorted towards chlorine		1 1 1	AO2 2.2.2j
4(b)(i)	The molecule is tetrahedral and symmetrical The electrons (electron clouds) are symmetrically distributed so the polar bonds cancelout OR not asymmetrically distributed		1 1	AO2 2.2.2j

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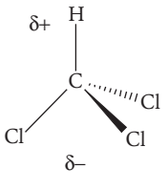
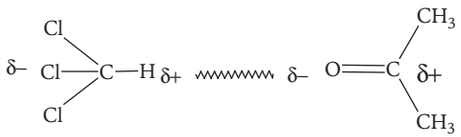
Question	Answers	Extra information	Mark	AO Spec reference
4(b)(ii)	1 mark for atoms and bonds 1 for dipole  		1 1	AO3 2.2.2j
4(c)	intermolecular bond is formed Diagram shows the orientation of the molecules as shown below with dipole-dipole forces shown in-between molecules  		1 1 1	AO3 2.2.2k
5(a)	$CH_3CH_2CH_2CH_2OH$ $CH_3\ CH_2CH_2CH_2CH_3$		1 1	AO1 4.1.1b
5(b)	Butan-1-ol has an OH group which can hydrogen bond to other -OH groups on the butan-1-ol molecules. Pentane has (weak) instantaneous dipole-instantaneous dipole forces between the molecules which are transient (temporary). (Butan-1-ol also has these forces.) The hydrogen bonds are stronger than the instantaneous dipole-instantaneous dipole forces between the molecules.		1 1 1	AO2 2.2.2l/4.2.1a

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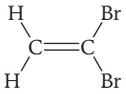
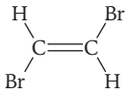
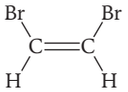
5(c)	Fill both burettes with the two liquids and rub the nylon rod with the silk rag to produce a charged rod Run each liquid slowly from the burette (into a beaker) Observe any deviation of the liquid stream The butan-1-ol will be deviated a lot because it is a polar liquid. The pentane stream will not be deviated because it is non-polar and will not be affected by the electrical field.		1 1 1 1 1	AO3 1.2.1a
6(a)	CH_2BrCH_2Br 1, 2-dibromoethane CH_3CHBr_2 1, 1-dibromoethane		1 1	AO2 4.1.1e
6(b)(i)	 1, 1-dibromoethene  E-1, 2-dibromoethene  Z-1, 2-dibromoethene		1 1 1	AO2 4.1.3c
6(b)(ii)	1, 1-dibromoethene and Z-1, 2-dibromoethene are polar The more electronegative bromine atoms are at one end or on one side of the molecule This leads to an asymmetric distribution of electrons/charge and therefore the molecule is polar		1 1 1	AO3 4.1.3c
6(b)(iii)	In $C_2H_4Br_2$ the bond angle is 109.5° In $C_2H_2Br_2$ the angle is 120°		1 1	AO2 2.2.2g/4.1.3b

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Answers:

1 (a) False.
π and 10 never changes/they are not variables so they can't be proportional to each other

(b) False.
$\pi^2 = 9.8696\ldots$ this is not the same as 10 (you could write: $\pi^2 \neq 10$) .

(c) True.
$\pi^2 = 9.8696$ which is very close to 10

(d) True.

(e) False.
e to a negative power is less than 1. The more negative it is, the smaller it gets.
$e^{-100} = 3.74 \times 10^{-44}$

(f) False.
For a zero order reaction, rate does not vary with concentration

(g) False.
Rate is proportional to the rate constant, k. $k = Ae^{-\frac{E_a}{RT}}$ (Arrhenius equation). So, rate does not increase linearly with temperature even though it does increase with
temperature. (Actually rate $\propto e^{-\frac{1}{T}}$.

(h) False.
The enthalpy change of combustion of propane is higher than ethane because there are more bonds made for the combustion of propane. However, it is incorrect to use the $\gg$ symbol, because $\Delta_c H^o(C_3H_8)$ is of the same order of magnitude as $\Delta_c H^o(C_2H_6)$. Both enthalpy changes are approximately in the 1000s kJ mol^{-1}.

2 (a) >
$A_r(Se) = 34$, $A_r(Se) = 16$. It would be wrong to use the $\gg$ symbol as they are both the same order of magnitude. Both in the tens.

(b) $\gg$
The mass of a diamond is likely to be comparable to the mass of plastic bag, but a polymer has millions of molecules in it. So, there would be millions more carbon atoms in diamond than polymer chains in a plastic bag. It's right to use $\gg$ and not >, because it is many orders of magnitude higher.

(c) $\sim$ or $\approx$.
Chemistry A level has a even gender split – it is the most gender balanced of the science subjects (at time of writing). It would not be right to use = as it is very, very unlikely to be perfectly balanced.