

FOR SUBMIT



11th International Junior Science Olympiad

Experimental Test: Answer Sheet

December 8th, 2014



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental Test: Answer Sheet December 8th, 2014

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. _____



GROUP CODE	
PARTICIPANT CODES	

Experimental test: Answer Sheet

Experimental Tasks

SECTION 1: ALCOHOLIC FERMENTATION [25.0 Marks]

D. Recording experimental data of fermentation.

D.3.

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

Initial temperature of warm water for preparing suspension A and solution B:		
Initial Temperature of suspension A+B (inside reaction flask):		
Time [min]	Accumulated gas volume $V_a(t)$; [ml]	Flow $F(t)$, [ml/min]
0		
2		
4		
6		
8		
10		
12		
14		
16		
18		
20		
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

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		
44		
46		
48		
50		

F. Identification of the gaseous product

F.1 Reaction with $\text{Ca}(\text{OH})_2$.

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

- White precipitate is observed
- Black precipitate is observed
- Precipitate is not observed

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

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

--



GROUP CODE	
PARTICIPANT CODES	

Experimental test: Answer Sheet

F.2.Reaction with bromthymol blue indicator

F.2.2.1.. Choose the correct answer by ticking the appropriate box. [0.2 Marks]

- Yellow color is observed
- Blue color is observed
- Red color is observed
- White color is observed

F.2.2.2. What can you deduce from the observation of the bromothymol blue solution? (Mark the correct answer). [0.2 Marks]

- An increase in pH
- A decrease in pH
- No change in pH

F.2.2.3. Formulate and balance the dissociation equation of CO₂ dissolved in water, which explain the pH change in the indicator solution [0.6 Marks]

--



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

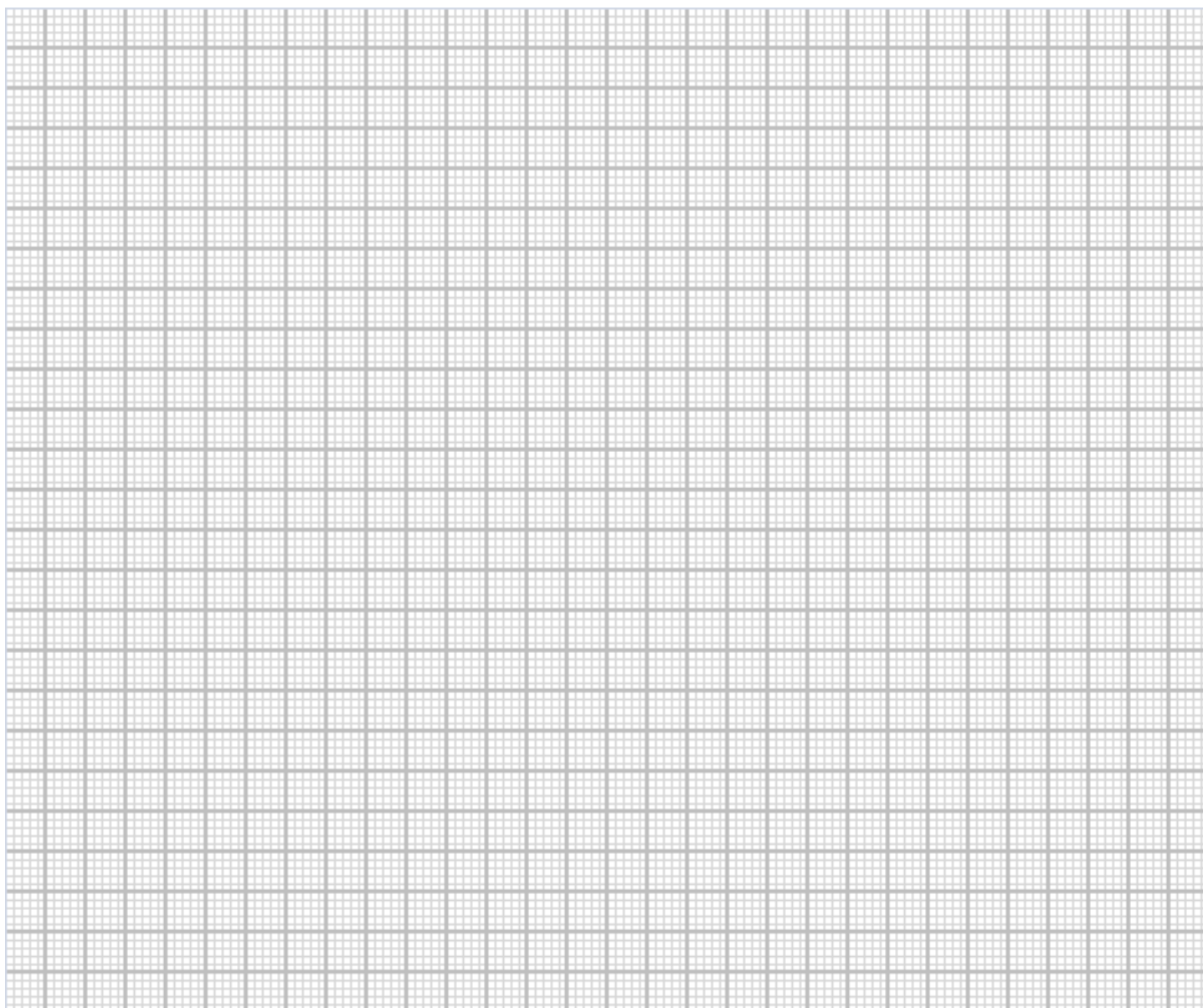
11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

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].





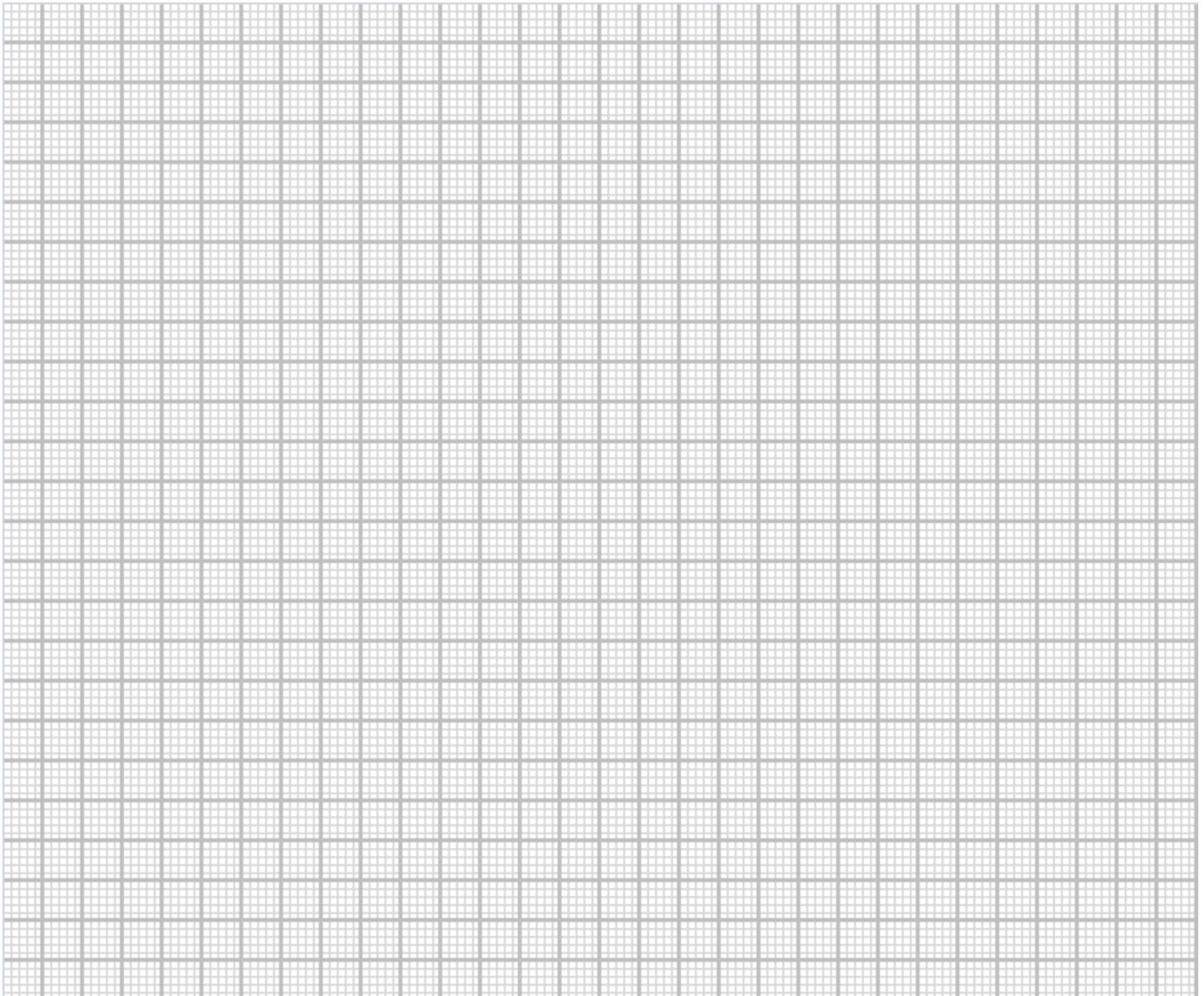
Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.2.2. GRAPH B: $F(t)$; [ml/min] vs. Fermentation time [min]. [1.8 Marks=1.5 Marks (plotting data) + 0.3 identify fermentation stages]





Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

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

Resolution

Answer



Experimental test: Answer Sheet

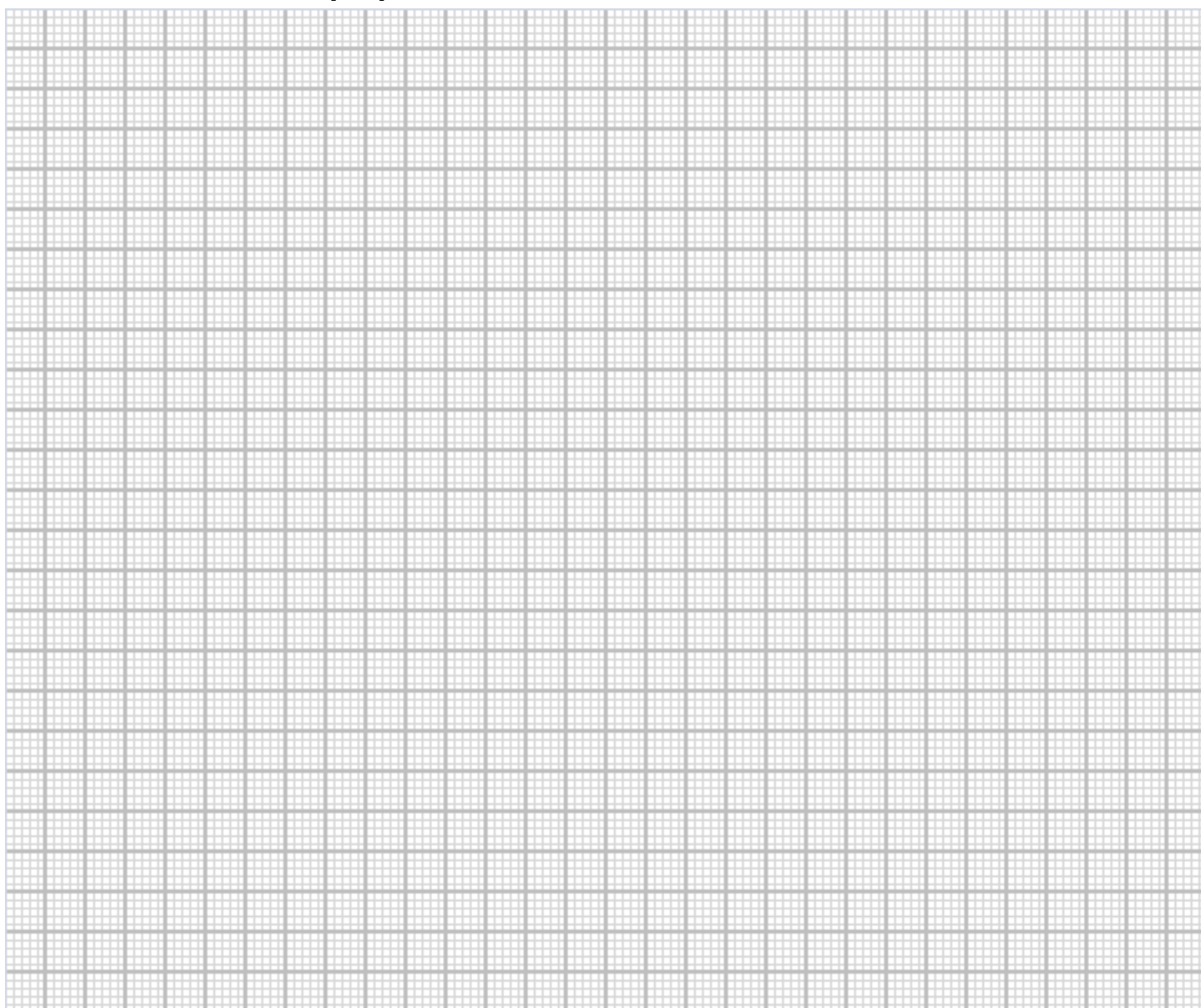
GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.3.2.3. Plot the data of Table 2.1 [1.0 Marks]

GRAPH C: ln F vs. time [min]



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



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.3.2.5. Data fitting

Calculation of the slope of the calibration curve (A) [0.3 Marks]

Resolution

Answer

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

Resolution

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Table 2.2: Linear equation of calibration curve

Linear equation	
Slope(A)	
Intercept (B)	

[0.1 Marks for equation]

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

Resolution	
Answer	



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

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

Resolution	
Answer	



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

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

Resolution

Answer

G.3.2.9. Total Mass of CO₂ produced by the glucose consumed [0.4 Marks]

Resolution

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.3.2.10. Mass of CO₂ released to the graduated cylinder during the 40 min fermentation [0.4 Marks]

Resolution

Answer

G.3.2.11. Mass of CO₂ dissolved in the reaction flask. [0.2 Marks]

Resolution

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.3.2.12. Solubility of CO₂ (g/L) in the reaction flask. [0.3 marks]

Resolution

Answer

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

Resolution

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

G.3.4. Concentration of ethanol (% w/v) produced at t=40 min. [0.5 Marks]

Resolution

Answer

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

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



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

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

B. PREPARATION OF CALIBRATION CURVE

B.1. Preparation of standard solutions of different concentration

B.1.1. Calculation of sucrose solution volume (62.5 g/100 ml) for preparation of standard solutions. [1.2 Marks]

Solution A

Answer



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

Solution B.

Answer



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

Solution C

Answer



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

olution D

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Solution E

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Table 3.1: Summary of standard solutions data

Solution identification	Initial Concentration [g/100 ml]	Initial Volume [ml]	Final Concentration [g/100 ml]	Final Volume [ml]
A	62.5		5	50
B	62.5		10	50
C	62.5		15	50
D	62.5		20	50
E	62.5		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	
B	10	
C	15	
D	20	
E	25	



GROUP CODE	
PARTICIPANT CODES	

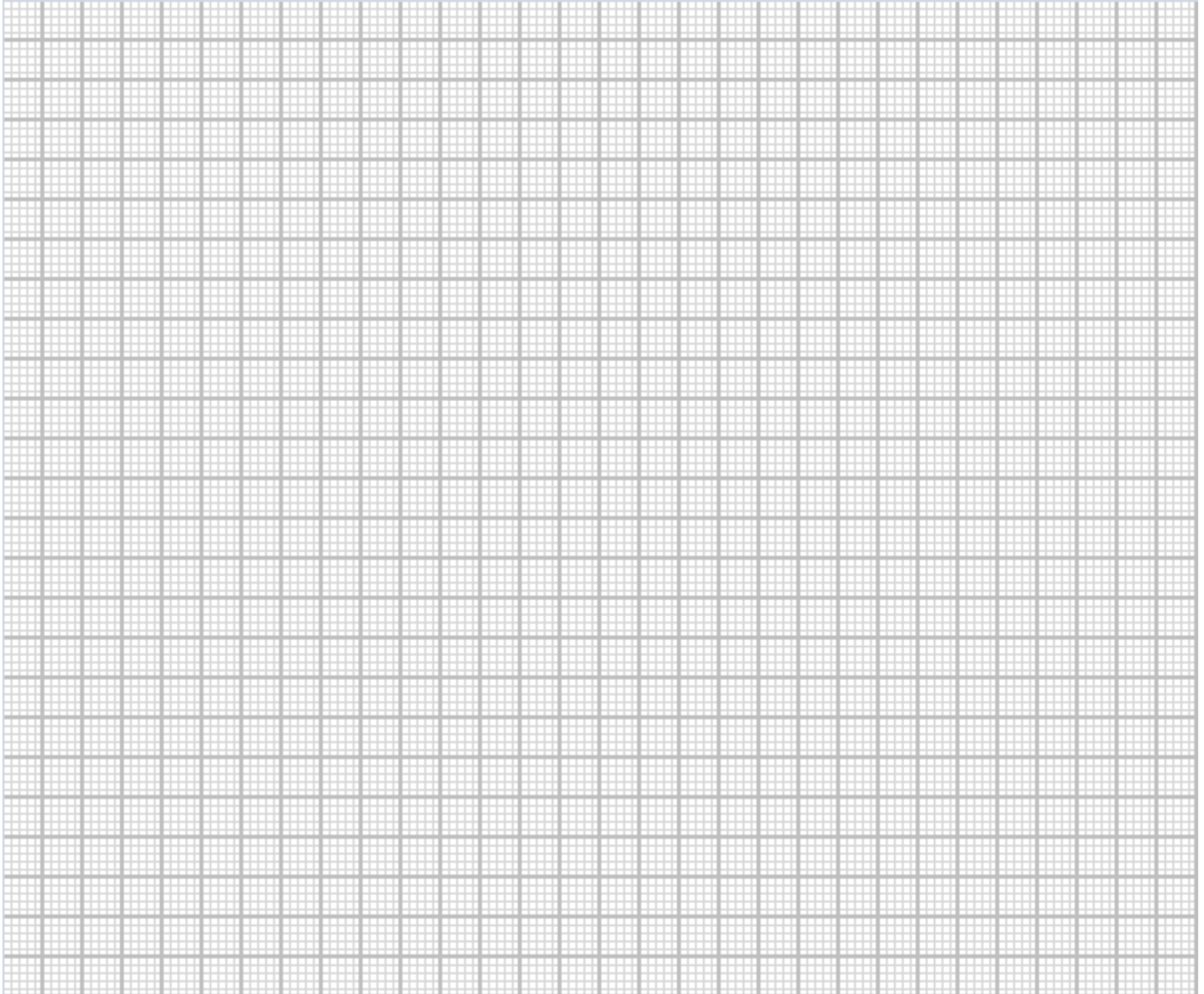
11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

B.3: Calibration curve

GRAPH D: Laser beam deviation from the zero point[mm] vs. Sucrose concentration [g/100 ml] [3.0 Marks]





GROUP CODE	
PARTICIPANT CODES	

Experimental test: Answer Sheet

B.3.3: Data fitting [0.9 Marks]

Calculation of the slope of the calibration curve (A)

Answer

Table 3.3: Linear equation of calibration curve

Linear Equation	
Slope	
Intercept	

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	
ID # XI	
ID # XII	



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

C.2. Determine 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 <u>graphically obtained</u> [g/100 ml]	Sucrose concentration <u>analytically obtained</u> [g/100 ml]	Concentration Difference [%]
ID # X			
ID # XI			
ID # XII			

C.2.2. Analytical determination

Resolution ID# X

Answer



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

Resolution ID# XI

Answer

Resolution ID# XII

Answer



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

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

Resolution ID# X

Answer

Resolution ID# XI

Answer



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Resolution ID# XII

Answer

D: Additional calculations and data analysis of samples XI and XII

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

Table 3.6.

Unknown Samples	Sucrose original concentration in honey [°Brix]
ID # XI	



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

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

Resolution

Answer

D.2. Safe preservation of honey

Table 3.7. [0.2 Marks]

SAFE	NOT SAFE

D.3: Theoretical calculations [0.5 Marks]



Experimental test: Answer Sheet

GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Resolution

Answer

Table 3.8.: Theoretical deviation of the laser beam [mm] for a solution
8.5g/100 ml sucrose concentration

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



GROUP CODE	
PARTICIPANT CODES	

11th International Junior Science Olympiad,
Mendoza, Argentina

Time : 4 hrs
Marks : 40

Experimental test: Answer Sheet

D.4. Sucrose concentration found in the analysed beverage. [0.5 Marks]

Resolution

Answer

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

Yes	
No	