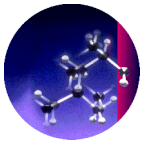

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# SUGGESTED SOLUTIONS TO 2008 CHEMISTRY TRIAL EXAM 1

## *Section A*

| | | | |
|---|---|---|---|
| **1 D** | | **11 D** | |
| **2 D** | | **12 C** | |
| **3 C** | In 0.5mole $CO_2$ there is 1 mole of O atoms. Thus, $6.02 \times 10^{23}$ atoms. | **13 D** | |
| **4 C** | Bases accept $H^+$ ions | **14 C** | |
| **5 A** | | **15 C** | |
| **6 B** | | **16 C** | Both are weak acids so neither will completely ionise. If X is stronger than Y then X will have a higher $[H^+]$ and a lower pH. |
| **7 A** | Mg reacts with acid and not base. NaOH neutralises acid with in an exothermic reaction. | **17 A** | Enzymes are proteins which are composed of amino acids. |
| **8 B** | $n(H_2SO_4) = (0.16 \times 0.036) / 2$<br>$[H_2SO_4] = [(0.16 \times 0.036) / 2] / 0.012 = 0.24M$ | **18 A** | |
| **9 D** | | **19 D** | |
| **10 C** | | **20 B** | 5 X 180 glucose units – (4 x 18) water for condensation reaction between glucose units. |
| | | **21 D** | Purple $MnO_4^-$ reduced to colourless $Mn^{2+}$ while $H_2O_2$ oxidised to oxygen. |

## Section B

### Question 1

a) 85.6 /12 : 14.4/1.1 => 7.13 : 14.3 ❶ => 1 : 2 Empirical Formula **$CH_2$** ❶

b) i) $n = pV / RT = \dfrac{1.10 \times 10^2 kPa \times 0.399}{8.31 \times 273} = 0.178$ mol ❶

$M_r = m / n = 1.00 / 0.017 = 56.3$ Accept range 56.0 – **56.3** ❶

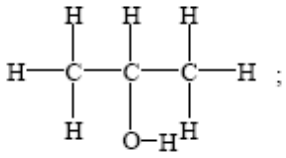
ii) 56.3 / 14 (mas of E/F unit $CH_2$) = 4 Molecular Formula $C_4H_8$

c) CO / C produced ❶
CO is toxic/ poisonous/ forms carboxy haemoglobin / interferes with oxygen transport. ❶ or
C (soot) is harmful to respiratory system

**Question 2**

(a) O—H **and** 3230 to 3550 $cm^{-1}$;
C—O **and** 1000 to 1300 $cm^{-1}$;
C—H **and** 2840 to 3095 $cm^{-1}$; ***[❶❶ max]***
*Award **[❶]** each for any two*.

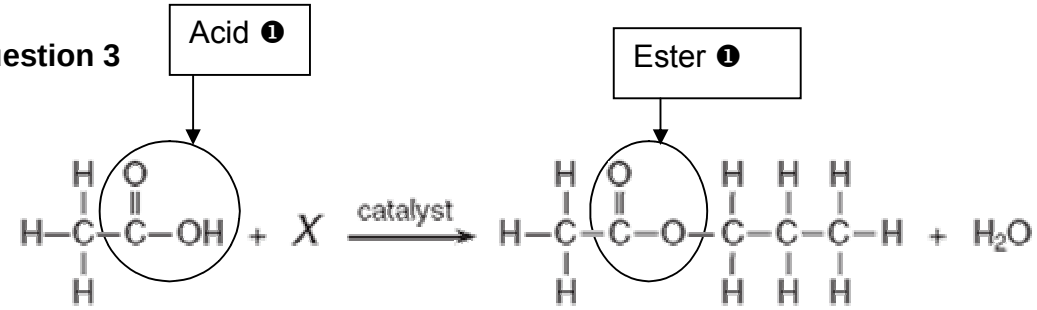
(b) four peaks; ❶ 3:2:2:1;❶

(c)  ❶

1H NMR identifies the number of hydrogen environments;
propan-2-ol has a different number of peaks / 3 peaks / 6:1:1 ratio; ❶❶
infrared spectroscopy shows the same functional groups / same absorptions / isomers have the same bonds; ❶

**Question 3**

a)




b) Propyl ethanoate ❶

**Question 4**

(a) i) fuel produced by biological processes / photosynthesis / living things / plants / ❶

ii) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$; ❶❶
*Award **[1]** for formulas and **[1]** for correct balancing*.

(b)
(i) <u>Direct Combustion</u>

***advantage***
can obtain a large fraction of the energy available / more efficient / ease of use; ❶

***disadvantage***
may cause a lot of pollution / expensive to transport / cannot replace liquid fuels; ❶

(ii) Conversion to Ethanol

***advantage***
liquid fuel has more uses (*e.g.* motor vehicles) / burns more cleanly; ❶

***disadvantage***
less energy is available from ethanol than from raw plants / time needed for conversion; ❶

*Do not accept both an advantage and a converse disadvantage*.

## Question 5

(a) the removal of hydrogen and oxygen in the (atomic) ratio 2 : 1 / removal of water from a compound / removal of H and OH from neighbouring carbon atoms / [illegible]
*Do not accept removal of water.*
concentrated sulfuric acid / concentrated phosphoric acid / hot $Al_2O_3$ / hot ceramic; ***[2]***

(b) $CH_3CH_2CH_2OH$;
$CH_3CH(OH)CH_3$;
1-propanol/propan-1-ol **and** 2-propanol/propan-2-ol;
*Names must match formulas.*
$CH_3CHCH_2$;
propene;

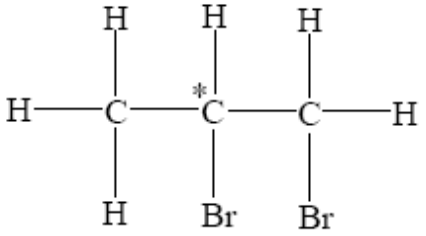
(c) (i)

| | |
|---|---|
| $C_3H_6$ | three peaks; |
| | relative areas 3:2:1; |
| $C_3H_7OH$ | four peaks; |
| | relative areas 3:2:2:1; |
| **OR** | |
| propan-2-ol | three peaks; |
| | relative areas 6:1:1; |

(ii) $C_3H_7OH$ absorption at $3230-3550\ (cm^{-1})$ due to O—H /
at $1000-1300\ (cm^{-1})$ due to C—O;
$C_3H_6$ absorption at $1610-1680\ (cm^{-1})$ due to C==C;

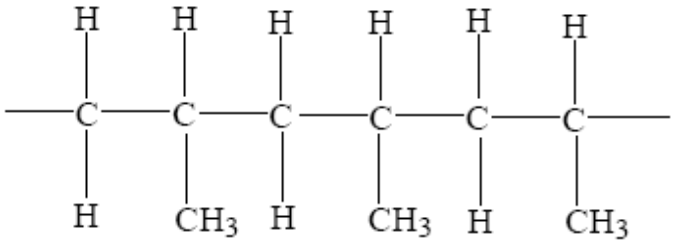
d)

$C_3H_6 + Br_2 \rightarrow C_3H_6Br_2$ ;
1,2-dibromopropane;
yellow/orange/brown/red colour of bromine disappears / bromine is decolorised; *[3]*
*Do not allow "goes clear".*

(ii)  / $CH_3C^*HBrCH_2Br$ ;

e)

addition polymerization;



*$CH_3$ groups can be above or below the horizontal.*

**Question 6**

a) $[H^+] = 2 \times 0.005M = 0.01M$ ❶

pH = -log (0.01) = 2 Indicator is **red**. ❶

b) $C_1 \times V_1 = C_2 \times V_2$

$0.005 \times 10 = C_2 \times 100$

$C_2 = 5 \times 10^{-4}$ M ❶

$[H^+] = 2 \times 5 \times 10^{-4} = 0.001M$

pH = -log (0.001) = 3 Indicator **Violet** ❶

c) $H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$

$n(H_2SO_4) = (5 \times 10^{-4}) \times 0.015 = 7.5 \times 10^{-6}$ mol ❶

$n(KOH) = 2 \times 7.5 \times 10^{-6}$ mol ❶

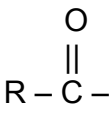
$[KOH] = [2 \times 7.5 \times 10^{-6}$ mol$] / 0.005 = 3.0 \times 10^{-3}$ L = **3.0ml** ❶

**Question 7**

(a) (i) the number of different hydrogen/proton environments / *OWTTE*; ***[1]***
(ii) the environment of proton / neighbouring group / *OWTTE*; ***[1]***
(iii) the ratio of the numbers of protons in each environment; ***[1]***

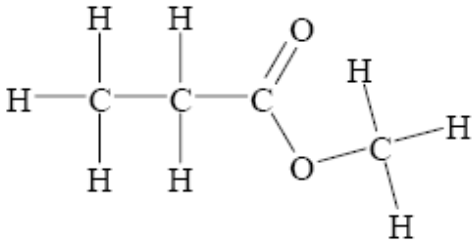
b)
0.9 ppm [H on C attached to a second C / alkyl group] R—$CH_3$ ❶
2.0 ppm H on C attached to carboxyl C / C of an ester / $CH_3$—CO—OR ❶

4.1 ppm H on C attached to O of carboxyl group / ester group /



❶

(c) *Structure* ***[2]***




**Question 8**

a) 60 ppm. ( +/- 2) ❶

b) Cu standards need to be produced and their absorption measured to produce a new standard curve. ❶

Silver lamp in AA needs to be replaced with copper lamp. ❶