PHYSICS EXPERIMENTAL MARKING SCHEME

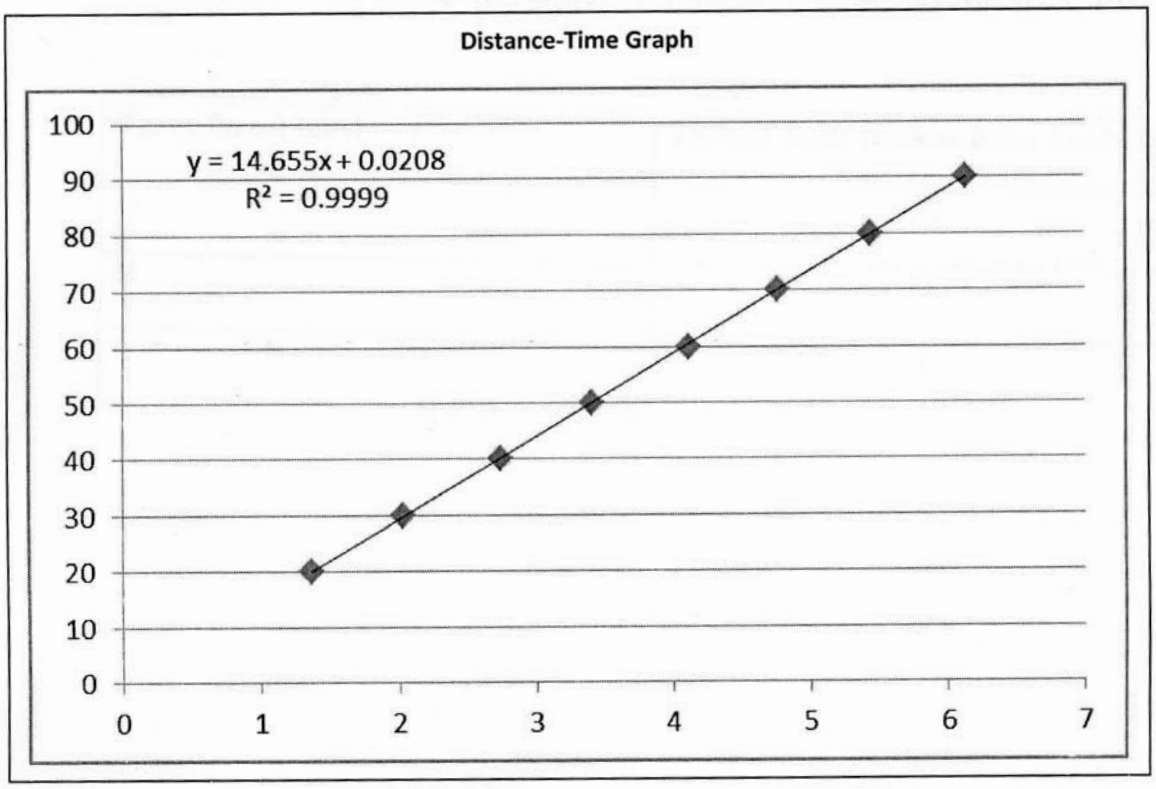
Table 1: Table of values

Distance marks on the tube (cm)	Distance travelled (cm)	Time (s)		
		t_1	t_2	t
20	_	0.00	0.00	0.00
40	20			1.36
50	30			2.00
60	40			2.74
70	50			3.41
80	60			4.12
90	70			4.78
100	80			5.44
110	90			6.14

(3.2 marks)

3.5.1 **Plot the graph of distance travelled against time.** **(1.6 marks)**

(Use the graph sheet provided)



3.5.2 **Determine the slope of the graph in question 3.5.1** **(1.2 marks)**

Slope = 14.66 cms^{-1} = 0.1466 ms^{-1}

3.5.3 **Identify the physical meaning of each of the three (3) terms in equation (1) labelled A, B, and C in Table 2 using Table 3 which gives the likely names of the terms (i. e, match Table 2 and Table 3 using the appropriate Table in the answer booklet).(1.5 marks)**

Term(force) label	Type of force (choose from Table 3)
A	III
B	IV
C	I

3.5.4 **Rearrange equation (1) to make η_ℓ the subject of the equation. Call this equation (2). (1.2 marks)**

$$\eta_\ell = \frac{2}{9v_o} r^2 g(\rho_s - \rho_\ell)$$

3.5.5 **Given that v_o is the slope determined in question (1.5.2) and that g = 9.8 ms^{-2}, ρ_ℓ = 900 kgm^{-3}, ρ_s = 7800 kgm^{-3}, calculate η_ℓ for the castor oil.**

(2.3 marks)

$$\eta_\ell = \frac{2\times 9.8\times(2.38\times10^{-3})^2\times(7800-900)}{9\times 0.1466} = 0.5806\ \text{kgm}^{-1}s^{-1}$$

3.5.6 The factors in Table 4 may affect the value of the coefficient of viscosity measured at different locations on the earth's surface by this method. Tick (V) as appropriate

(1.0 mark)

Table 4

	True	False
Altitude	V	
Latitude	V	
Relative humidity		V
Ambient temperature	V	

3.5.7 Precautions which may be taken in order to obtain a precise result are given in Table 5. Tick (√) as appropriate (1.0 mark)

Table 5

	True	False
Minimize parallax error	√	
Avoid the balls touching the walls of the glass cylinder	√	
Changing the starting point of timing to 50 cm		√
Dropping the ball from a height above the liquid surface		√

CHEMISTRY EXPERIMENT MARKING SCHEME

EXPERIMENT TWO

2.1 From the list given, choose two substances that constitute the bottom layer obtained in step 4 from the preparation of biodiesel **(1mark)**

(i) Potassium Hydroxide (KOH)
(ii) Water
(iii) PKO
(iv) Biodiesel.

Substance	Options
One	KOH
Two	PKO

2.2. Calculate the percentage yield by mass of PKO-biodiesel from PKO based on your results. **(2.5 marks)**

Volume of PKO bio-diesel = 24.0 cm^3

Ranges of volumes for PKO-biodiesel:

18.16 cm^3 - 24. 56 cm^3 **(1 mark)**

17.02 cm^3 – 26.70 cm^3 **(0.5 mark)**

Mass = Volume X density

For PKO-biodiesel, mass = 24.0 cm^3 x 0.89 g cm^{-3} = 21.36 g **(0.5 mark)**

For PKO, mass = 30 cm^3 x 0.912 g cm^{-3} = 27.36 g (0.5 mark)

$$\%\ yield\ for PKO-biodiesel = \frac{21.36g}{27.36g} x \frac{100}{1} = 78.07\%$$ **(0.5 mark)**

2.3. Why is anhydrous magnesium sulphate ($MgSO_4$) added in step 6 in the extraction of PKO-biodiesel? Select the correct option from the table below **(0.5 mark)**

Option	Reason
A	To improve the conductivity
B	To reduce the oil to hydrocarbons
C	To remove any remaining water
D	To increase the viscosity of the biodiesel

Option chosen	C **(0.5 mark)**

2.4. From equations 1 and 2 derive the expression for absolute viscosity η **(1 mark)**

Divide equation (1) by equation (2) to obtain

$$\frac{8lV\eta}{8klV} = \frac{\pi gh\rho r_0^4 \Delta t}{\pi ghr_0^4}$$ **(0.5 mark)**

$$\frac{\eta}{k} = \rho\Delta t$$ **(0.25 mark)**

Therefore $\eta = k\rho\Delta t$ **(0.25 mark)**

2.5. Record the titre value you obtained in the acid determination of PKO **(1.5 marks)**

Titration Run				
Initial Reading (cm^3)				
Final Reading (cm^3)				
Titre (cm^3)				

Final titre :

21.70 cm^3 - 29.30 cm^3 **(1.5 marks)**

19.10 cm^3 - 31.90 cm^3 **(1 mark)**

Value outside the above ranges **(0.5 mark)**

2.6. Using the formula Acid value = (V x c x Z)/ m, calculate the acid value.

Where V= volume in dm^3 / l of 0.01 mol dm^{-3} (mol l^{-1}) Potassium Hydroxide (KOH) solution consumed (titre value)

c = concentration of Potassium hydroxide (KOH) solution

m = mass (g) of PKO sample

Z = 56.1 g/mol **(1.0mark)**

$$Acid\ value = \frac{V\ x\ c\ x Z}{m}$$

m = density x volume = 0.912 g cm^{-3} x 2 cm^3 = 1.814 g

For titre = 21.70 cm^3

$$Acid\ value = \frac{21.70 cm^3\ x0.01 mol\, cm^3\ x56.1 g\, mol^{-1}}{1.814 g} = 6.73$$

For titre = 29.30 cm^3

$$Acid\ value = \frac{29.30 cm^3\ x0.01 mol\, cm^3\ x56.1 g\, mol^{-1}}{1.814 g} = 9.08$$

Therefore for acid value ranging between 6.73 - 9.08 **(1 mark)**

For titre = 19.10 cm^3

$$Acid\ value = \frac{19.10 cm^3\ x0.01 mol\, cm^3\ x56.1 g\, mol^{-1}}{1.814 g} = 5.92$$

For titre = 31.90 cm^3

$$Acid\ value = \frac{31.90 cm^3\ x0.01 mol\, cm^3\ x56.1 g\, mol^{-1}}{1.814 g} = 9..89$$

Therefore for acid value ranging between 5.92 - 9.89 **(0.5 mark)**

2.7. Calculate the acid concentration in mol dm^{-3} of PKO. (K = 39.1, O = 16.0, H = 1.0). ***(1mark)***

Assume 1 : 1 mole ratio,

$$\frac{M_{KOH}V_{KOH}}{n_{KOH}} = \frac{M_{PKO}V_{PKO}}{n_{PKO}}$$ **(0.5 mark)**

$$\frac{0.01\ x\ 25.5}{1} = \frac{M_{PKO}\ x\ 2}{1}$$

$$M_{PKO} = \frac{0.255}{2} = 0.127 \approx 0.13 mol\, dm^3$$ **(0.5 mark)**

One mark for calculation working even if the measurement is incorrect

Also based on correct approach but incorrect titre win the marks

2.8. Record the titre value you obtained in the acid determination of PKO-biodiesel **(1.5 marks)**

Titration Run				
Initial Reading (cm^3)				
Final Reading (cm^3)				
Titre (cm^3)				

Final titre :

2.60 cm^3 - 3.60 cm^3 **(1.5 marks)**

2.30 cm^3 - 3.90 cm^3 **(1 mark)**

Value outside the above ranges **(0.5 mark)**

2.9. Using the formula Acid value = (V x c x Z)/ m, calculate the Acid value of PKO-biodiesel.

Where V= volume in dm^3 / l of 0.01 mol dm^{-3} (mol l^{-1}) Potassium Hydroxide (KOH) solution consumed (titre value)

c = concentration of Potassium hydroxide (KOH) solution

m = mass (g) of PKO-biodiesel sample

Z = 56.1 g/mol

Ensure you use the appropriate units and assume 1 cm^3 of PKO-biodiesel weighs 0.89 g **(1mark)**

$$Acid\ value = \frac{V\ x\ c\ x\ Z}{m}$$

m = density x volume = 0.89 g cm^{-3} x 2 cm^3 = 1.78 g

For titre = 2.60 cm^3

$$Acid\ value = \frac{2.60 cm^3\ x 0.01 mol\, cm^3\ x 56.1 g\, mol^{-1}}{1.78 g} = 0.83$$

For titre = 3.60 cm^3

$$Acid\ value = \frac{3.60 cm^3\ x 0.01 mol\, cm^3\ x 56.1 g\, mol^{-1}}{1.78 g} = 1.19$$

Therefore for acid value ranging between 0.83 - 1.19 **(1 mark)**

For titre = 2.30 cm^3

$$Acid\ value = \frac{2.30 cm^3\ x 0.01 mol\, cm^3\ x 56.1 g\, mol^{-1}}{1.78 g} = 0.74$$

For titre = 3.90 cm^3

$$Acid\ value = \frac{3.90 cm^3\ x 0.01 mol\, cm^3\ x 56.1 g\, mol^{-1}}{1.78 g} = 1.25$$

Therefore for acid value ranging between 074 – 1.25 **(0.5 mark)**

One mark for calculation working even if the measurement is incorrect

2.10. Calculate the acid concentration in mol dm^{-3} of the PKO-Biodiesel. (K = 39.1, O = 16.0, H = 1.0) **(1 mark)**

Assume 1 : 1 mole ratio,

$$\frac{M_{KOH}V_{KOH}}{n_{KOH}} = \frac{M_{BD}V_{BD}}{n_{BD}} \quad \textbf{(0.5 mark)}$$

$$\frac{0.01 \ x \ 3.1}{1} = \frac{M_{BD} \ x \ 2}{1}$$

$$M_{BD} = \frac{0.031}{2} = 0.0155 \approx 0.016 \, mol \, dm^3 \quad \textbf{(0.5 mark)}$$

2.11. Provide the correct option from A-D for the differences in the observed acidity of PKO and PKO-biodiesel **(0.5 mark)**

A. Method of preparation of PKO- Biodiesel makes it more volatile
B. Magnesium sulphate was used in the extraction of PKO-Biodiesel
C. In the extraction PKO-biodiesel it was mixed with potassium hydroxide (KOH) which neutralized the acidity
D. The extraction process increases the yield of PKO-Biodiesel

Option selected	A **(0.5 mark)**

2.12. Select the best option in the list below for the reason that Biodiesel releases less pollutants into the atmosphere than petro-diesel when combusted.

A. It contains more oxygen
B. Biodiesel contains less sulphur.
C. It contains more carbon atoms
D. It is highly dense **(0.5 mark)**

Option selected	B **(0.5 mark)**

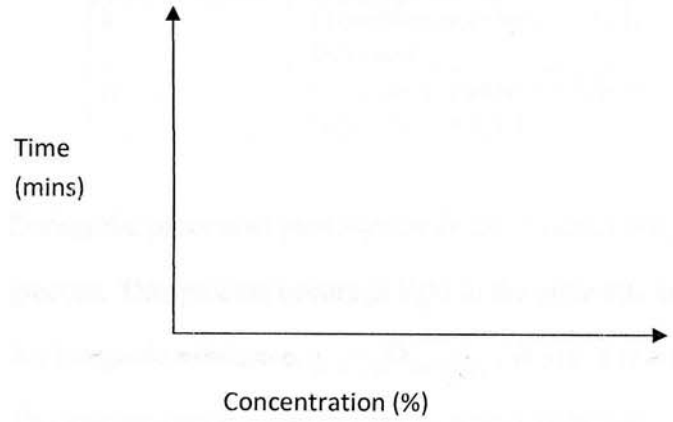
BIOLOGY EXPERIMENTAL EXAMINTATION MARKING SCHEME

Table 2: Glucose concentration and time taken to decolourise

Conical flask number	G1	G2	G3	G4
Glucose Concentration (%)	2.0	6.0	10.0	12.0
Time (mins)	11.0 - 16.0 0.5 mark	10.0 – 13.0 0.5 mark	8.0 – 11.0 0.5 mark	7.0 – 10.0 0.5 mark

(2.0 marks)

1.1 Standard curve (Use the graph sheet provided) **(2.0 marks)**



Correct axes = 1.0 mark

Line plot = 0.5 mark

Units =0.5 mark

Table 3: Time taken decolourise test solutions (2.0 marks)

Conical flask	A	B
Time (mins)	1.5 – 3.0 1.0 mark	1.0 – 2.0 1.0 mark

1.2. Concentration **of glucose in samples A and B estimated from the standard curve.**

Samples	**A**	**B**
Concentration of glucose (%)	19.5% (1.0 mark)	20.5 % (1.0 mark)

(Any correct determination from correct standard curve will score)

1.3. Sample with highest concentration of glucose.....**B**..... **(1.0 mark)**

1.4. Glucose is a reducing agent because, (tick appropriate boxes below)

Option	**Reason**	**True**	**False**
i	Oxidation number of Mn is decreased	**X (0.5 mark)**	
ii	Oxidation number of Mn in MnO_4^- became +4		**X (0.5 mark)**

1.5. During the process of photosynthesis green plants use ___C____ gas to synthesise glucose. This process occurs in light in the organelle called ___F____.

An inorganic substance, _____D_____, is also a reactant in the process.

The glucose that is manufactured is stored mainly as ____N____ in the plants.

The glucose in the fruits plays a role in the dispersal of the seeds. Animals are attracted by the ___Q____ of the fruit and they eat it. The seeds have a hard __B___ which prevents the seed from being ___J___ by the ____G___ in the alimentary canal of the animals.

Later the animal ____P___ the seeds, usually away from the parent plant. This helps reduce _____M_____ between the parent plant and its offspring.

(Any correct answer x 0.2 mark) = 2 marks

1.6. Fruit recommended for JauroAmadu's consumption ___Sample D___**(1.0 mark)**

1.7. Reason for answer to **1.6** above (1.0 mark)

Options	Reason	True	False
i	JA does not produce insulin	X	
ii	Fruit C has more water content than fruit D		X
iii	Fruit C has more glucose	X	
iv	JA does not produce glucagon		X

Any correct answer x 0.25 mark = 1.0 mark

Maximum marks = 14