Country | Team

ID Code: 1) | 2) | 3)

2013 india 10th

International Junior Science Olympiad,
Pune, India

Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

Task B

In this set of experiments we will investigate, **Total Marks: 20**

A1: The buffering capacity of milk
A2: Enzymatic digestion of milk proteins
A3: Determining the calcium content of milk

B1 The buffering capacity of milk

B.Q1.A pH of water = [ ] **[0.25 Mark]**
[6.0 – 7.0: 0.25, Other values = Zero]

B.Q1.B pH of sodium carbonate = [ ] **[0.25 Mark]**
[>10: 0.25, Other values = Zero]

B.Q1.C pH of acetic acid = [ ] **[0.25 Mark]**
[2 – 4: 0.25, Other values = Zero]

B.Q1.D pH of milk = [ ] **[0.25 Mark]**
[6.0 – 8.0: 0.25, Other values = Zero]

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B.Q2 Observation Table B.1 **[2.0 Marks]**

	Stepwise addition to 40 ml water			
	Sodium carbonate solution		Acetic acid solution	
	Stepwise volume added in ml	**pH** value	Stepwise volume added in ml	**pH** value
1	0		0	
2	0.1		0.1	
3	0.1		0.1	
4	0.1		0.1	
5	0.1		0.1	
6	0.1		0.1	
7	0.1		0.1	
Total	……	Volume of Na_2CO_3 solution added to reach pH 10.0	……	Volume of CH_3COOH solution added to reach pH 4.0

Marks will be given based on the volume of the solution required to get the desired pH in each case.

Range of volume: 0.3 - 0.5 ml for each solutions [1 x 2 = 2.0]

0.2 - 0.3 ml or 0.5-0.6 ml for each solutions [0.5 x 2 = 1.0]

Other values = zero.

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B.Q3 Observation Table B.2 [2.0 Marks]

	Stepwise addition to 40 ml Milk			
	Sodium carbonate solution		Acetic acid solution	
	Stepwise volume added in ml	**pH** value	Stepwise volume added in ml	**pH** value
1	0		0	
2	0.5		0.5	
3	0.5		0.5	
4	0.5		0.5	
5	0.5		0.5	
6	0.5		0.5	
7	0.5		0.5	
Total	……	Volume of Na_2CO_3 solution added to reach pH 10.0	……	Volume of CH_3COOH solution added to reach pH 4.0

Marks will be given based on the volume of the solution required to get the desired pH in each case.

Range of volume: 1.5 - 2.5 ml for each solutions [1 x 2 = 2.0]

1.0 - 1.5 ml or 2.5-3.0 ml for each solutions [0.5 x 2 = 1.0]

Other values = zero

Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

Questions:

B.Q4 **[1.0 Mark]**

Comparing the observations in Table B.1 and B.2 which of the following statements describe the role played by milk?

a) You require more acetic acid solution to lower the pH of milk to 4 than to lower the pH of water to 4.

True (T) [X] False (F) [ ]

b) Less sodium carbonate solution is required to raise the pH of milk to 10 than to raise the ph of water to 10

True (T) [ ] False (F) [X]

B.Q5 **[1.0 Mark]**

As compared to water, milk resists change in pH of the resulting solution when acetic acid is added. This is because components of milk:

a) lead to increase in concentration of the OH^- ions in the resulting solution
b) prevent increase in concentration of the free H^+ ions in the resulting solution
c) lead to decrease in concentration of CH_3COO^- ions in the resulting solution

Write the correct option in the appropriate box [b)]

Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

B2 Enzymatic digestion of Milk protein

B.Q6.A I_w = [ ] **[0.5 Mark]**

I_w > 0.6 mA [0.5]
I_w = 0.2-0.6 mA [0.25]

B.Q6.B I_O = [ ] **[0.5 Mark]**

Anything below 0.2mA or the value based on the curve [0.5]

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Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

B.Q7 Observation Table B.3 **[2.0 Marks]**

	Time (in s)	Current (in mA)		Time (in s)	Current (in mA)
1.			16.		
2.			17.		
3.			18.		
4.			19.		
5.			20.		
6.			21.		
7.			22.		
8.			23.		
9.			24.		
10.			25.		
11.			26.		
12.			27.		
13.			28.		
14.			29.		
15.			30.		

20 Readings [0.1 x 20 = 2.0]

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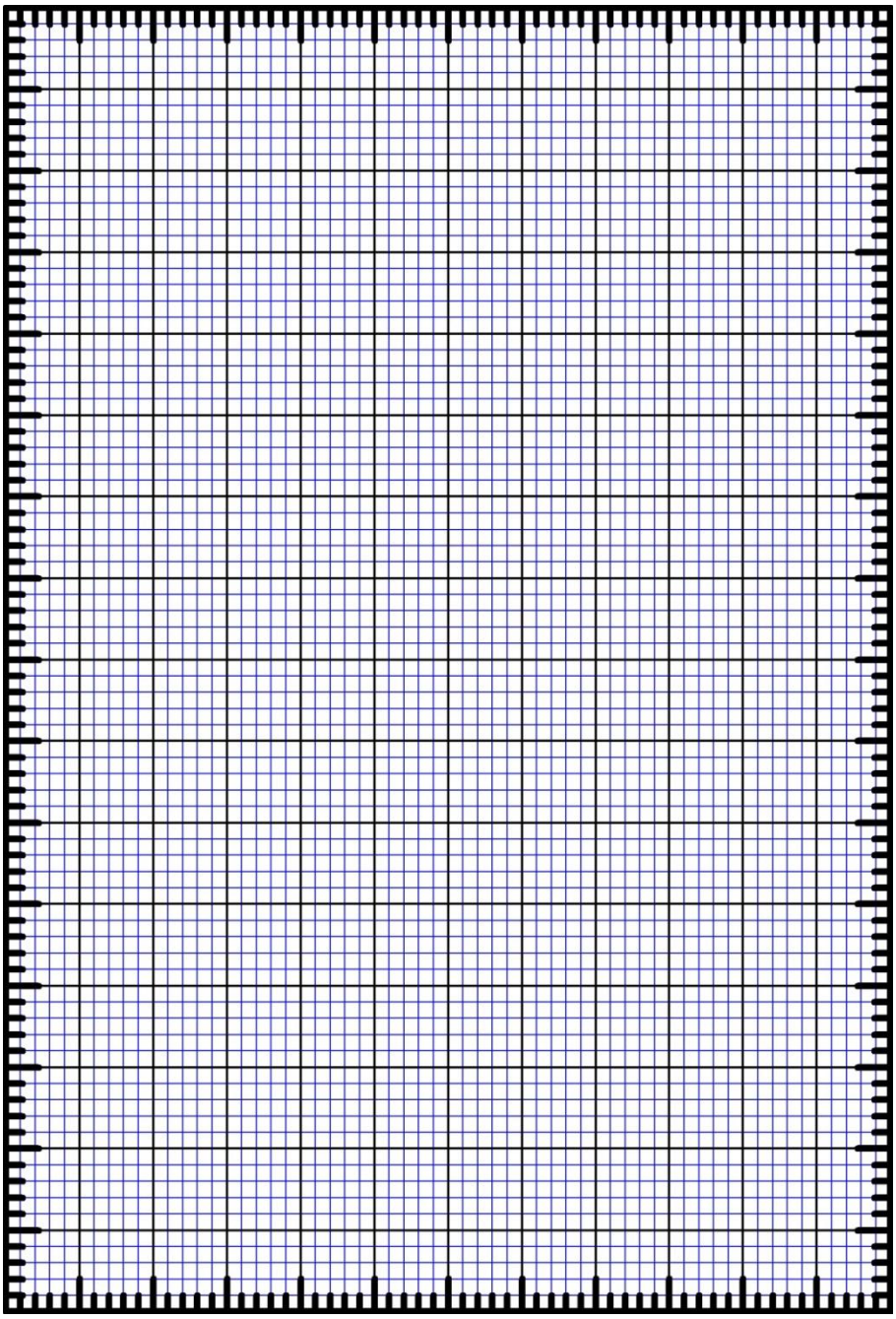
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Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

B.Q8 Graph plotting: [3.5 Marks]



Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

Plot a graph of current versus time.
Labels on each axis [0.25]
Scale on each axis [0.25]
Marks for occupying more than 60 % of graph paper [0.25]
Drawing smooth curve [0.25]
Based on the plot, within I_w and I_0 ranges and the nature of the curve [0.1 x 20 = 2.0]

B.Q9 **[1.0 Mark]**

Mark a point K on the graph paper where the casein concentration is maximum, a point L where casein concentration is minimum and a point M where the casein concentration is half-way between the maximum and minimum values.

Based on the plot, all 3 correct [1.0]
2 correct [0.5]
1 correct [0.25]

B.Q10 **[1.0 Mark]**

If the increase in current is proportional to the amount of digested casein and maximum current represents complete digestion of casein, deduce from the graph the time taken for digestion of 50% casein.

Time taken based on the value of M in the above question [1.0]
Other values = Zero

Experimental Tasks A + B + C

Time : 3 hrs
Marks : 40

B3 Estimation of calcium content in milk

B.Q11 Observation Table B.4 **[3.5 Marks]**

Sr. No.		Titration I	Titration II	Titration III
1	Initial burette reading ml			
2	Final burette reading ml			
3	Difference in burette reading ml			

Average burette reading: (A)……ml of 0.001 M Na_2EDTA

Average difference in burette reading (m1) = (6.8 – 7.2) [2.0 marks]
Average difference in burette reading (m1) = (6.6 – 7.4) [1.5 marks]
Average difference in burette reading (m1) = (6.2 – 7.8) [1.0 marks]
Average difference in burette reading (m1) = (6.0 – 8.0) [0.5 marks]
Any other Average difference in burette reading: [0.0 marks]

An average value deduced using anomalous reading will result in deduction of 0.25 mark.

B.Q12 **[1.0 Mark]**

Deduce the amount in milligrams of Ca^{2+} per 10 ml of the diluted solution (the atomic weight of Ca is 40).

0.756 mg based on 7.0 ml in the previous question or for correctly calculated value based on the previous question [1.0]
Wrong calculations [0.5]