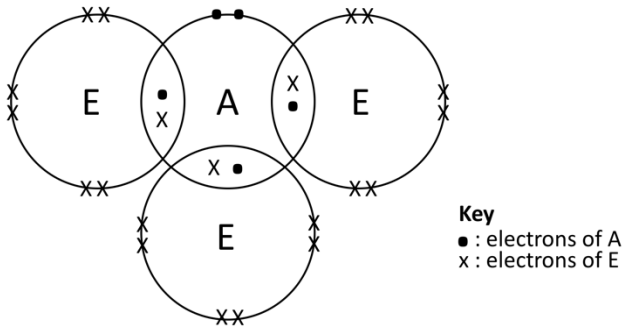
DUNMAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
CHEMISTRY (REVISED) 6092 PAPER 2

		Answers	**M**
1	**(a)**	$FeSO_4$	[1]
	(b)	Ag_2CO_3	[1]
	(c)	SiO_2 or Al_2O_3	[1]
	(d)	Al_2O_3	[1]
	(e)	$CaCl_2$	[1]
2	**(a)**	**D** and **E** / **C** and **F**	[0]
		They have the <u>same number of protons but different number of neutrons</u>.	[1]
	(b)	**B** and **D**.	[0]
		B is a cation, D is an anion and they will form an ionic compound where	[1]
		<u>giant ionic lattice structure breaks down</u> in aqueous or molten state and <u>ions are mobile</u> to carry the charge to conduct electricity.	[1]
	(c)		[1]
3	**(a)**	Methane.	[1]
		Methane has a <u>relative molecular mass</u> (M_r) of <u>16</u>, which is the <u>lowest</u> among the gases tested.	[1]
	(b)	Temperature affects the kinetic energy of the particles. At <u>higher temperatures, particles move faster</u> and further apart / <u>speeding up the rate of reaction</u> / <u>have higher kinetic energy</u>. OR Difference in temperature will result in particles of gas moving at different speed/kinetic energy and affect rate of diffusion.	[1]
		Keeping the temperature at a constant ensures that particles have the <u>same average kinetic energy</u>. (ORA)	[1]

(c) Sulfur dioxide. *[R: chlorine & oxygen as they are sparingly soluble; thus SO_2 is the best option]* [0]

Sulfur dioxide is a soluble gas. [1]

4 (a) (i) R_f value for pigment X = 8.5-1(7.5)/11-1(10) = **0.75** [1]

R_f value for pigment Y = 5-1(4)/11-1(10) = **0.40** [1]

(ii) Pigment X is chlorophyll B; pigment Y is beta-carotene. [1]

(iii) Pigments are separated based on their relative/different/levels of solubility in the organic solvent *[R: water]*. [1]

The more/less soluble the pigment, the further/shorter the distance it travels up the chromatogram / the larger the R_f value. [1]

(b) (i) Oxalic acid is a dibasic acid / dissolves and ionizes/dissociates in water to produce 2 moles of H^+ per mole of acid. [1]

(ii) Oxalic acid is a reducing agent / undergoes oxidation [1]

5 (a) Exothermic. [0]

The total amount of energy released/ given out in the formation of 12 mols of C=O bonds in carbon dioxide and 12 mols of O-H bonds in water is more than [1]

the total amount of energy absorbed/taken in for the breaking of bonds in 1 mol of glucose and 6 mols of O=O bonds in oxygen. (ORA) OR [1]

The total amount of energy released in the formation of 12 C=O bonds in carbon dioxide and 12 O-H bonds in water is more than

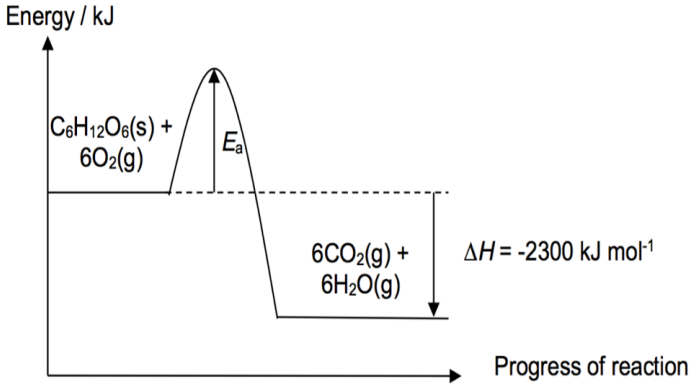
the total amount of energy taken in for the breaking of bonds in 1 molecule of glucose and 6 O=O bonds in oxygen.

(b) No. of mols of CO_2 = 150/24000 = 0.00625mol [1]

Mole ratio comparison,
$CO_2 : C_6H_{12}O_6$
= 6 : 1
= 0.00625 : 0.001042 mol [1]

Energy change = (-2300) x 0.001042 mol = **-2.40kJ**

(c)



- *shape of energy profile diagram + reactant/product labels* [1]
- *labelling of activation energy (Ea) with single headed upward arrow* [1]
- *labelling of enthalpy change (ΔH) with single headed downwards arrow* [1]

(d)

	Cu	O
mass	1.28g	0.16g
A_r	64	16
no. of mols	0.02	0.01
÷ by smallest number of mols	2	1

[2]

∴empirical formula = **Cu_2O**

6 (a) (i) Zinc is more reactive than copper and displaces copper metal from copper(II) chloride solution. [1]

$Zn (s) + Cu^{2+} (aq) \rightarrow Cu (s) + Zn^{2+} (aq)$ [1]

(ii) A catalyst speeds up a reaction. [0]

Graph 2 shows a steeper gradient than Graph 1, indicating a faster reaction as catalyst speeds up a reaction. [1]

Graph 2 shows the maximum volume of hydrogen gas is obtained in a shorter time compared to Graph 1, hence reaction is faster. [1]

(b) (i) Graph 3 should show the following: [1]

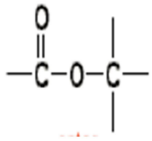
- *gentler gradient with horizontal portion occuring later than graph 1*
- *same volume of hydrogen gas produced***.**

(ii) Gradient of graph was gentler/ less steep and reaches the maximum volume of gas collected at a later time since reaction is slower.
Ethanoic acid is a weak acid, partially ionizes in water to produce a low concentration of hydrogen cations. This results in lower frequency of collisions and lower frequency of successful/effective collisions, hence slower reaction.
2 points [1]
Ethanoic acid present in excess and mass of limiting agent, zinc remains constant hence volume of hydrogen gas produced remains the same. [2] [1]

(c) Rate of reaction will increase. [1]

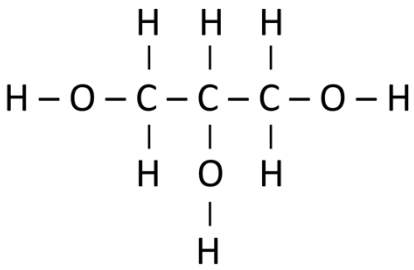
Powdered zinc metal has a smaller particle size hence larger surface area to volume ratio exposed for reaction. This will result in a higher frequency of collisions between zinc atoms and chloride ions (and hydrogen ions) leading to higher frequency of successful/effective collisions. [1]

7 (a) (i) [1]



Ester group or ester linkage or -COO- or

(ii) [1]



(b) (i) (A) Calculate no. of mols of sodium thiosulfate solution reacted: [1]
1000 cm^3 - 0.121 mol
24.2 cm^3 - **0.002928 mol**

(B) Calculate no. of mols of iodine added:
No. of mols of iodine = 42.5 / 254 = **0.1673 mol**
[1]

(C) Calculate no. of mols of iodine reacted:

Mole ratio comparison,
$Na_2S_2O_3 : I_2$
= 2 : 1
= 0.002928 : *0.001464 mol of I_2 added in excess*

∴ no. of mols of iodine reacted = 0.1673 – 0.001464 = **0.166 mol** [1]
(3sf)

(ii) (A) Calculate mass of iodine reacted: [1]

Mass of iodine reacted = 0.166 x 254 = **42.16g**

(B) Calculate iodine number:

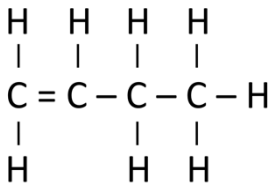
[1]

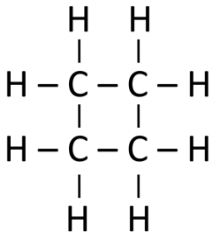
35.1 g of corn oil - 42.16 g of iodine
100 g of corn oil - 120 g iodine

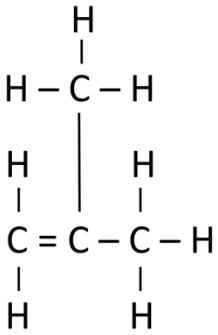
∴ iodine number is **120**.

8 (a)

[2]



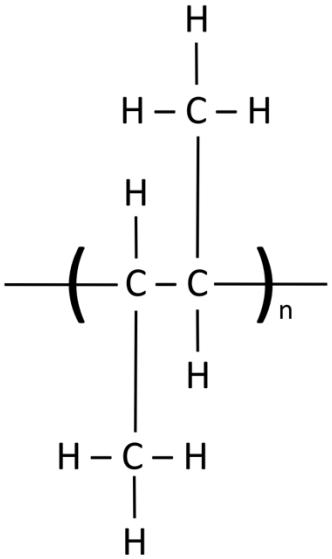




Any 2 of the above – [2]

(b)

[1]



Paper 2 Section B

No	Marking Scheme	Marks
B10 a	The oxidation state of P increases from **0** in P to **+5** in P_2O_5. Phosphorus is oxidised. The oxidation state of Cl decreases from **+5** in $KClO_3$ to **-1** in KCl. Potassium chlorate is reduced. There is oxidation and reduction. Hence, reaction is redox.	1 1
bi	$P_2O_5 + H_2O \rightarrow 2HPO_3$	1
bii	Phosphoric acid is **tribasic**. One mole of the acid produces 3 moles of hydrogen ions to be neutralized in water. $H_3PO_4(aq) \rightarrow 3H^+(aq) + PO_4^{3-}(aq)$	1 1
ci	Both red phosphorus and white phosphorus consist of phosphorus atoms that are **covalently bonded**. (Each phosphorus atom is covalently bonded to 3 other phosphorus atoms) Each white P molecule is made up of 4 atoms but red P is made up of large number of atoms. OR However, red phosphorus exists as a **giant/long chained molecule** while white phosphorus exist as **simple molecules** in a tetrahedral structure. OR Atoms in white P are covalently bonded to 3 others in a tetrahedral structure forming P_4 molecules. In red P, each tetrahedral unit of 4 atoms has 2 atoms each bonded to one adjacent P atom in the next tetrahedral arrangement of atoms.	1 1
cii	White phosphorus is **more reactive** than red phosphorus as it requires **lesser energy to break the bonds** in the simple molecule. (than in a giant molecule)	
di	Sb_2S_3	1
dii	Both compounds have **low melting/boiling points** and are **poor conductors of electricity**. Phosphorus sesquisulfide and antimony sulfide exist as **simple covalent molecules.** A **small amount of energy** is required to overcome the **weak intermolecular forces of attraction** for melting to occur. In addition, there are **no free moving ions or electrons** to carry a charge when a potential difference is applied.	1 1 1
B10	Anode.	1
a	$2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$	1
b	**Bubbles** of gas / **Effervescence**.	1
c	The colour of the electrolyte (universal indicator) changes from **green** to **purple/blue**.	1 1

H^+ and Cl^- are being discharged, leaving behind Cs^+ and OH^-. This results in the formation of **caesium hydroxide which is an alkali** which turns universal indicator purple/blue.

d $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ 1

e Replace zinc with magnesium. 1
OR
any other metals that are further apart in the reactivity series than zinc and copper.
(Do not accept reactive metals such as sodium, potassium and calcium)

f **Bubbles of colourless gas** would be observed at electrode 2 instead of 1 1
OR
Pale greenish-yellow gas would be observed at electrode 1 instead of 2.

Eit 1

B11

a graph 10.1: **Across the period** (left to right), melting points of elements 1
increase steadily but **decreases sharply after carbon**.
All the elements after carbon have a **constant low** melting point. 1

graph 10.2: Generally, melting points of the oxides **decreases across the period** (left to right). **BeO** however, was an exception. Even though it was placed after Li_2O, it has a higher melting point. 1

b Lithium, beryllium, boron and carbon 1

c Graphite 1
Within the giant hexagonal layers of carbon atoms in graphite, **each carbon atom is bonded to 3 other carbon atoms**. 1
This leaves **one free moving valence electron** per carbon atom to conduct electricity when a potential difference is applied. 1

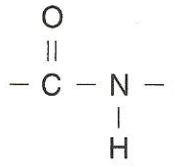
d The **electrostatic forces of attraction** between beryllium ions and oxide ions are **stronger** than that between lithium ions and oxide ions. (Due to higher charge of Be^{2+} compared to Li^{+}.) 1
More energy needed to break the stronger ionic bonds in beryllium oxide. 1
Hence, higher melting point.

e Neon is very **unreactive**. It **does not react with oxygen** to form any oxides. 1

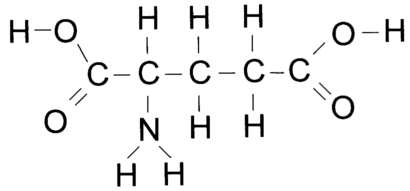
OR

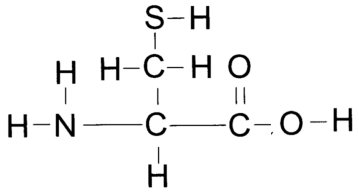
B10

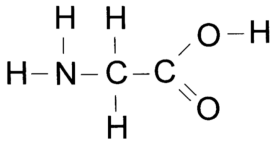
a Amide linkage 1

 1

b 1,1,1







c Mass of glutathione in 10.0 cm^3 = no. of moles x Mr

= 5.00×10^{-6} x 307

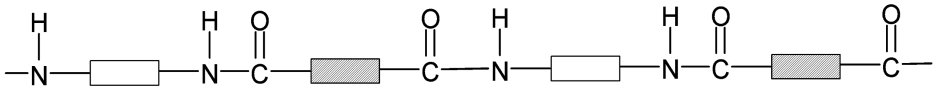
= **0.001535 g** 1

Concentration in g/dm^3 = 0.001535 / 0.005 (Accept ECF)

= **0.307 g/dm^3** 1

d Alcohol reacts with glutathione to form an ester, hence decreasing the concentration of glutathione in blood. 1

e Nylon 1



1