SUGGESTED MARKING GUIDE (S.5 CHEMISTRY EOT I-2026 (X/80)

ITEM ONE; (X/25)

ITEM ONE – 25
ITEM TWO – 25
ITEM THREE – 30
Total = 80

(a) On the graph paper.

Time (s)	20	40	60	80	100	120
Mass of Uranium (g)	48.2	38.5	31.5	26.0	21.0	17.2
$\log_{10}$ mass	1.683	1.585	1.498	1.415	1.322	1.236

01

(b) (i) From the graph;

$\log_{10} N_o = 1.78$ ✓

02

$N_o = 10^{1.78}$ ✓ $= 60.26g$ ✓

∴ Initial mass of Uranium = 60.26g.

(ii) Slope $= \frac{-K}{2.303}$ ✓

∴ But slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{1.236 - 1.683}{120 - 20}$ ✓

0.5

$= \frac{-0.447}{100}$

slope $= -4.47 \times 10^{-3} g s^{-1}$ ✓

$\therefore -K = (2.303 \times -4.47 \times 10^{-3})$ ✓

$K = 1.03 \times 10^{-2} g/s$ ✓

From $t_{1/2} = \frac{\ln 2}{K}$ or $t_{1/2} = \frac{2.303 \log 2}{K}$

$t_{1/2} = \frac{\ln 2}{1.03 \times 10^{-2}}$ ✓

02

$t_{1/2} = 67.3$ ✓ seconds.

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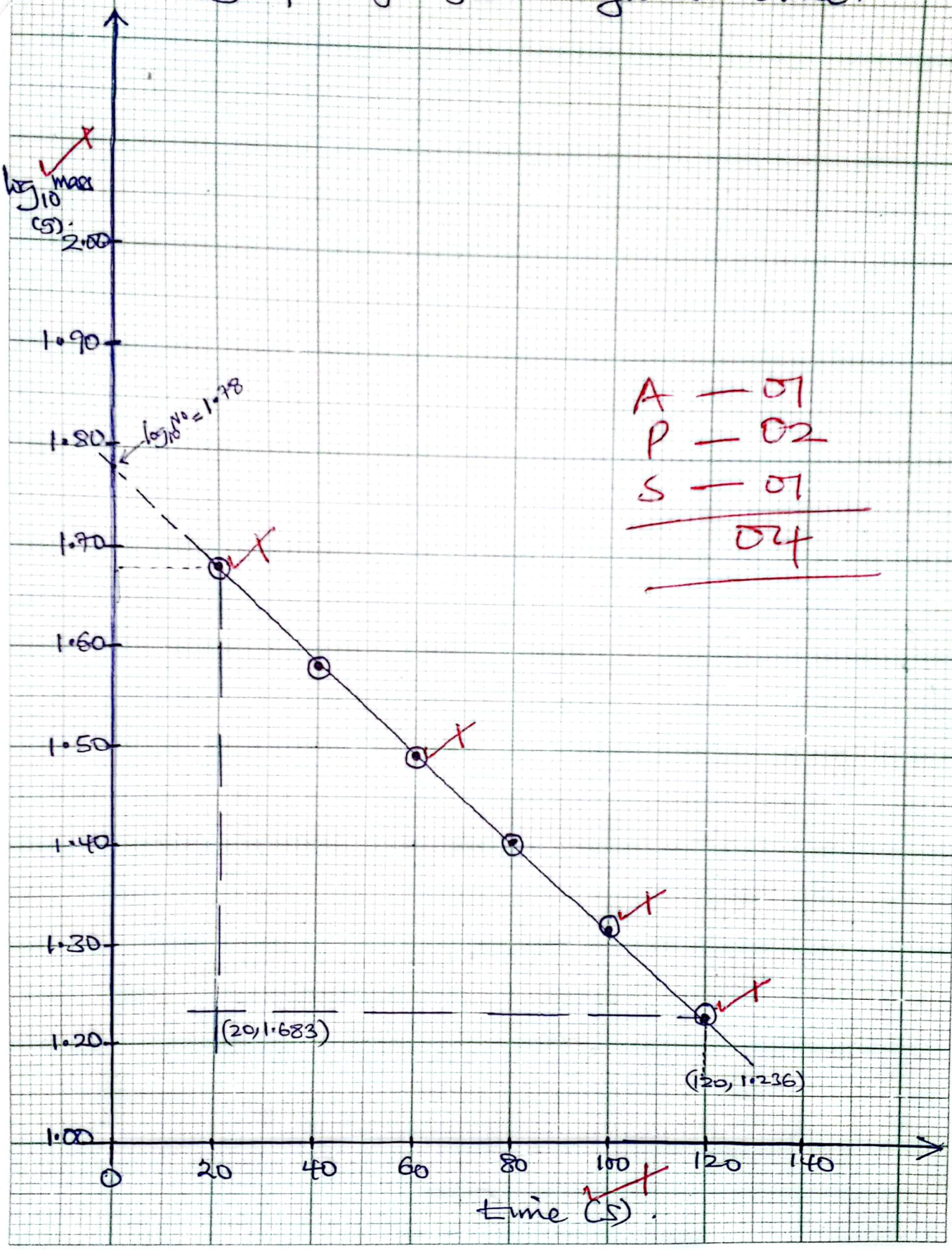
ITEM ONE

(a)

A graph of $\log_{10}$ mass against time.



A — 01
P — 02
S — 01
04

(c) From $\ln\left(\frac{No}{Nt}\right) = Kt$. , But $Nt = 100 - 85$

$Nt = 15\%$

$\ln\left(\frac{100}{15}\right) = 1.03 \times 10^{-2} \times t$.

$\therefore t = \frac{\ln\left(\frac{100}{15}\right)}{1.03 \times 10^{-2}}$ (04)

$t = 184.186$ seconds.

(e) (i) $^{27}_{13}Al + {}^{1}_{0}n \longrightarrow {}^{24}_{11}Na + {}^{4}_{2}He$

(ii) $^{236}_{92}U \longrightarrow {}^{92}_{36}Kr + 3{}^{1}_{0}n + {}^{141}_{56}Ba$ (02)

(iii) $^{214}_{83}Bi \longrightarrow {}^{206}_{82}Pb + 3{}^{0}_{-1}e + 2{}^{4}_{2}He$

(iv) $^{226}_{88}Ra \longrightarrow {}^{115}_{45}Rh + {}^{111}_{43}Te + {}^{0}_{0}Y$

(d) Danger + Mitigation of radioactivity

✓ Radiations emitted cause cancer and mutation of body cells. This results into death. Mitigated by use of protective gears such as Lead coats. (03)

11 (20)

SECTION B.

PART ONE (X/25)

ITEM TWO ; X(12), Y(17), Z(20), K(29), M(26).

(a) Elements X, Z, K, and M are Metals I because they lose E their outmost electrons to their corresponding metal E ions which are positively charged. 06

X - Magnesium, Z - Calcium, K - copper and M - Iron. and Y is chlorine an non-metal I because it gains electrons to form negatively E charged ion.

(b) $_{12}X$; $1s^2 2s^2 2p^6 3s^2$

$_{17}Y$; $1s^2 2s^2 2p^6 3s^2 3p^5$

$_{20}Z$; $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ 05

$_{29}K$; $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$

OR $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

$_{26}M$; $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

(c) X is in group II and period 3.
Y is in group VII and period 3
Z is in group II and period 4 03
K and M are in d-block in the periodic table.

(d) (i) $Cl_{2(g)} + H_2O_{(l)} \rightarrow HCl_{(aq)} + HOCl_{(aq)}$. 03

(iii) $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$.

17

(e) Properties of any one;

Y ✔ Is a non-metal with
→ simple molecular structure PI
→ low boiling and melting points. (04
→ Exists as a gas at room temperature.
→ Soluble in water. Use

Use; → Used to decolourize water (water treatment).

(f) Danger (M) → Iron
→ Pollutes the environment reducing DE soil feritility, Soil toxication etc. (04
Mitigated by proper disposal of waste. DM

08

PART TWO; $\left(\frac{X}{30}\right)$.

NO 3

(a) Function group is a group of atoms or an atom which determines the physical and chemical properties of a given compound. E.g -OH; the hydroxyl group for alcohols. (02)

(b) Structure — Name — Function group.

A; CH_4 — Methane.

B. $CH_3CH(CH_3)CH_3$ — 2-methyl propane — $-C-C-$ Carbon-carbon Single bond.

C; $CH_3CH_2CH_3$ — Propane. (04)

D; $CH_3CH=CHCH_3$ — But-2-ene.

(b) Functional groups;

For

E; $-C(=O)-$ — carbonyl group.

$-C(OH)-$ — hydroxyl group. (05)

$-C-Br$ — Bromine group.

$-C\equiv C-$ — carbon-carbon triple bond.

$-C(=O)-OH$ — Carboxyl group.

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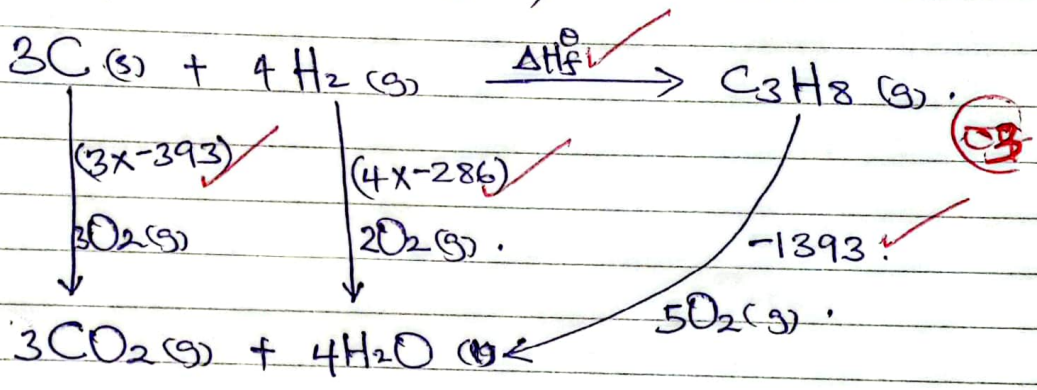
(d) Required equation;

Heat of formation is the enthalpy change that occurs when one mole of a compound is formed from its constituents elements in their standard physical states at given temperature and pressure.

$3C_{(s)} + 4H_{2(g)} \xrightarrow{\Delta H_f^\theta} C_3H_{8(g)}$. (01)

Using Born haber cycle;



(03)

From Heats of Summation (Hess' law).

$\therefore \Delta H_f^\theta = (3X-393) + (4X-286) - (-1393)$

$\Delta H_f^\theta = -930\ KJmol^{-1}$ (02)

Comment; Since the enthalpy of formation is negative, then the formation of C_3H_8 is stable. (01)

(e) Use of C → Used as fuel for both domestic and industrial use. (01)

Danger; Combustion of C produces carbondioxide which is a green-house gas and its accumulation increases temperature causing global warming. Mitigated by use of clean energy or planting of trees. (02)

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Pg VI

(i) Empirical formula;

Rfm of $CO_2 = (1\times12)+(2\times16) = 44$

But Mass of $C = \left(\frac{12}{44} \times 8.45\right) = 2.3045g$

Rfm of $H_2O = (2\times1)+(1\times16) = 18$

Mass of $H = \left(\frac{2}{18} \times 3.46\right) = 0.3844g$. (03)

Mass of $O = 4.24 - (2.3045 + 0.3844)$

$= 1.5511g$

Elements :	C	: H	: O
Moles :	$\frac{2.3045}{12}$	$\frac{0.3844}{1}$	$\frac{1.5511}{16}$
	0.1920	0.3844	0.0969
Mole ratio;	$\frac{0.1920}{0.0969}$	$\frac{0.3844}{0.0969}$	$\frac{0.0969}{0.0969}$ (04)
	1.98	: 3.96697	1
Simplest ratio;	2	4	1

Empirical formula; C_2H_4O

(ii) Molecular formula;

$(C_2H_4O)n = 88$.

$(2\times12n)+(4\times1n)+(1\times16n) = 88$.

$44n = 88$

$\frac{44n}{44} = \frac{88}{44}$ (02)

$n = 2$.

Molecular formula; $C_4H_8O_2$.

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