International Junior Science Olympiad

Mendoza, Argentina

Experimental Test:

Answer Sheet

December8th, 2014

PRINCIPLES

1. Errors will only be penalized once therefore an error in one part of the question will lose marks there but if this error is used correctly in another part of the question the student will not be penalized second time.

2. If the student presents the correct answer but arrives at it in a different way or does not show any working then this student should be awarded the full marks for the question.

Time: 4 hrs

Marks: 40 [Section 1: 25.0 Marks, Section 2:15.0 Marks]

Complete the following:

NAME:	1. _____ 2. _____ 3. _____
SEAT N°:	
COUNTRY:	
SIGNATURE	1. _____ 2. _____

	3. _____

Experimental Tasks

SECTION 1: ALCOHOLIC FERMENTATION [25.0 Marks]

D. *Recording experimental data of fermentation.*

D.3.

Table 1.1: Recording fermentationdata [8.5 Marks=7.0 (Record data) + 1.5 (Flow calculation)]

Initial Temperature:		19	23	38	40					
Time [min]	Accumulated gas volume $V_a(t)$; [ml]					Flow F(t) [ml/min]				
0	0	0	0	0	0		0	0	35	53
2	10	0	0	70	105	5	0	0	56	79
4	40	0	20	125	165	15	0	4	46	66
6	70	0	50	210	280	15	0	4	51	71
8	125	0	80	310	410	27.5	0	10	50	68
10	180	0	105	395	525	27.5	0	17	60	79
12	260	0	145	505	665	40	7	21	54	68
14	325	25	195	565	735	32.5	6	17	41	51
16	390	75	245	615	785	32.5	0	6	34	46
18	440	125	285	655	815	25	0	6	39	51
20	490	190	335	670	815	25	0	8	25	31
22	525	245	375	695	835	17.5	2	8	22	28
24	565	275	405	715	850	20	2	6	16	20
26	590	290	425	735	870	12.5	0	3	17	22
28	610	325	450	745	870	10	0	4	11	15
30	630	350	470	765	885	10	0	0	12	17
32	645	370	490	765	880	7.5	0	0	12	18

34	660	395	510	770	885	7.5	0	0	12	16
36	660	405	520	780	895	0	0	1	9	11
38	670	420	530	790	900	5	0	0	9	13
40	670	420	535	800	915	0	0	0	35	53
Ç										

RECORD DATA						
Consideration	Marks		CORRECT ANSWER			
Full completed table	4	Data collection	Proportional to the total n° of data	3		
		Precision of data	5 ml, 10 ml	1		
Initial temperature	1					
Shape of the data	2		Sigmoid	2	Concave down	1
TOTAL	**7**					

FLOW CALCULATION = 1.5/n° data calculated

E. *Recording Experimental data of fermentation reactivation* [2.5 Marks=2.0 (Record data) +0.5 (Flow calculation)]

E.7. TABLE 1.2.

Time [min]	Accumulated gas volume $V_a(t)$; [ml]					Flow, F(t) [ml/min]				
42	680	425	540	810	925	5	0	1	12	18
44	700	440	560	830	950	10	0	1	12	17
46	710	450	580	875	1005	5	0	2	28	38
48	750	470	610	915	1055	20	0	11	39	51
50	800	485	655	1045	1215	25	0	19	66	87

RECORD DATA				
	Marks		CORRECT ANSWER	
Complete table	1.5	Data collection	Proportional to the total n° of data	1

		Precision	5 ml, 10 ml	0.5
Shape of the data	0.5		increasing	0.5
TOTAL	**2**			

FLOW CALCULATION = 0.5/n° data calculated

F. *Identification of the gas metabolite*

F.1 Reaction with $Ca(OH)_2$.

F.1.3. Choose the correct answer by ticking the appropriate box/es. **[0.5 Marks]**

• White precipitate is observed	X
• Black precipitate is observed	
• Precipitate is not observed	

F.1.4. Formulate stoichiometric equation of reaction **[0.5 Marks]**

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$

	Marks
Reagents correct formulation	0.1
Products correct formulation	0.1
Correct stoichiometric coefficient	0.1
Complete equation	0.2
Total	**0.5**

F.2.Reaction with bromthymol blue indicator

F.2.3.1.Choose the correct answer by ticking the appropriate box/es.**[0.2 Marks]**

• Yellow color is observed	**X**
• Blue color is observed	
• Red color is observed	
• White color is observed	

F.2.3.2. What can you deduce from the observation of the bromothymol blue solution?**[0.2 Marks]**

• An increase pH	

• A decrease in pH	**X**
• No change in pH	

F.2.4.Formulate and balance the dissociation equation of CO_2dissolved in water, which explain the pH change in the indicator solution **[0.6 Marks]**

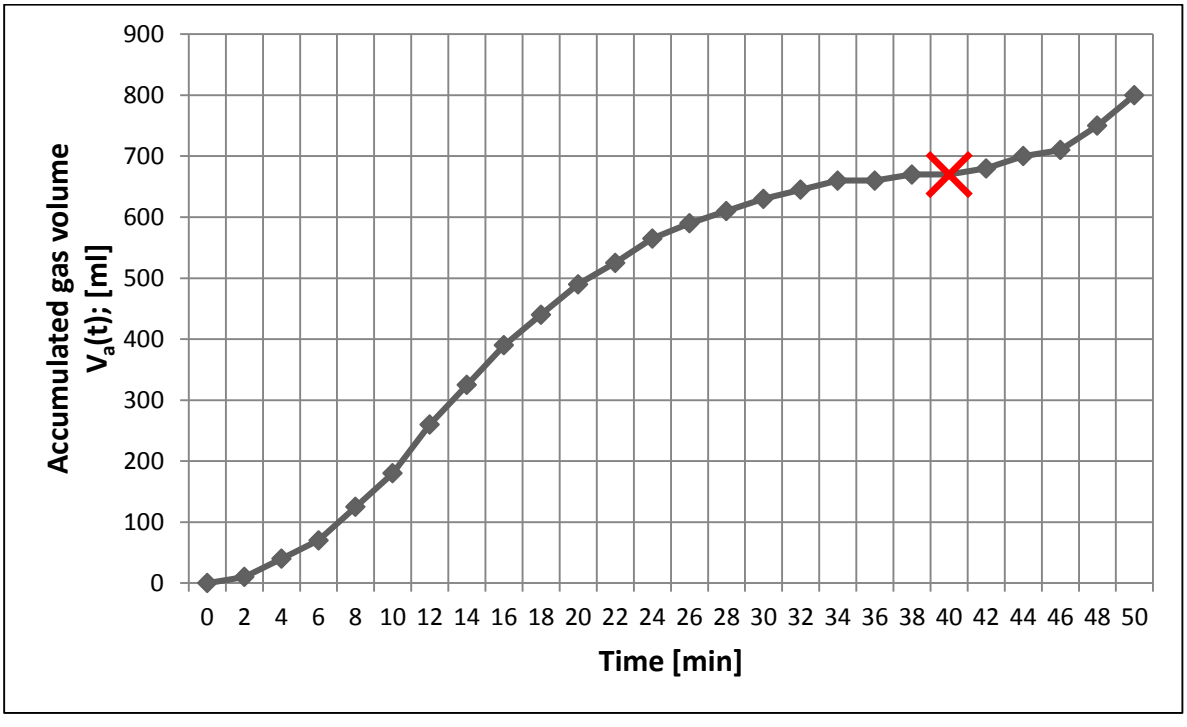
$$\boldsymbol{CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-}$$

	Marks
Reagents correct formulation	0.1
Products correct formulation	0.2
Correct stoichiometric coefficient	0.1
Complete equation	0.2
Total	**0.6**

G. *Data processing and analysis*

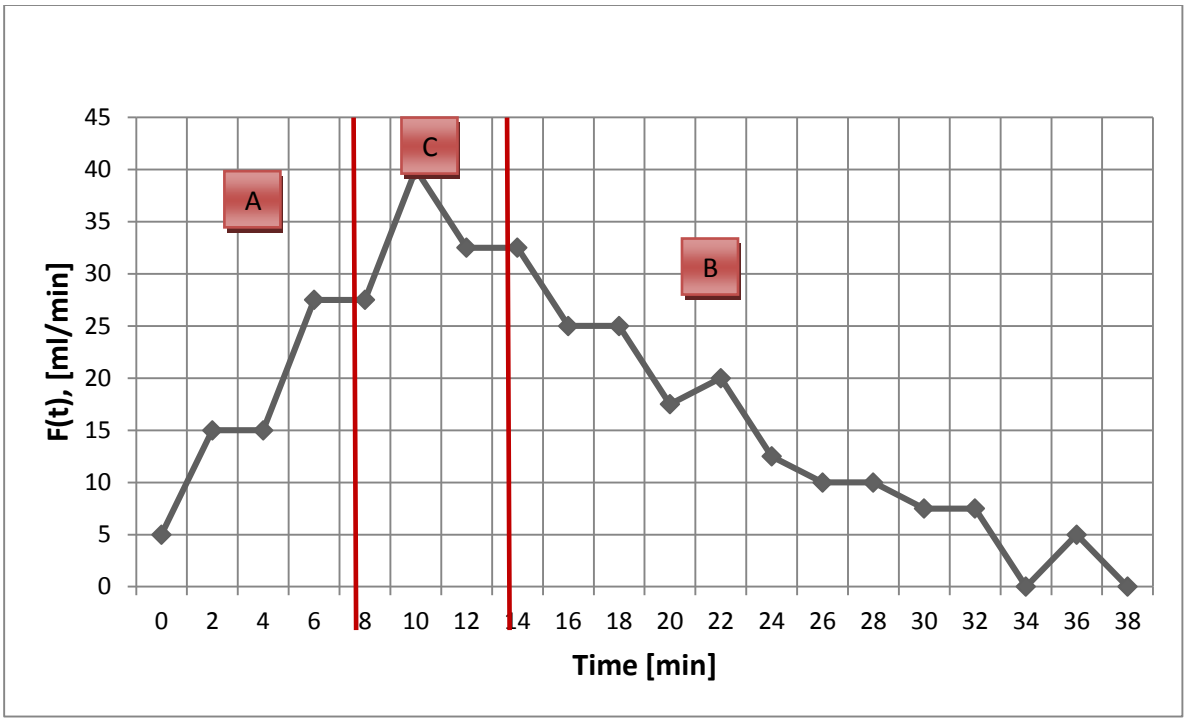
G.2. Plot the data of Table 1.1. and Table 1.2. [2.5 Marks]

G.2.1.: GRAPH A: Accumulated gas volume $V_a(t)$;[ml]vs. Fermentation time [min].



			Marks
Axis	units	Axis name	0.1
		scale	0.2
	Proper use of space for graphic		0.2
Draw points			1.5 (being 1.5/n°points)
Cross mark			0.5
TOTAL			**2.5**

G.2.2. GRAPHB: F(t); [ml/min] vs. Fermentation time [min]. Time range ≤40 min **[1.8 Marks=1.5 Marks (plotting data) + 0.3 identify fermentation stages]**



Plotting data			Marks
Axis	units	Axis name	0.1
		scale	0.2
	Proper use of space for graphic		0.2
Draw points			1.0 (being 1.0/n°points)
Identify fermentation stages			0.3
TOTAL			**1.8**

G.3.1. Amount (in grams) of metabolized glucose at t=40 min.[1.0 Marks]

Resolution

$C_6H_{12}O_6 \rightarrow$ 57 kcal + 2 CH_3CH_2OH + 2CO_2

M_{CO2}= 44,01 g/mol V_{molar}= 22,4 l/mol V_{CO2}= 670 ml

$$0.670\ \cancel{L} \times \frac{1\ \cancel{mol_{CO_2}}}{22.4\ \cancel{L}} \times \frac{44.01\ g_{CO2}}{1\ \cancel{mol_{CO_2}}} = 1.316\ g_{CO_2}$$

$$1.316\ \cancel{g_{CO_2}} \times \frac{1\ \cancel{mol_{glucose}}}{2\ \cancel{mol_{CO_2}}} \times \frac{180{,}06\ g_{glucose}}{1\ \cancel{mol_{glucose}}} \times \frac{1\ \cancel{mol_{CO_2}}}{44.01\ \cancel{g_{CO_2}}} = 2.7\ g_{glucose}$$

Answer

$2.7\ g_{glucose}$

		Marks
Procedure		0.7
Results	….±….	0.3
TOTAL		**1.0**

Values outside the above mentioned range = Zero

G.3.2.2. Natural logarithm (ln) calculate. Fermentation stage corresponding to decrease of the gaseous metabolite production rate .

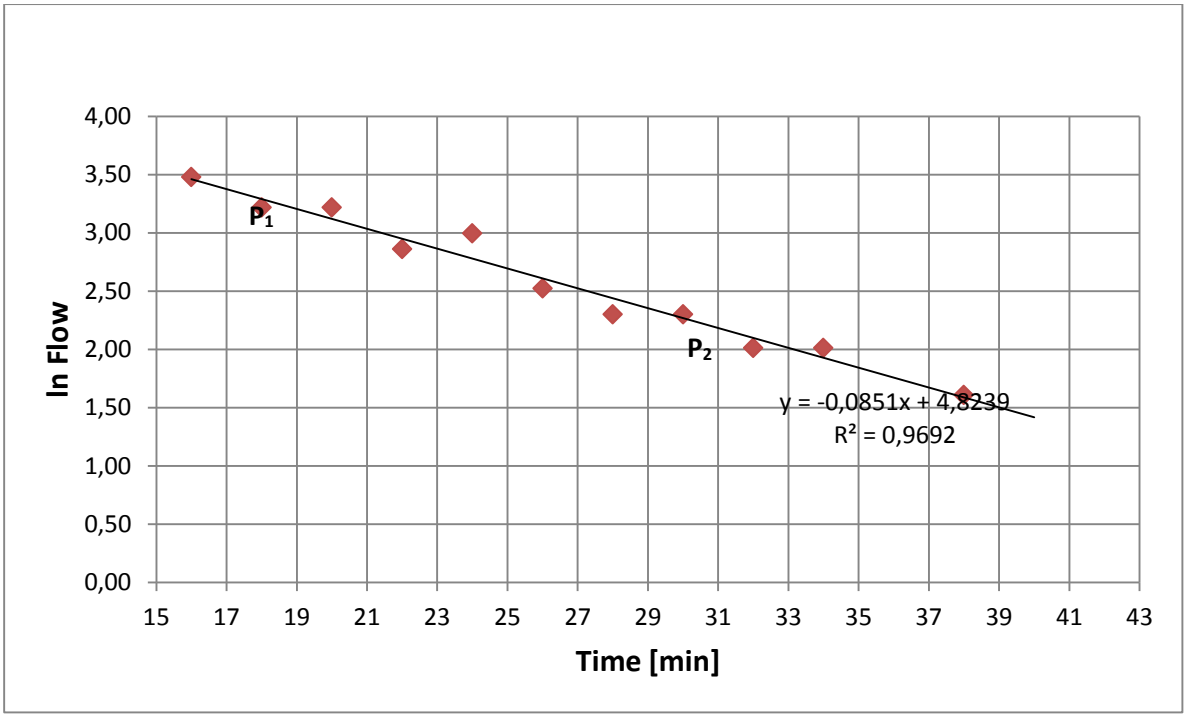
Table 2.1.[0.5 Marks]

Time [min]	Flow	ln flow
16	32.5	3.4
18	25	3.2
20	25	3.2
22	17.5	2.9
24	20	3.0
26	12.5	2.5
28	10	2.3
30	10	2.3
32	7.5	2.0
34	7.5	2.0
36	0	
38	5	1.6
40	0	

Proper choice of range of data to evaluate=0.1 Marks
ln calculate = 0.4; being 0.4 / n° data
Total= 0.5 Marks

G.3.2.3. Plot the data of Table 2 [1.0 Marks]

GRAPH C: ln V_P vs. time [min]



Plotting data			Marks
Axis	units	Axis name	0.1
		scale	0.1
	Proper use of space for graphic		0.1
Draw points			0.7 (being 0.7/n°points)
For best fit straight line			1.0
TOTAL			**2.0**

G.3.2.4. Draw a straight line that best fits the data points of GRAPH C. [1.0 Marks]

G.3.2.5. Data fitting
Calculation of the slope of the curve (A) [0.7 Marks]

Resolution
$P_1=(x_1,y_1)= (19, 3.25)$
$P_2=(x_2, y_2)=(31,2.2)$

$$A = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2.2 - 3.25}{31 - 19} = -0.08$$

Answer

-0.08

Calculation of the intercept of the curve (B) **[0.3 Marks]**

Resolution $\boldsymbol{Y = Ax + B}$ $\boldsymbol{B = Y - Ax}$ $\boldsymbol{B = 1,5 - (-0.085) \times 39}$ $\boldsymbol{B = 4.815}$
Answer **4.8**

Table 2.2: Linear equation of calibration curve

Linear equation	$\boldsymbol{y = -0.08 + 4.8x}$
Slope(A)	-0.08
Intercept(B)	4.8

		Marks	Range			
Slope calculate	Calculate	0.1				
	Result	0.1				
	Range	0.1	-0,11	-0,1	-0,06	-0,05
Intercept	Calculate	0.1				
	Result	0.1				
	Range	0.1	3,7	4,1	5	5,4
TOTAL		**0.6**				

G.3.2.6. Hypothetical volume (V_h) of fermentation.[0.2 Marks]

Resolution

$$V_h = -\frac{e^{(-0.085\times 40+4.815)}}{-0.085} = 48.43 \text{ ml}$$

Answer

48.4 ml

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	0	20	90	120
TOTAL	**0.2**				

G.3.2.7. Mass of glucose that corresponds to the volume V_h of CO_2 [0.4 Marks]

Resolution

$C_6H_{12}O_6 \rightarrow$ 57 kcal + 2 CH_3CH_2OH + 2CO_2

M_{CO2}= 44,01 g/mol V_{molar}= 22,4 l/mol V_h= 0.04843 l

$$0.04843 \text{ L} \times \frac{1 \text{ mol}_{CO_2}}{22.4 \text{ l}} \times \frac{44.01 \text{ g}_{CO2}}{1 \text{ mol}_{CO_2}} = 0.095 \text{ g}_{CO_2}$$

$$0.095 \text{ g}_{CO_2} \times \frac{1 \text{ mol}_{glucose}}{2 \text{ mol}_{CO_2}} \times \frac{180{,}06 \text{ g}_{glucose}}{1 \text{ mol}_{glucose}} \times \frac{1 \text{ mol}_{CO_2}}{44.01 \text{ g}_{CO_2}} = 0.19 \text{ g}_{glucose}$$

Answer

0.2 $g_{glucose}$

	Marks	Range			
Correct Procedure	0.2				
Correct Result	0.2	0	0,07	0,37	0,48

TOTAL	**0.4**				

G.3.2.8.Total Mass of Glucose fermented during the 40 min fermentation [0.2 Marks]

Resolution

Consumed glucose= Initial glucose – residual glucose

Consumed glucose = 4.0 g – 0.2 g = 3.8 g

Answer

3.8 $g_{consumed\ glucose}$

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	3,52	3,63	3,93	4,04
TOTAL	**0.2**				

G.3.2.9. Total Mass of CO_2 produced by the glucose consumed [0.4 Marks]

Resolution

$C_6H_{12}O_6 \rightarrow$ 57 kcal + 2 CH_3CH_2OH + 2CO_2

$$3.81\ g_{glucose} \times \frac{2\ mol_{CO_2}}{1\ mol_{glucose}} \times \frac{1\ mol_{glucose}}{180{,}06\ g_{glucose}} \times \frac{44.01\ g_{CO_2}}{1\ mol_{CO_2}} = 1.9\ g_{CO_2}$$

Answer

$1.9\ g_{CO_2}$

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	1,72	1,77	1,92	1,98

TOTAL	**0.2**				

G.3.2.10. Mass of CO_2released to the graduated cylinder during the 40 min fermentation[0.4]

Resolution

$$\frac{0.670\ \cancel{L}}{22.4\ \cancel{L}/\cancel{mol}} \times 44.02\ g/\cancel{mol} = 1.3\ g_{CO2\ released}$$

Answer

$1.3\ g_{CO2\ released}$

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	0,8	1	0,6	1,8
TOTAL	**0.2**				

G.3.2.11. Mass of CO_2dissolved in the reactor.[0.2Marks]

Resolution

Mass of CO_2 dissolved = Total mass of CO_2 – mass of CO_2 released

Mass of CO_2 dissolved = 1.9 g $_{CO2}$ – 1.3 g $_{CO2}$ released

Mass of CO_2 dissolved = 0.5 g

Answer

0.5 g $_{CO2\ dissolved}$

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	0,07	0,29	0,83	1,05
TOTAL	**0.2**				

G.3.2.12. Solubility of CO_2 (g/l) in the reactor.[0.3 marks]

Resolution

Solubility : $\frac{0.54\ \text{g}}{0.5\ \text{L}} = 1.1\ \frac{\text{g}}{\text{l}}$

Answer

1.1 g/l

	Marks	Range			
Correct Procedure	0.1				
Correct Result	0.1	0,14	0,6	1,65	2,09
TOTAL	**0.2**				

G.3.3. Moles of ethanol produced at t=40 min. [0.4 Marks]

Resolution

$$3.81\ \text{g}_{\text{glucose}} \times \frac{2\ \text{mol}_{\text{ethanol}}}{1\ \text{mol}_{\text{glucose}}} \times \frac{1\ \text{mol}_{\text{glucose}}}{180{,}06\ \text{g}_{\text{glucose}}} = 0.04\ \text{moles}_{\ \text{ethanol}}$$

Answer

$$\mathbf{0.04\ moles}_{\ \mathbf{ethanol}}$$

		Marks	Range			
Correct Procedure	Moles number CO_2	0.2				
	Moles Number glucose	0.2				
	Moles Number ethanol	0.3				
Correct Result		0.3	0,039	0,04	0,044	0,045
TOTAL		**1.0**				

G.3.4. Concentration of ethanol [g/100 ml] produced at t=40 min. Correct calculation 0.5 Marks

Resolution

Ethanol weight=0.04 mol x 46.07 g /mol = 1.84 g ethanol

Ethanol concentration reactor = $\frac{1.84\ g\ x\ 100\ ml}{500\ ml} = 0.37\ g/100ml\ \ ethanol$

Answer

$0.37\ g/100\ ml\ \ ethanol$

	Marks				
Correct Procedure	0.2				
Correct Result	0.1	0.360	0.372	0.402	0.414
TOTAL	**0.3**				

G.3.5. Justification of the fermentation process stopping. Choose the correct answer by ticking the appropriate box/es. Consider alcohol concentration calculated previously (G.3.4) , and toxic concentration threshold for yeast, which is 14 g/100 ml (w/v). Choose correct option 0.5 Marks

a. Death yeast	
b. Inhibition of yeast due to the concentration of alcohol.	
c. Shortage of fermentable substrate	**X**

SECTION 2: REFRACTOMETRIC DETERMINATION OF SUCROSE CONCENTRATION [15.0 Marks]

B. PREPARATION OF CALIBRATION CURVE

B.1.Preparation of calibration solutions

B.1.1. Calculation of sucrose solution volume (62.5 % w/v) for preparation of calibration solutions.

[1.2 Marks]

Solution A. [0.2 marks]

Data

V_f: final volume	50 ml
C_f: final concentration	5 % w/v sucrose
C_i: initial concentration	62.5 % w/v sucrose
V_i: initial volume	?

$$V_f * C_f = V_i * C_i$$

$$\frac{V_f * C_f}{C_i} = V_i$$

$$\frac{50\ \text{ml} * 5\ \%}{62.5\%} = V_i$$

$$4\ \text{ml} = V_i$$

Answer

$$4\ \text{ml} = V_i$$

Solution B. **[0.2 marks]**

Data

V_f: final volume	50 ml
C_f: final concnetration	10 % w/v sucrose
C_i: initial concentration	62.5 % w/v sucrose
V_i: initial volume	?

$$V_f * C_f = V_i * C_i$$

$$\frac{V_f * C_f}{C_i} = V_i$$

$$V_i = \frac{50\ \text{ml} * 10\ \%}{62.5\%}$$

$$V_i = 8\ \text{ml}$$

Answer

$$\mathbf{V_i = 8\ ml}$$

Solution C [0.2 marks]

Data

V_f: final volume	50 ml
C_f: final concnetration	15 % w/v sucrose
C_i: initial concentration	62.5 % w/v sucrose
V_i: initial volume	?

$$V_f * C_f = V_i * C_i$$

$$\frac{V_f * C_f}{C_i} = V_i$$

$$V_i = \frac{50\ ml * 15\ \%}{62.5\%}$$

$$V_i = 12\ ml$$

Answer

$$\mathbf{V_i = 12\ ml}$$

Solution D [0.2 marks]

Data

V_f: final volume	50 ml
C_f: final concentration	20 % w/v sucrose
C_i: initial concentration	62.5 % w/v sucrose
V_i: initial volume	?

$$V_f * C_f = V_i * C_i$$

$$\frac{V_f * C_f}{C_i} = V_i$$

$$V_i = \frac{50\ ml * 20\ \%}{62.5\%}$$

$$V_i = 16\ ml$$

Answer

$$\mathbf{V_i = 16\ ml}$$

Solution E [0.2 marks]

Data

V_f: final volume	50 ml
C_f: final concentration	25 % w/v sucrose
C_i: initial concentration	62.5 % w/v sucrose
V_i: initial volume	?

$$V_f * C_f = V_i * C_i$$

$$\frac{V_f * C_f}{C_i} = V_i$$

$$V_i = \frac{50\ ml * 25\ \%}{62.5\%}$$

$$V_i = 20\ ml$$

Answer

$$\mathbf{V_i = 20\ ml}$$

Table 3.1: Summary of calibration solutions data **[0.2 Marks]**

Solution identification	Initial Concentration [g/100 ml]	Initial Volume (ml)	Final Concentration [g/100 ml]	Final Volume (ml)
A	62.5	**4**	5	50
B	62.5	**8**	10	50
C	62.5	**12**	15	50
D	62.5	**16**	20	50
E	62.5	**20**	25	50

B.2.5.3.

Table 3.2: Calibration curve data **[4.0 Marks]**

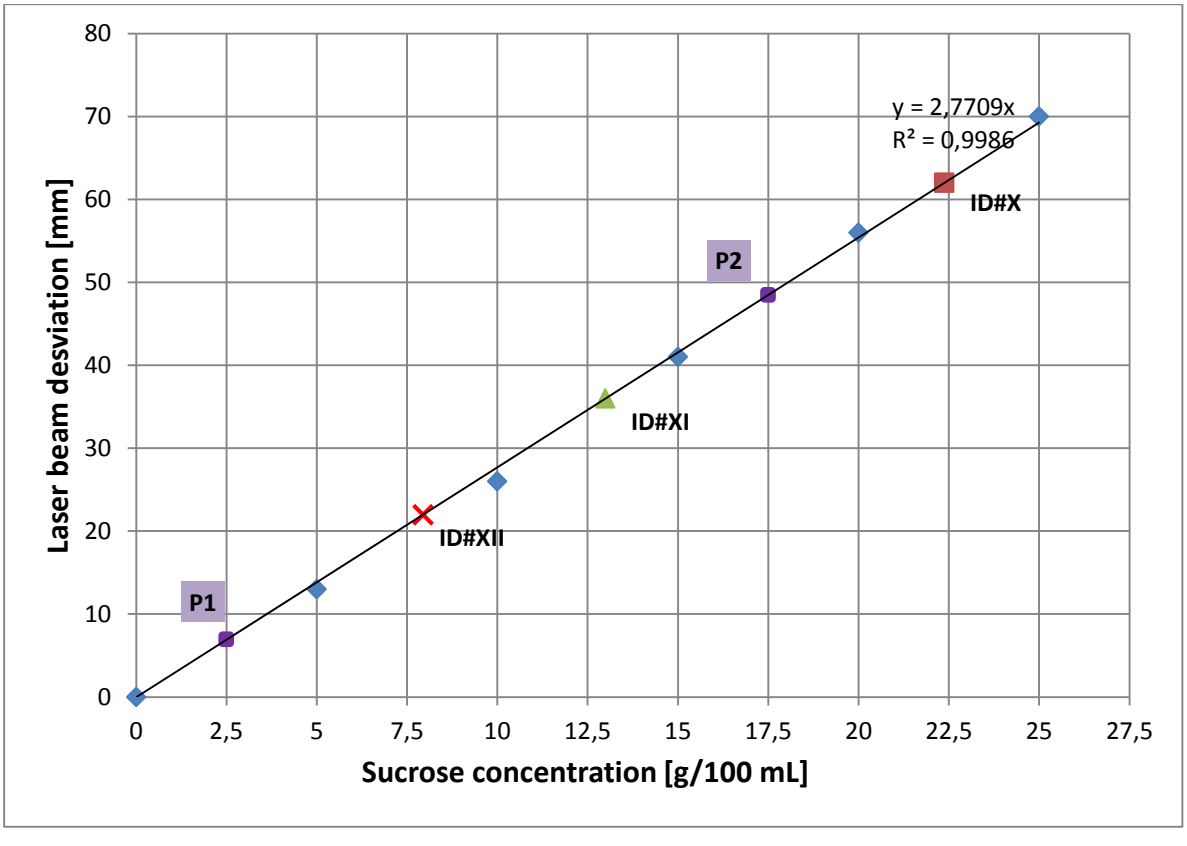
Solution Name	Sucrose Concentration [g/100 ml]	Laser beam deviation from the zero point [mm]				
Water	**0**	0				
A	**5**	13	0	0	0	0
B	**10**	26	6	9	17	20
C	**15**	41	18	22	33	37

D	**20**	56	25	32	50	57
E	**25**	70	35	43	65	73
		average	42	56	92	106

Calibration curve data	Total Marks
Zero	0.5
Data within the range	0.5 each point ± 1 SD(x5)
Precision	1.0
Total	**4.0**

B.3: Calibration curve

GRAPH D: Laser beam deviation from the zero point[mm] vs. Sucrose concentration [% w/v] **[3.0 Marks]**



Plotting data			Marks
Axis	units	Axis name	0.2
		scale	0.2
	Proper use of space for graphic		0.2
Draw points			1.4 (being 1.4/n°points)
For best fit straight line			1.0
TOTAL			3.0

B.3.3**: Data fitting [0.9 Marks]**

Calculation of the slope of the calibration curve (A)

$P_1=(x_1,y_1)= (2.5, .7.0)$
$P_2=(x_2, y_2)=(17.5, 48.5)$

$$A = \frac{y_2 - y_1}{x_2 - x_1} = \frac{48.5 - 7.0}{17.5 - 2.5} = 2.77$$

Answer

$$\boldsymbol{A = 2.77\ (2.34 - 3.18)}$$

		Marks	Range			
Slope calculate	Calculate	0.3				
	Result	0.1	1,7	2,2	3,5	4
	Range	0.1				
Intercept	Result	0.2	-4	-3	2	3
	Range	0.2				
TOTAL		**0.9**				

Table 3.3: Linear equation of calibration curve

Linear Equation	$\boldsymbol{y = 2.77x}$
Slope	**2.77 (2.34 - 3.18)**
Intercept	**0**

C. Samples analysis

C.1.7. Data of samples with unknown sugar concentration

Table 3.4: Data of analyzed samples **[2.1 Marks]**

Unknown Samples	**Millimeters deviation [mm]**				
ID # X	67	5	2	72	92
ID # XI	40	9	30	86	107
ID # XII	25	13	18	31	36

Unknown samples	Total Marks

Data within the range	0.7 each point (x3)
Total	2.1

C.2. Calculation of the sucrose concentration of the samples [2.3 Marks]

Table 3.5. Graphical and Analytical determination of sucrose concentration in analyzed samples

Unknown Samples	Sucrose concentration graphically obtained [g/100 ml]	Sucrose concentration analytically obtained [g/100 ml]	Concentration Difference (%)
ID # X	**22.5 (22.0-23.0)**	22.38 (21.21-22.6)	0.54 (3.72- 1.77)
ID # XI	**12.8 (12.6-13.0)**	12.99 (12.7-13.2)	-1.46 (-0.79- -1.52)
ID # XII	**7.8 (7.3-8.2)**	7.94 (7.4-8.4)	-1.76 (-1.35 - -2.38)
Note: **C_G:** Sucrose concentration graphically obtained; **C_M**: Sucrose concentration analytically obtained.			

C.2.2.Analytical determination

Resolution ID# X

$$y = 2.77x$$

$$y = 62$$

$$\frac{y}{2.77} = x$$

$$\frac{62}{2.77} = 22.38$$

Answer

22.38 g/100 ml

Resolution ID# XI

$$y = 2.77x$$

$$y = 36$$

$$\frac{y}{2.77} = x$$

$$\frac{36}{2.77} = 12.99$$

Answer

12.99 g/100 ml

Resolution ID# XII

$$y = 2.77x$$

$$y = 22$$

$$\frac{y}{2.77} = x$$

$$\frac{22}{2.77} = 7.94$$

Answer

7.94 g/100 ml

C.2.3. Calculation of the percentage difference [D(%)]

Resolution ID# X

$$D\ (\%) = \frac{C_G - C_M}{C_M} \times 100$$

$$D\ (\%) = \frac{22.5 - 22.38}{22.38} \times 100$$

$$D\ (\%) = 0.54$$

Answer

0.54

Resolution ID# XI

$$\boldsymbol{D}\ (\%) = \frac{\boldsymbol{C_G - C_M}}{\boldsymbol{C_M}} \times \mathbf{100}$$

$$\boldsymbol{D}\ (\%) = \frac{\mathbf{12.8 - 12.99}}{\mathbf{12.99}} \times \mathbf{100}$$

$$\boldsymbol{D}\ (\%) = \mathbf{-1.46}$$

Answer

-1.46 %

Resolution ID# XII

$$\boldsymbol{D}\ (\%) = \frac{\boldsymbol{C_G - C_M}}{\boldsymbol{C_M}} \times \mathbf{100}$$

$$\boldsymbol{D}\ (\%) = \frac{\mathbf{7.8 - 7.94}}{\mathbf{7.94}} \times \mathbf{100}$$

$$\boldsymbol{D}\ (\%) = \mathbf{-1.76}$$

Answer

-1.76 %

		Marks
Sucrose concentration graphically obtained (0.2x3)		0.6
Sucrose concentration analytically obtained	Procedure (0.1x3)	0.3
	Results (0.1x3)	0.3
Concentration Difference (%)	Procedure (0.1x3)	0.3
	Results (0.1x3)	0.3
Complete the table		0.5
Total		2.3

D: Additional calculations and data analysis of samples XI

D.1: Sucrose concentration in original honey sample **[0.3 Marks]**

Table 3.6.

Unknown Samples	Sucrose original concentration in honey	Range

	[°Brix]				
ID # XI	81.19 (78.75-82.5)	33	73	163	203

D.1. Calculation of original sucrose concentration of honey sample

Resolution

$$100\ \cancel{g\ honey}\ \frac{12.99\ g_{sucrose}}{16\ \cancel{g_{honey}}} = 81.19\ g_{sucrose}$$

Answer

81.19 g/100 g (78.75-82.5)

D.2. Safe preservation of honey

Table 3.7.[0.2 Marks]

SAFE	NOT SAFE
X	

D.3: Theoretical calculations[0.5 Marks]

Resolution[0.3]

$\boldsymbol{y = 2.77x}$

$\boldsymbol{x = 8.5\%}$

$\boldsymbol{y = 2.77 \times 8.5}$
$\boldsymbol{y}$ =23.54

Answer[0.2]

23.54 ± 3.57

Table 3.8.: Theoretical deviation of the laser beam [mm] for a solution 8.5% (w/v) sucrose concentration

Calculation	Theoretical deviation of the laser beam [mm]

Analytical	
Graphical	

D.4.Sucrose concentration of beverages
[0.5 Marks]

Resolution [0.2]

$$sucrose\ concentration = \frac{15\ g}{200\ ml} \times 100\ ml$$

$$sucrose\ concentration = 7.5\ \% \left(\frac{g}{ml}\right)$$

Answer [0.2]

7.5% (± 1)

D.3. Calculate the theoretical deviation of the laser beam [mm] for a solution 8.5% (w/v) sucrose concentration.

Table 3.8.: Theoretical deviation of the laser beam [mm] for a solution 8.5% (w/v) sucrose concentration

Calculation	Theoretical deviation of the laser beam [mm]
Analytical	**~ 23**
Graphical	**23**

D.4. Sucrose concentration found in the analysed beverage.

Table 3.9.: Analysed beverage specification according to package label statement

Yes	**X**
No	

[0.1]