Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) (i) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	**1**	
(ii) fermentation	**1**	Learn the equation of fermentation and remember there is no oxygen there. The yeast respires anaerobically.
(b) (i) $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$	**1**	
(ii) CO *or* carbon monoxide *or* C *or* carbon	**1**	
2 (a) (i) potassium (or sodium) dichromate(VI) *or* correct formula *or* potassium manganate(VII)	**1**	If you give a contradiction of name and formula you lose the mark. Also if you give the name, you must give the correct name including the oxidation state.
H_2SO_4 / HCl* / H_3PO_4 / HNO_3	**1**	Acidified is accepted. *If you put $KMnO_4$ in the last part of the question you cannot have HCl here.
oxidation *or* redox	**1**	
(b) (i) $CH_3CH_2C(H)=O$	**1**	The structure must clearly be an aldehyde showing the C=O
(ii) Reagents can be: Tollens' reagent *or* Fehling's/ Benedict's reagent *or* acidified potassium dichromate *or* ammoniacal silver nitrate *or* $AgNO_3 + NH_3$	**1**	$AgNO_3$ on its own will not score. Also potassium dichromate must show that it is acidified.
with propanone: stays colourless with Tollens' reagent, stays blue with Fehling's/Benedict's solution, stays orange with potassium dichromate in acid solution	**1**	If your reagent is correct then you can also have no change for the observation here for propanone.
with propanal: there is a reaction. Depending on your reagent the following happens: Tollens' reagent gives silver mirror	**1**	
Fehling's/Benedict's reagent gives a red / brown / orange precipitate / solid		
acidified potassium dichromate goes green		
3 **(a)** aqueous *or* solution in water *or* (aq) in the equation	**1**	
yeast *or* zymase	**1**	Don't just say 'an enzyme'.

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anaerobic / absence of oxygen / absence of air *or* neutral pH	1	
T in the range 30–40 °C only	1	Learn these 4 points.
fermentation	1	
$C_6H_{12}O_6 \rightarrow 2CH_3CH_2OH + 2CO_2$	1	
$CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$	1	You can use C_2H_5OH but you should not use C_2H_6O.
(b) dehydration is the <u>elimination</u> of water *or* removal of <u>combined</u> water from a compound / molecule	1	Don't say from a 'substance'.
catalyst = concentrated H_2SO_4 *or* concentrated phosphoric acid *or* aluminium oxide	1	
$CH_3CH_2OH \rightarrow H_2C{=}CH_2 + H_2O$	1	You can use C_2H_5OH but you should not use C_2H_6O. Also CH_2CH_2 is not given credit.
4 (a) (i) compounds with the same molecular formula	1	
but different structural formulae / different structures	1	This is a definition so should be learnt.
(ii) C_3H_6O only	1	
(iii) CH_2 only	1	
(b) potassium dichromate(VI) / $K_2Cr_2O_7$ and acid / acidified / H_2SO_4 / H^+	1	You can also have $KMnO_4$ / H_2SO_4, but not HCl.
remains orange *or* no change *or* no reaction	1	Or remain purple if $KMnO_4$ used.
orange to green	1	Or goes from purple to colourless if $KMnO_4$ in acid used or gives brown precipitate or goes green if $KMnO_4$ neutral or in alkali.
(c) <u>choice of reagents</u>	1	

potassium dichromate(VI) / $K_2Cr_2O_7$ and acid / acidified / H_2SO_4 / H^+ *or* $KMnO_4$ / H_2SO_4	Fehling's / Benedict's reagent	Tollens' reagent *or* $AgNO_3$ / NH_3 *or* ammoniacal silver nitrate Not $AgNO_3$ alone.

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with the aldehyde C	1	

goes orange to green goes purple to colourless / brown ppt. / green solution if $KMnO_4$ used red solid Potassium dichromate is more usual to do in school.	red solid	silver mirror

Answers	Marks	Examiner's tips
with the ketone D	1	

remains orange *or* no change *or* no reaction *or* purple for $KMnO_4$	remains blue *or* no change *or* no reaction	remains colourless *or* no change *or* no reaction

These tests always come up, so learn the tests to distinguish aldehydes and ketones. If you can't learn them all pick one to really learn.

Answers	Marks	Examiner's tips
(d) bromine	1	This is the test for unsaturation.
alkane remains yellow / orange *or* no change *or* no reaction	1	
the alkene goes colourless *or* decolourised	1	Don't say goes clear! If both observations are the same then you will get no credit for either.
5 (a) (i) $CH_3CH_2CH_2CH_2CH_2OH + [O] \rightarrow CH_3CH_2CH_2CH_2CHO + H_2O$	2	You can write $C_4H_9CH_2OH$ but the product must show the aldehyde group CHO, e.g. C_4H_9CHO
(ii) $CH_3CH_2CH_2CH(OH)CH_3 + [O] \rightarrow CH_3CH_2CH_2COCH_3 + H_2O$	2	You could use $C_3H_7C(OH)CH_3$ but the product must show CO in the ketone, e.g. $C_3H_7COCH_3$
(b) *reagent:* Fehling's/Benedict's reagent *or* Tollens' reagent *or* potassium dichromate *conditions*: if Fehling's/Benedict's reagent – boil, heat, warm if Tollen's reagent – ammoniacal silver nitrate if potassium dichromate – in acid	1 1	Aldehyde and ketone distinguishing tests again.
with aldehyde product from (a)(i): if Fehling's/Benedict's reagent used, get orange or brown or red precipitate if Tollens' reagent used, get silver mirror if potassium dichromate used, solution goes green	1	

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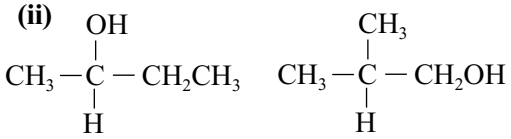
with ketone product in (b)(ii): if Fehling's/Benedict's reagent used, get no precipitate / no reaction if Tollens' reagent used, get no silver mirror / no reaction if potassium dichromate used, get no reaction	1	Do not say 'nothing'.
6 (a) (i) $CH_3CH_2CH_2CH_2CHO + [O] \rightarrow CH_3CH_2CH_2CH_2COOH$	1	*Hint:* In this case you can put C_4H_9CHO going to C_4H_9COOH
(ii) pentanoic acid	1	
(b) (i) $CH_3CH_2CH_2CH_2CH_2OH$ *or* pentan–1–ol	1	
(ii) primary	1	You will be given credit for the abbreviation 1° or 1^y
7 (a) % O = 21.6 %	1	If you do not calculate % O you cannot really carry on!
C $\frac{64.9}{12}$ H $\frac{13.5}{1}$ O $\frac{21.6}{16}$	1	
ratio: 4 : 10 : 1 ($\therefore C_4H_{10}O$)	1	These are always the same method so you should always get them right.
(b) (i) *type of alcohol:* tertiary	1	
reason: no hydrogen atom on central carbon	1	
(ii)  *Isomer 3* *Isomer 4*	2	Always put in all the H's.
(c) (i) aldehyde	1	
(ii) $CH_3CH_2CH_2CH_2OH + [O] \rightarrow CH_3CH_2CH_2CHO + H_2O$	2	$C_4H_{10}O$ is OK as a reactant but C_3H_7CHO is not accepted for product.
(iii) *name:* butanoic acid	1	
structure: $CH_3CH_2CH_2COOH$	1	
(d) *advantage:* fast reaction / pure product/ continuous process / cheap / high yield, 100% alcohol	1	
disadvantage: high technology / ethene from non-renewable source / expensive equipment	1	You cannot just have 'costly'.
8 (a) $CH_3CH_2CH_2CH_2OH$	1	
$CH_3CH(OH)CH_2CH_3$	1	
(b) correct structures drawn for butanal, butanone and butanoic acid	3	You must show the CHO, C=O and COOH groups.

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Answers	Marks	Examiner's tips
or the reaction of butan-1-ol with [O] to produce butanal and water	1	
balanced equation for the reaction of butan-1-ol with [O] to produce butanoic acid and water *or* balanced equation for the reaction of butanal with [O] to produce butanoic acid	1	
balanced equation for the reaction of butan-2-ol with [O] to produce butanone and water	1	
(c) correct structure drawn for 2-methylpropan-2-ol	1	
name: 2-methylpropan-2-ol	1	You must show the alcohol as –O–H. If you put C–H–O, then it looks like an aldehyde and will be marked wrong
9 (a) compounds with the same molecular formula	1	
but different structures due to different positions of the same functional group on the same carbon skeleton / chain	1	Another definition to learn!
(b) compound A is butan-1-ol only	1	
compound C is a ketone	1	
(c) (i) oxidation *or* redox	1	
(ii) $K_2Cr_2O_7$ *or* potassium dichromate(VI)	1	If you write the 'dichromate ion' it will be marked wrong. A reagent must come out of a bottle.
acidified *or* H_2SO_4	1	You must state the acid not just put H^+
(iii) heat under reflux	1	
(iv) correctly drawn structure of 2-methylpropan-2-ol	1	Use clearly drawn C–C and C–O bonds.
(v) correctly drawn structure of methanoic acid	1	You must have C–O and C=O displayed.
(d) (i) Tollens' reagent or ammoniacal silver nitrate *or* Fehling's/Benedict's reagent *or* acidified potassium dichromate(VI)	1	
(ii) correctly drawn structure of methylpropanal	1	You must have C–H and C=O of aldehyde displayed.

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10 (a) (i)

Isomer	Name	
$CH_3CH_2CH_2CH_2OH$	butan-1-ol	**1**
$CH_3-C(CH_3)(OH)-CH_3$	2-methylpropan-2-ol	**1**
$CH_3-CH(CH_3)-CH_2OH$	(2-)methylpropan-1-ol	**1**
$CH_3CH_2-CH(OH)-CH_3$	butan-2-ol	**1**

(b) (i) 2-methylpropan-2-ol **1**

(ii) *dehydrating agent:* conc. H_2SO_4 *or* conc. H_3PO_4 *or* Al_2O_3 **1**

equation:

$$CH_3-C(CH_3)(OH)-CH_3 \longrightarrow \underline{CH_3-C(CH_3)=CH_2 + H_2O}$$

1 C_4H_9OH in equation is allowed provided RHS is correct.

(c) (i) *isomer:* butan-2-ol **1**

structure of the ketone:

$$CH_3CH_2(-)\underline{C(=O)}(-)CH_3$$

1

(ii) isomer: butan-1-ol *or* 2-methylpropan-1-ol **1**

structure of the aldehyde:

either $CH_3CH_2CH_2(-)\underline{C(=O)H}$

or $CH_3-CH(CH_3)(-)\underline{C(=O)H}$ **1**

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(iii) Choice of reagent again		
Reagent — Tollens' ($AgNO_3/NH_3$) — Fehling's /Benedict's	1	
Observation with ketone — stays colourless, no change — stays blue, no change	1	
Observation with aldehyde — silver mirror, black ppt — red solid, orange / red brown / red ppt / solid	1	
(d) *equation:* $CH_3CH_2CH_2CH_2OH + 2[O] \rightarrow CH_3CH_2CH_2COOH + H_2O$	1	You can put C_4H_9OH here and C_3H_7COOH
name of product: butanoic acid	1	
11 (a) fermentation	1	
dehydration *or* elimination	1	
(b) (i) yeast / zymase	1	
(ii) concentrated sulfuric acid *or* phosphoric acid	1	This is not aqueous or dilute acid.
(c) (i) primary *or* 1°	1	
(ii) sugar or glucose or ethanol is renewable *or* ethanol does not contain sulfur-containing impurities *or* ethanol produces less pollution *or* is less smoky *or* less CO / C	1	This type of answer is really common sense.
(d) $C_2H_6 \rightarrow C_2H_4 + H_2$	1	
12 a fuel made from plants or organic matter	1	
C in the sugar plant initially so when fuel is burnt the same amount of C burns to give CO_2 which is reabsorbed by sugar plants etc.	2	
ethanol produced in this way is a renewable resource, sugar – this conserves valuable oil resources since the alternative method to produce alcohol is from ethane and steam	2	