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) $CH_3CH_2C(=O)H$	**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 elimination of water *or* removal of combined 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) choice of reagents	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.

Answers to examination-style questions

Answers	Marks	Examiner's tips

with the aldehyde C

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

1

with the ketone D

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

1

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.

(d) <u>bromine</u>
alkane remains yellow / orange
or no change *or* no reaction
the alkene goes <u>colourless</u> *or* decolourised

1
1
1

This is the test for unsaturation.

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

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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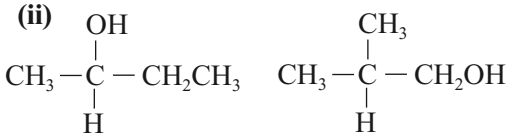
with ketone product in (b)(ii): if Fehling's/Benedict's reagent used, get no precipitate / no reaction if Tollens' reagent used, get no silver mirror / no reaction if potassium dichromate used, get no reaction	1	Do not say 'nothing'.
6 (a) (i) $CH_3CH_2CH_2CH_2CHO + [O] \rightarrow CH_3CH_2CH_2CH_2COOH$	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^o 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.

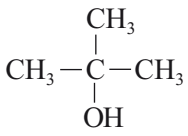
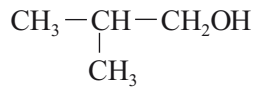
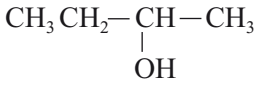
Answers to examination-style questions

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	1	
or Fehling's/Benedict's reagent *or* acidified potassium dichromate(VI)		
(ii) correctly drawn structure of methylpropanal	1	You must have C–H and C=O of aldehyde displayed.

Answers to examination-style questions

Answers	Marks	Examiner's tips

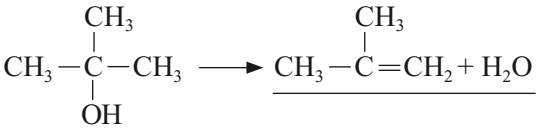
10 (a) (i)

Isomer	Name	
$CH_3CH_2CH_2CH_2OH$	butan-1-ol	**1**
	2-methylpropan-2-ol	**1**
	(2-)methylpropan-1-ol	**1**
	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:



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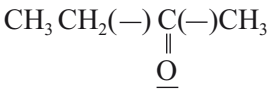
C_4H_9OH in equation is allowed provided RHS is correct.

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

structure of the ketone:



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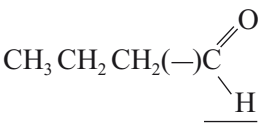
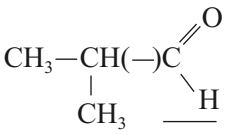
(ii) isomer: butan-1-ol *or* 2-methylpropan-1-ol **1**

structure of the aldehyde:

either 

or 

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Answers	Marks	Examiner's tips
(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 ppt / solid / 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	1	
or ethanol does not contain sulfur-containing impurities		
or ethanol produces less pollution *or* is less smoky *or* less CO / C		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 ethene and steam	2	