	Diameter /cm				Slope		
Vol /cc	Water	30% Salt	Glycerine		A	0.0368	**123.9588**
50	1.9	1.7	1.5		mu(30% Salt)	0.0343	**1.372978**
100	3.8	3.4	3.0		mu(Glycerine)	0.0301	**1.466048**
150	5.6	5.1	4.5				
200	7.3	6.9	6.0				
250	9.2	8.6	7.6				
300	11	10.3	9.0				

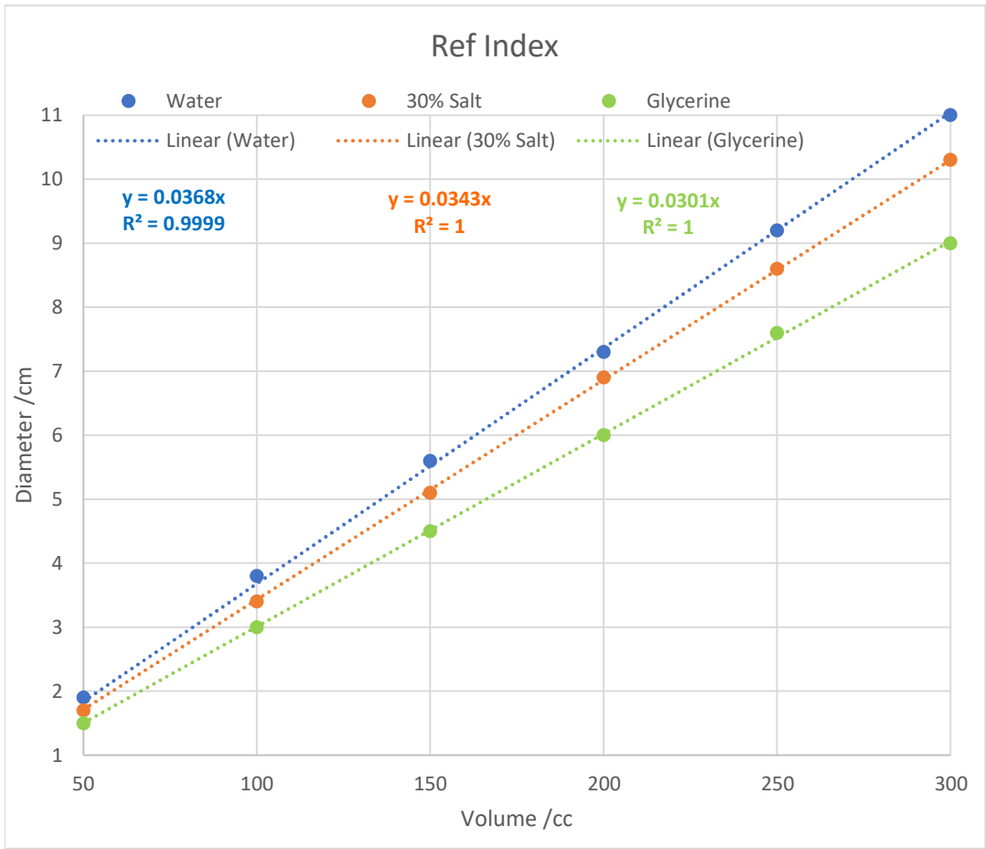
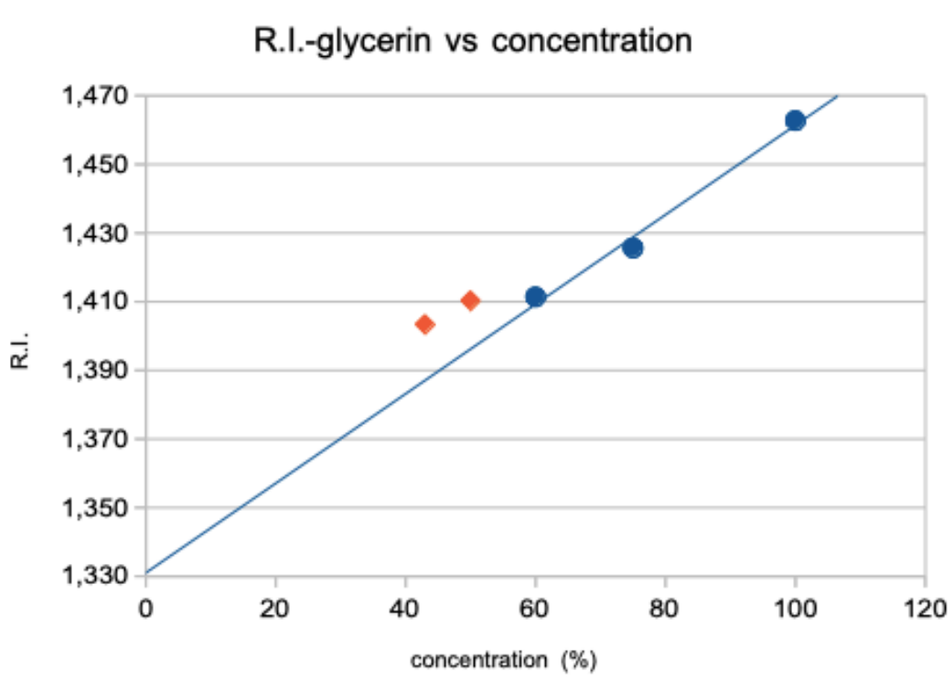


Table 5.

	water			glycerin		
volume	d_water (cm)	h (calibration)	concentration	d (cm)	R.I. (form1)	
150,00	5,6	1,23	100	4,60	1,463	
200,00	7,3	1,60	75	6,30	1,426	
250,00	9,2	2,02	60	8,10	1,411	
300,00	11	2,41	50	9,70		1,410
350,00	12,8	2,81	43	11,40		1,403



IJSO 2021 Physics Marking Scheme for Experiment

Part	Experimental Task	Mark	Total
A0	Temperature	0.2	0.2
A1	Readings of pure water, 50 ml to 300 ml – 6 reading possible, 6 columns provided	6 x 0.2	1.2
A2	Graph plotting Labelling axes and scales 75% utilization of space Plotting 6 points Drawing proper fit straight line	 0.2 0.2 1.2 0.2	1.8
A3	Slope	0.2	0.2
A4	Calculation of A from the slope	0.4	0.4
B1	Readings of 30% salt solution (6)	1.2	1.2
B2	Graph plotting Use different symbols for plotting points Plotting 6 points Drawing proper fit straight line	 0.2 1.2 0.2	1.6
B3	Slope	0.2	0.2
B4	Calculation of μ from the slope	0.4	0.4
C-1-1	Readings of Glycerin	1.2	1.2
C-1-2	Graph plotting Use different symbols for plotting points Plotting 6 points Drawing proper fit straight line	 0.2 1.2 0.2	1.6
C-1-3	Slope	0.2	0.2
C-1-4	Calculation of μ from the slope	0.4	0.4
C-2-1	Readings with 3 dilutions Calculations of concentration – 3 readings Calculations of μ in each case	0.6 0.4 0.6	1.6
C-2-2	Graph 2 Graph plotting 75% utilization of space Plotting 5 points Drawing proper fit straight line	 0.2 1.0 0.2	1.4
C-2-3	Concluding Questions		0.2
C-2-4	Concluding Questions		0.2
	Grand total		14.0

Notes:

1. Any part missing – marks will not be rewarded. For example, if 5 readings are taken in Parts 1 – 3 (i), then 1 mark is to be awarded.
2. Less than 75% graph page used – 0.2 mark not awarded.
3. V is taken in round figure, so for any wrong plotting – no mark awarded – for d a small range can be allowed.
4. Range of values of A and RI can be decided and marks can be awarded for values falling within that range.
5. Ideally graph has to pass through the origin. But if it is not passing, then there must be some systematic error, mostly due to the instrument – mostly in the TIR container. (We have encountered similar situation in past). No penalty for graph not passing through the origin.
6. Mechanism for avoiding double punishment is to be developed using excel sheet.

Experiment

A2-1

English (Official)

Determination of the Glucose Content of Date Syrup Sample (8 Marks)

2.1 (3.0 pt)
Observation Table 1

Sr.		Titration I	Titration II	Titration III
1	Initial burette reading mL	0.0	0.0	0.0
2	Final burette reading mL	10.0	10.0	10.0
3	Difference in burette readings mL	10.0	10.0	10.0

Constant Burette reading = 10.0 **mL**

2.2 (0.5 pt)
Molarity of Iodine solution = 0.05 / 0.049 / 0.057 M

*1

2.3 (3.0 pt)
Observation Table 2

Sr.		Titration I	Titration II	Titration III
1.	Initial titration reading mL	0.0	0.0	0.0
2	Final Titration reading mL	4.0	4.0	4.0
3	Difference in burette readings mL	4.0	4.0	4.0

*2 **Constant burette reading =** 4.0 **mL**

*1 5% deviation 9.5 to 10.5 (2.5 marks)
10% deviation 9 to 11 (1.5 marks)
11-15% deviation 8.5 to 11.5 (0.5 marks)

*2 5% deviation 3.8 to 10.2 (3 marks)
10% deviation 3.6 to 4.4 (2 marks)
11-15% deviation 3.4 to 4.6 (1 mark)

Since no carry over error, for this page any solution is considered correct as long as they give titration data.

2.4 (1.5 pt)
Calculations

1. Determine the amount of Glucose in the given sample of Date syrup. (in moles) - 0.5 mark

3×10^{-3} moles

2 Mass of glucose in given sample (0.5 mark)

0.54 g

2.Determine the percentage of Glucose in the given sample of Date syrup. (0.5 mark)

54 %

Results:

1. Amount of Glucose in the given sample of Date syrup = 0.54 **g**

2. Percentage of Glucose in the given sample of Date syrup = 54 **%**

Experiment

A3-1

English (Official)

pH Titration using Yamada indicator (6 Marks)

3.1 (1.5 pt)
Observation Table 1

Sr.		Titration I	Titration II	Titration III
1	Initial burette reading, mL	0.0	0.0	0.0
2	Final burette reading, mL	20.3	20.3	20.3
3	Difference in burette readings, mL	20.3	20.3	20.3

3.2 (0.5 pt)
Molarity of $NaOH$= 0.01 .....M
0.0099
0.011

5% deviation 19.3 – 21.3 (1.5 marks)

10% deviation 18.3 – 22.3 (1 mark

11-15% deviation 17.3 – 23.3 (0.5 mark

If the graphs look good give the full mark

3.3 (2.5 pt)
Observation Table 2

Volume of diluted $NaOH$ added in mL	Colour of solution	pH	ΔpH	ΔV	Δ pH /Δ V
0.0	pink	2	–	–	–
0.5	pink	2	–	–	–
1.0	pink	2	–	–	–
1.5	pink	2	–	–	–
2.0	orange	3	–	–	–
2.5	orange	3	–	–	–
3.0	orange	3	–	–	–
3.5	orange	3	–	–	–
4.0	orange	3	–	–	–
4.5	orange	3	–	–	–

Observation Table 2 continued on the next page.

If the graphs are not OK

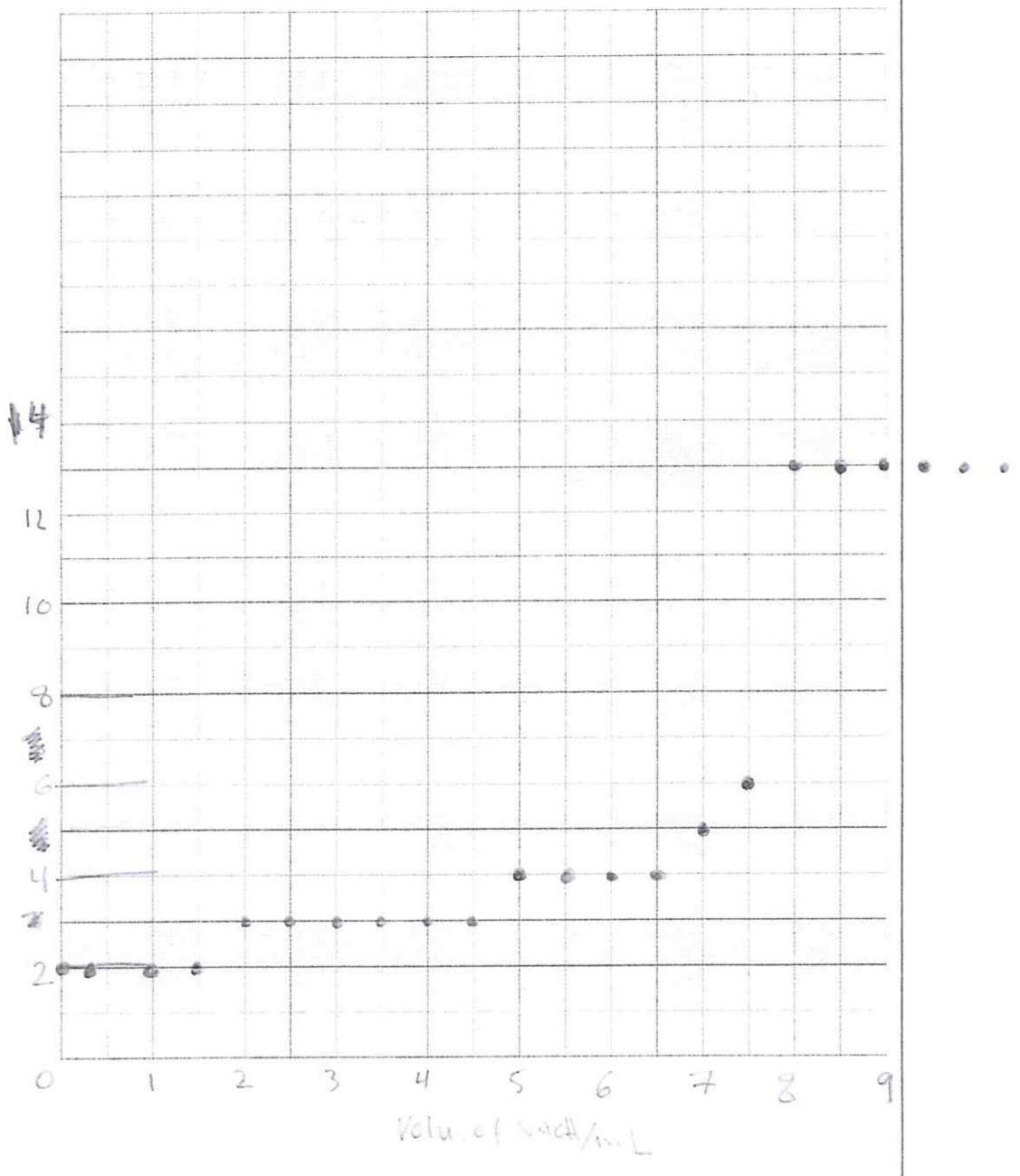
If only the 1st 3 Column are given, give 1 ~~mark~~ mark

3.3 (cont.)

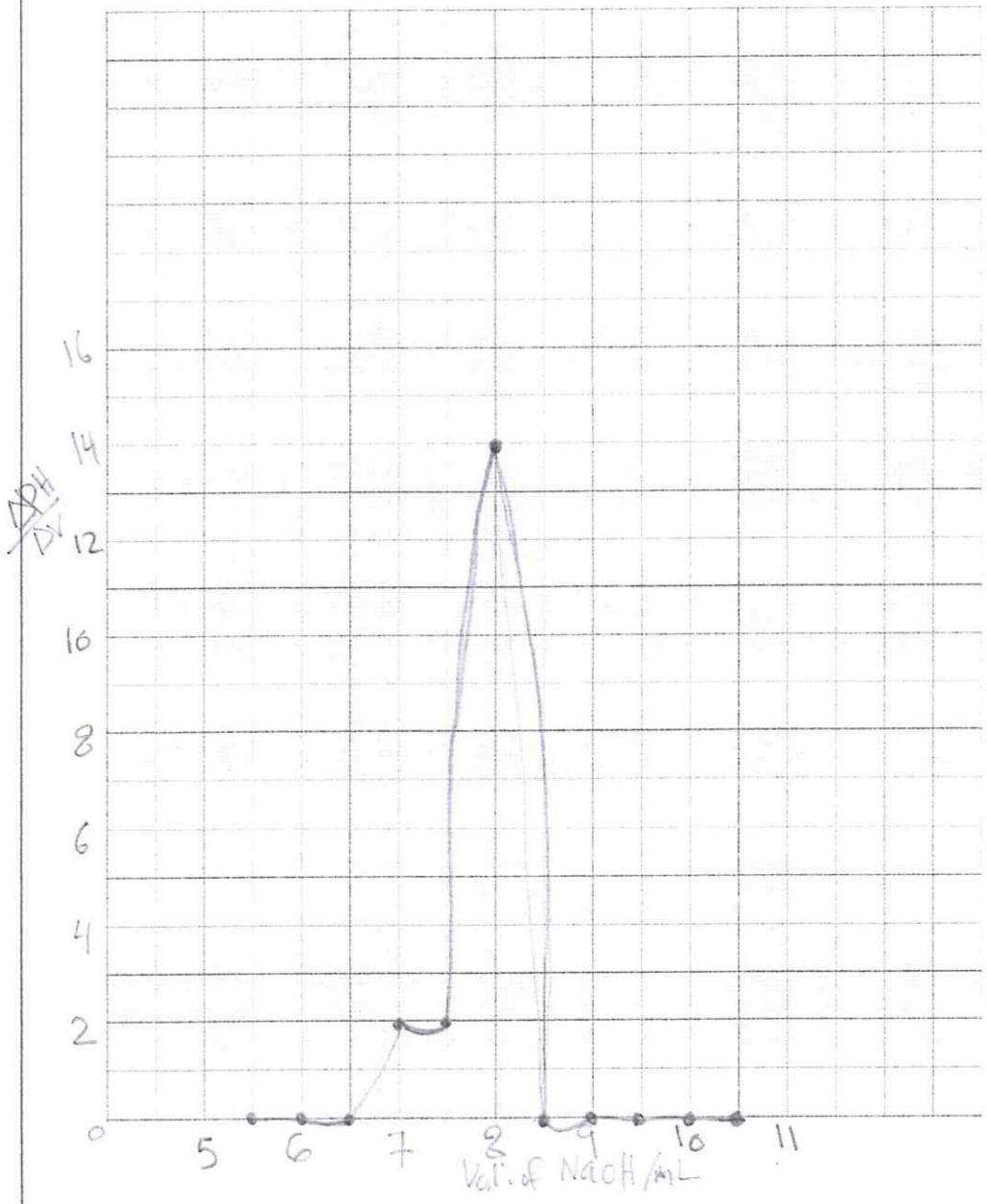
Volume of Diluted $NaOH$ added in mL	Colour of solution	pH	ΔpH	ΔV	Δ pH /ΔV
5.0	orange-yellow	4	—	—	—
5.5	orange-yellow	4	0.5	0	0
6.0	orange-yellow	4	0.5	0	0
6.5	orange-yellow	4	0.5	0	0
7.0	orange-yellow	5	0.5	1	2
7.5	Yellow	6	0.5	1	2
8.0	light green	13	0.5	7	14
8.5	purple	13	0.5	0	0
9.0	purple	13	0.5	0	0
9.5	purple	13	0.5	0	0
10.0	purple	13	0.5	0	0

Look at the graph overall

3.4 (0.5 pt)
Graph of pH vs. volume of $NaOH$ added



3.5 (0.5 pt)
Graph of ΔpH/ΔV vs volume of $NaOH$ added



look at the graph it it like that full mark

3.6 (0.5 pt)
Equivalence point=8.0 **mL**

≈ 8 – 11 ml

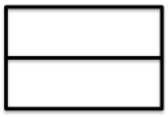
IJSO 2021, Biology Experiment
Answers & Marking Scheme

Experiment: Biology (12 points)

General Instruction:

1. Only the answers marked or written in the answer sheet will be evaluated.
2. Instruction to mark a cell with a cross (X) has to be marked as follows:

3. Instruction to mark a cell with a dash (--) has to be marked as follows:



I.1 (0.75 points)

Table 1.1

	W	X	Y	Z
Anti-A	—	X	—	X
Anti- B	—	—	X	X
NA	—	—	—	—

I. 2 (0.25 points)

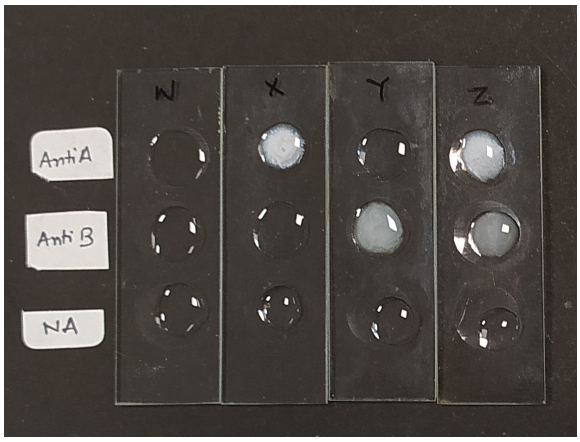
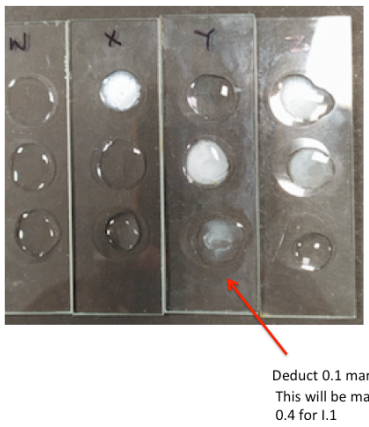


Photo 1.

I.1 0.75 points for precipitate in the correct wells as indicated above (no partial marking). If precipitation (even light) is observed in the wells that should be clear deduct 0.1 marks for each such well to a maximum of 0.75 marks. So if all wells have precipitate this is scored as 0



I. 2. 0.25 points for a properly labeled photograph

I. 3 (0.25 points)

Table 1.2

Sample	Blood group			
	A	B	AB	O
W				✗
X	✗			
Y		✗		
Z			✗	

0.25 points for identification of the blood group based on the observation above (even if it is wrong)

Note for the evaluator:

1. There should be no precipitation in the row corresponding to NA. 0.1 points to be deducted for even a faint precipitate seen in this row.

2. A sample with **NO** precipitate with both Anti A and Anti B is of blood group O

3. A sample with precipitate with only Anti A is of blood group A

4. A sample with precipitate with only Anti B is of blood group B

5. A sample with precipitate with both Anti A and Anti B is of blood group AB

I.4 (0.25 points)

Anti A	Anti B	NA
—	—	X

II.1.1 (4.5 marks)

Table 1.3

	IF	IM	2F	2M	3F	3M	C	D	E
Anti-A	X	—	X	—	X	X	—	X	—
Anti- B	X	—	—	X	X	—	X	X	—
NA	—	—	—	—	—	—	—	—	—

Photo 2.

Note for evaluator: Cross check if table 2 matches with photo 2.

1.5 point for each correct row, no partial marking = Total 4.5

II.1.2 (0.50 points)

Table 1.4				
Blood group of babies				
Baby	Blood group A	Blood group B	Blood group AB	Blood group O
C		X		
D			X	
E				X
Blood group of parents				
1F			X	
1M				X
2F	X			
2M		X		
3F			X	
3M	X			

Marking will be done on the basis of observations made in Table 2 (no double penalty).

0.20 points for blood groups all of C, D and E being correct.

0. 30 points for blood groups all of 1F to 3M being correct

II.2 (0.5 point)

Table 1.5			
	Parent 1	Parent 2	Parent 3
Baby C	X	X	X
Baby D	—	X	X
Baby E	—	X	—

Evaluation will be based on the blood groups identified by the student (avoid double penalty)

1.0 point for correct answer for all 3 babies
0.5 point for correct answer for 2 babies
0 point for correct answer for 1 baby

Note for the evaluator:
A table at the end of the exercise summarizes all possibilities of parents for a child with a particular blood group. The genotypes of the child and the parents are also mentioned. This may be useful for evaluation of questions related to blood groups.

II.3 (0.5 points)

.

Child	C	**Parent**	**1**
Child	D	**Parent**	**3**
Child	**E**	**Parent**	**2**

Evaluation will be based on the blood groups identified by the student (avoid double penalty)

0.5 point for correctly identifying parents of all 3 children.

0.25 point for correctly identifying parents of either C and/or E correctly.

II.4 (0.5 points)

		Genotype of the child			**Genotype of the parents**	
					Father	**Mother**
Child	C	$I^B i$	**Parent**	1	$I^A I^B$	ii
Child	D	$I^A I^B$	**Parent**	3	$I^A I^B$	$I^A i$ or $I^A I^A$
Child	E	ii	**Parent**	2	$I^A \boldsymbol{i}$	$I^B i$

Evaluation will be based on the blood groups identified by the student (avoid double penalty)

0.5 point (no partial marking)

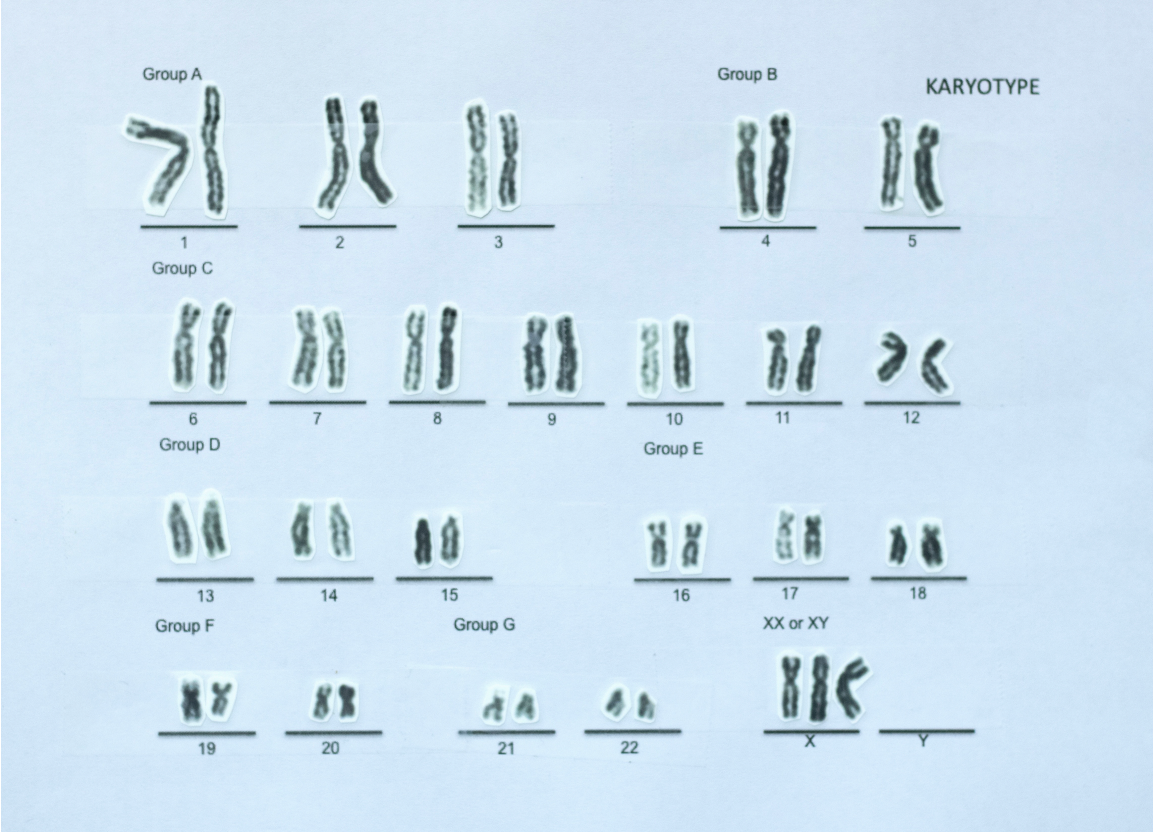
Table for evaluators					
Blood group of child	Genotype of child	Blood group of parents		Genotype of parents	
		Parent 1	Parent 2	Parent 1	Parent 2
O	ii	O	O	ii	ii
		A	B	I^Ai	I^Bi
		O	A	ii	I^Ai
		O	B	ii	I^Bi
A	I^AI^A	A	A	I^Ai	I^Ai
				I^AI^A	I^AI^A
				I^AI^A	I^Ai
	I^Ai	A	O	I^Ai	ii
				I^AI^A	ii
		A	B	I^Ai	I^Bi
				I^AI^A	I^Bi
		A	AB	I^Ai	I^AI^B
B	I^BI^B	B	B	I^Bi	I^Bi
				I^BI^B	I^BI^B
				I^BI^B	I^Bi
	I^Bi	B	O	I^Bi	ii
				I^BI^B	ii
		B	A	I^Bi	I^Ai
				I^BI^B	I^Ai
		B	AB	I^Bi	I^AI^B
AB	I^AI^B	AB	AB	I^AI^B	I^AI^B
		AB	A	I^AI^B	I^Ai
				I^AI^B	I^AI^A
		AB	B	I^AI^B	I^Bi
				I^AI^B	I^BI^B
		A	B	I^AI^A	I^Bi
				I^AI^A	I^BI^B
				I^Ai	I^Bi
				I^Ai	I^BI^B

Experiment 2. Analyzing human chromosomes (4 points)

2.1 (0.25 points) Count the number of chromosomes and record in the answer book.

Number of chromosomes = **47**

2.2 (3.0 points) Make a karyotype



0.20 points for a neatly done karyotype.

0.50 points for identifying trisomy for X chromosome. That the extra chromosome is X comes from the stem of the exercise.

0.50 points each for identifying chromosomes of the groups A, B and D = 1.50 points.

0.20 points each for identifying chromosomes of the groups C, E, F and G = 0.80 points

2.3.1 (0.25 points)

S.No.	Cells	Yes	No
1.	Erythrocyte RBC		X
2.	Lymphocyte WBC	X	

2.3.2 (0.25 points)

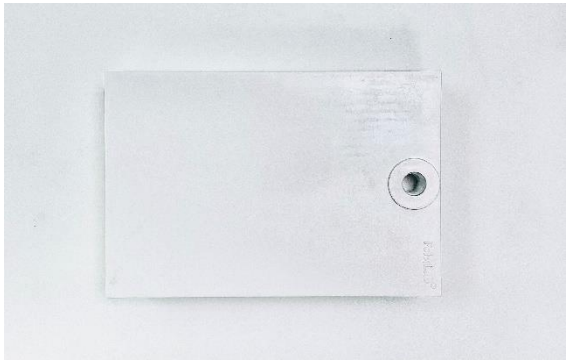
S.No.	Plant parts	Yes	No
1.	Leaf blade		X
2.	Anther		X
3.	Root tip	X	

2.3.3 (0.25 points)

Stage of division	Yes	No
Mitotic Metaphase		X
Mitotic Anaphase		X
Meiotic Metaphase I		X
Meiotic Anaphase I	X	
Meiotic Metaphase II		X
Meiotic Anaphase II		X

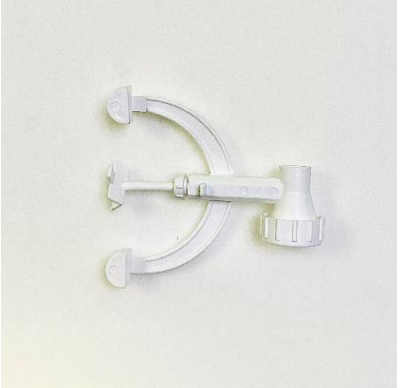
U

Appratus Sent from UAE

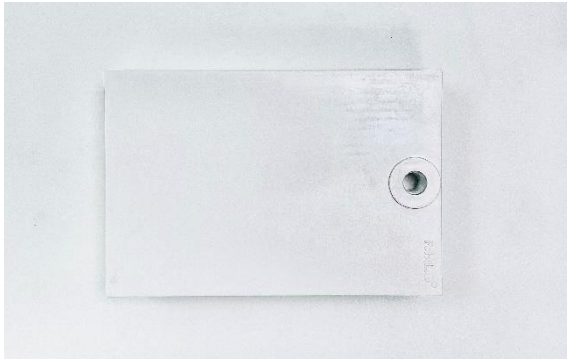
S.no	ITEMS	Quantity	Photo
1	Retort Stand 225 x 150 mm - Side Hole	1	
2	Beaker (Euro Design) 500 ml	3	

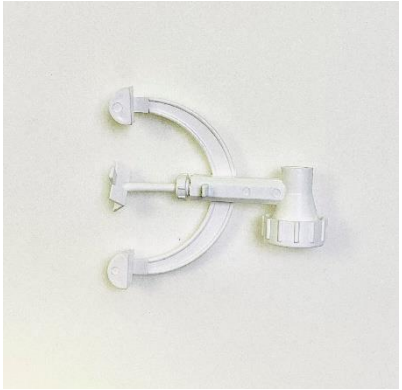
3	Dropper for measuring , 50ml	1	
4	THERMO HYGROMETER (DIGITAL), Simple Wall Type Without Probe also measures temperature without battery	1	

5	GLASS STIRRER 8"	1	
6	JAIBROS Spring Caliper compass 8 inch Divider Pack of 1	1	

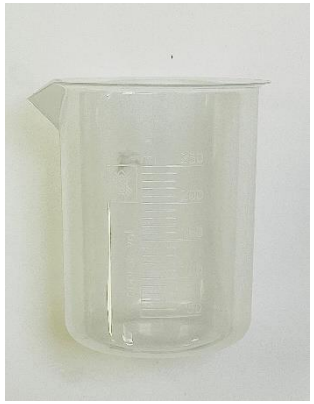
7	LASER BEAM GREEN (PEN TYPE 5mW , 532 nm Class 3A) without battery	2	
8	Fisher Clamp- Single	1	

9	LAB COAT Tericot, (Full Sleve) medium size	1	
10	Disposable latex glove (01 pair)	1	

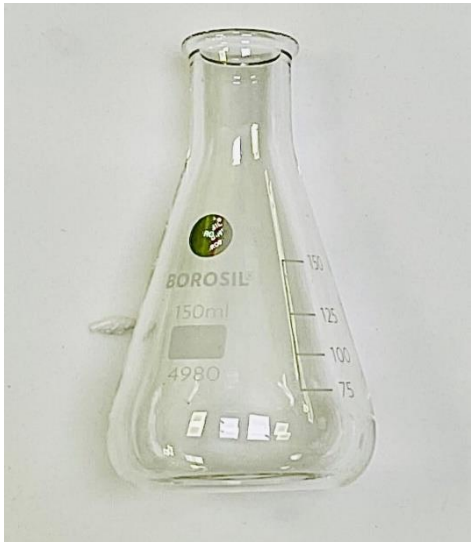
11	BUR: BOROFLO,PTFE.KEYS,CL 'B' 25X0.10ML	2	
12	Retort Stand 225 x 150 mm - Side Hole	1	

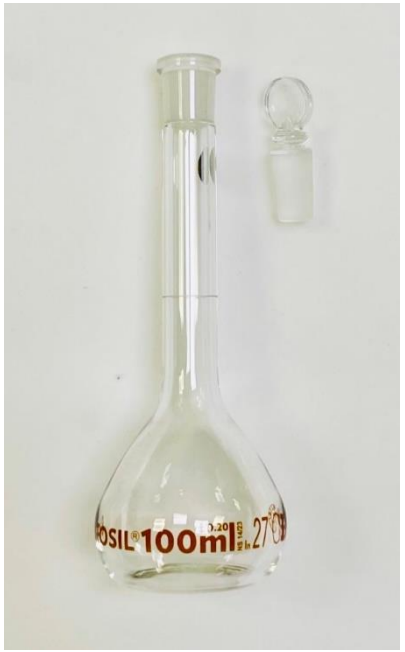
13	Fisher Clamp- Single	1	
14	PIPETTE VOLUMETRIC, ‘B.G.’10 ML	6	

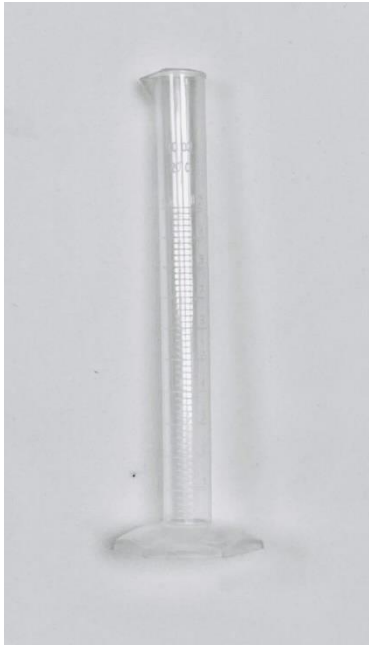
15	Pipette Pump 10 ml	6	
16	PIPETTE BULB RUBBER, Large	6	

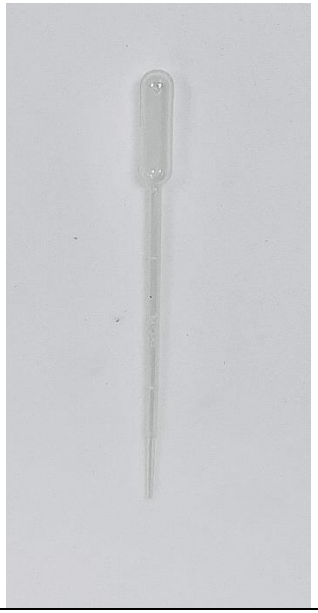
17	BOTTLES REAGENT WITH I/C STPR 250 ML	3	
18	Beaker (Euro Design) 250 ml	1	

19	Beaker (Euro Design) 100 ml	1	

20	CONICAL FLASK150 ML	5	

21	VOLUMETRIC FLASK 'B'100 ML	4	

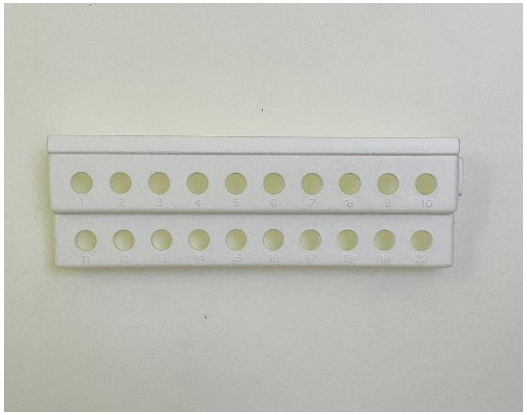
22	Measuring Cylinder 10 ml	1	
23	BOTTLES WASH SET 500 ML	1	

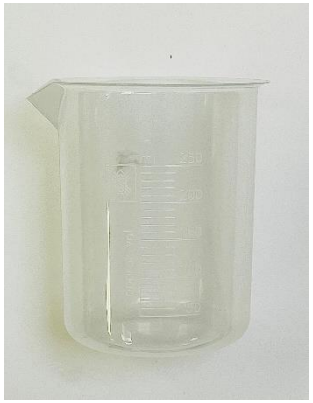
24	Analytical Funnel 75 mm	2	
25	Pasteur Pipette (Dropper plastic) 1ml	1	

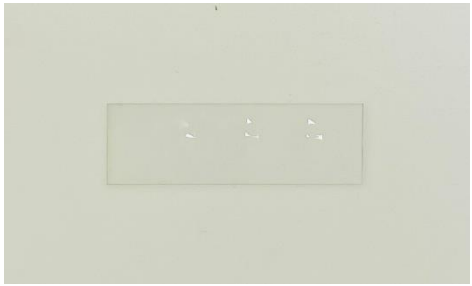
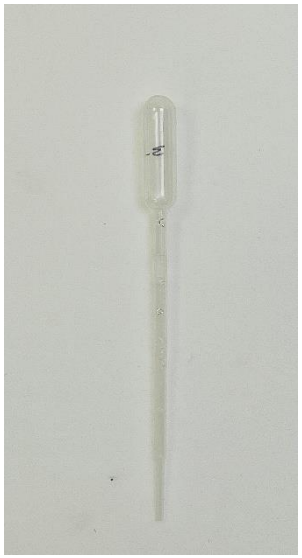
26	Dropping Bottle 125 ml	2	
27	LAB COAT Tericot, (Full Sleve) medium size	1	

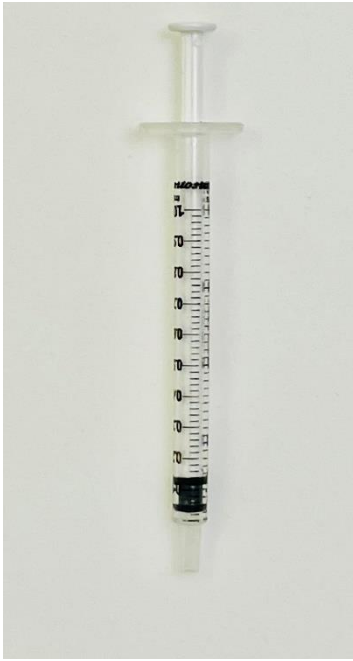
28	SAFTEY GOGGLES, with Ventilation (Polycarbonate) Superior.	1	
29	Disposable latex glove (01 pair)	1	

30	Dry Fruit Hub Dates Syrup 400gm Date crown dates syrup	1	
31	Centrifuge Tube Conical Bottom, 15 ml	1	

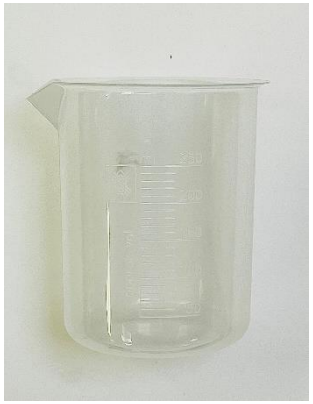
32	Micro Centrifuge Tubes, PP, 1.5 ml	15	
33	Rack for Micro Centrifuge Tube, RPP, Capacity 1.5 & 2.0 ml, 20 Places (10x2 Array)	1	

34	Centrifuge Tube Conical Bottom, 15 ml	6	
35	Beaker (Euro Design) 250 ml	1	

36	CAVITY SLIDE Glass (Pack of 10), (with 3 cavities)	1	
37	Pasteur Pipette/ Plastic droppers 1 ml	7	

38	dropper for measuring 01 ml	5	

39	Centrifuge Tube Conical Bottom, 50 ml	1	
40	SCISSOR (Stainless Steel), 4" Pointed	1	

41	Beaker (Euro Design) 250 ml	1	
42	Petri Dish 75 mm	1	

43	DROPPER GLASS WITH TEAT, RUBBER TEAT, 6"	2	
44	LAB COAT Tericot, (Full Sleve) medium size	1	

45	SAFTEY GOGGLES, Ventilation (Polycarbonate) Superior.	1	
46	Disposable latex glove (01 pair)	1	

47	FORCEPS (Stainless Steel) Pointed 5”	1	
48	BOTTLES WASH SET 500 ML	1