Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4 'O' Level Programme

B

CHEMISTRY

6092/02

Paper 2

20 August 2024
1 hour 45 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section B
Answer **one** question.
Write your answers in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page **6**.

The use of an approved scientific calculator is expected, where appropriate.

For examiner's use only:

Section B	/ 10

Section B

Answer **one** question from this section.

10 Malonic acid is a white crystalline solid which is soluble in water.

Fig. 10.1 shows the structural formula of malonic acid.

$CH_2(COOH)_2$ or HOOC–CH_2–COOH

Fig. 10.1

Malonic acid ionises according to the equation below.

$$CH_2(COOH)_2 \rightleftharpoons 2H^+ + CH_2(COO)_2^{2-}$$

(a) State **one** similarity between the acidic behaviour of malonic acid and sulfuric acid.

……..

…… [1]

(b) Experiments are carried out using equal volumes of malonic acid and sulfuric acid of the same concentration to investigate their properties.

Compare and explain the properties of malonic acid and sulfuric acid.

Your answer should include a discussion of the similarities and differences in their

- pH
- reaction with excess solid sodium carbonate.

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……..

…… [5]

(c) Compound **A**, $C_3H_8O_2$, reacts with acidified potassium manganate(VII) to form malonic acid.

(i) Name the type of reaction compound **A** undergoes to form malonic acid.

……..... [1]

(ii) Draw the displayed formula of compound **A**.

[1]

(iii) Name the homologous series that contains the functional group in compound **A**.

……..... [1]

(iv) Using a different reagent, compound **A** forms compound **B**. The structure of compound **B** is shown in Fig. 10.2.

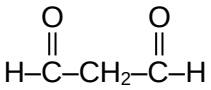


Fig. 10.2

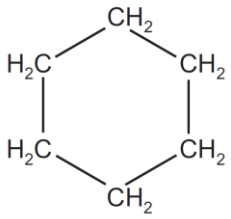
Are malonic acid and compound **B** isomers? Explain your reasoning.

……..

……. [1]

[Total: 10]

11 **(a)** Cyclohexane is a saturated hydrocarbon while hexene is an unsaturated hydrocarbon. Fig. 11.1 shows the structures of cyclohexane and hexene.



cyclohexane

$CH_3CH_2CH_2CH_2CH=CH_2$

hexene

Fig. 11.1

(i) Are cyclohexane and hexene isomers? Explain your reasoning.

……

…… [1]

(ii) Compare the properties of cyclohexane and hexene.

Your answer should include a discussion of the similarities and differences in their

- combustion reaction
- reaction with aqueous bromine.

Include equations and observations, where necessary, for any reactions you discuss.

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…… [5]

(b) Vegetable oils react with methanol to produce a biofuel. Fig. 11.2 shows the structures of some of the molecules involved in the reaction.

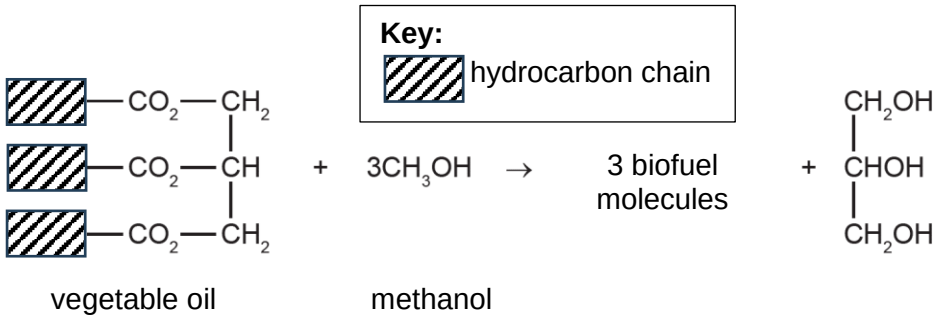

Fig. 11.2

(i) Name the homologous series that contains the functional group in vegetable oil.

…… [1]

(ii) One molecule of vegetable oil reacts to form three molecules of biofuel.

The biofuel and vegetable oil contain the same functional group.

Suggest the displayed formula of one molecule of biofuel.

Use  to represent the hydrocarbon chain.

[1]

(iii) Explain why biofuel is considered a renewable and more environmentally sustainable energy source compared to diesel obtained from crude oil.

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……

…… [2]

[Total: 10]

- End of Paper -

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$

[Turn Over