

**IJSO 2021, Biology Experiment  
Answers & Marking Scheme**

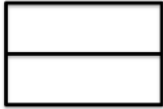
**Experiment: Biology (12 points)**

**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:



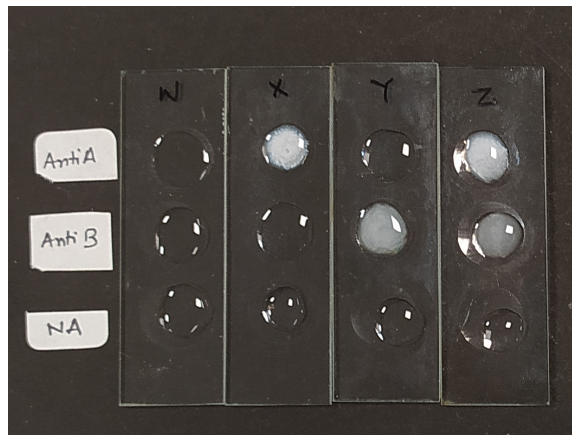
3. Instruction to mark a cell with a dash (--) has to be marked as follows:



**I.1 (0.75 points)**

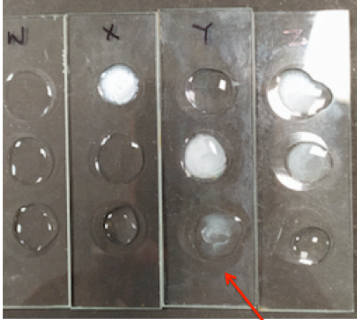
|               | <b>W</b> | <b>X</b> | <b>Y</b> | <b>Z</b> |
|---------------|----------|----------|----------|----------|
| <b>Anti-A</b> | --       | X        | --       | X        |
| <b>Anti-B</b> | --       | --       | X        | X        |
| <b>NA</b>     | --       | --       | --       | --       |

**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



Deduct 0.1 marks  
This will be marked as  
0.4 for 1.1

I. 2. 0.25 points for a properly labeled photograph

I. 3 (0.25 points)

| Sample | Blood group |             |             |             |
|--------|-------------|-------------|-------------|-------------|
|        | A           | B           | AB          | O           |
| W      |             |             |             | <del></del> |
| X      | <del></del> |             |             |             |
| Y      |             | <del></del> |             |             |
| Z      |             |             | <del></del> |             |

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 precipitate 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           |
|--------|--------|--------------|
|        |        | <del>X</del> |

II.1.1 (4.5 marks)

|         | IF           | IM | 2F           | 2M           | 3F           | 3M           | C            | D            | E |
|---------|--------------|----|--------------|--------------|--------------|--------------|--------------|--------------|---|
| Anti-A  | <del>X</del> | —  | <del>X</del> | —            | <del>X</del> | <del>X</del> | —            | <del>X</del> | — |
| Anti- B | <del>X</del> | —  | —            | <del>X</del> | <del>X</del> | —            | <del>X</del> | <del>X</del> | — |
| 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)**

| <b>Table 1.4</b>              |                       |                       |                       |                       |
|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>Blood group of babies</b>  |                       |                       |                       |                       |
| Baby                          | Blood group A         | Blood group B         | Blood group AB        | Blood group O         |
| C                             |                       | <del>          </del> |                       |                       |
| D                             |                       |                       | <del>          </del> |                       |
| E                             |                       |                       |                       | <del>          </del> |
| <b>Blood group of parents</b> |                       |                       |                       |                       |
| 1F                            |                       |                       | <del>          </del> |                       |
| 1M                            |                       |                       |                       | <del>          </del> |
| 2F                            | <del>          </del> |                       |                       |                       |
| 2M                            |                       | <del>          </del> |                       |                       |
| 3F                            |                       |                       | <del>          </del> |                       |
| 3M                            | <del>          </del> |                       |                       |                       |

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)**

| <b>Table 1.5</b> |                       |                       |                       |
|------------------|-----------------------|-----------------------|-----------------------|
|                  | Parent 1              | Parent 2              | Parent 3              |
| Baby C           | <del>          </del> | <del>          </del> | <del>          </del> |
| Baby D           | <del>          </del> | <del>          </del> | <del>          </del> |
| Baby E           | <del>          </del> | <del>          </del> | <del>          </del> |

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 | <input type="text" value="C"/> | Parent | <input type="text" value="1"/> |
| Child | <input type="text" value="D"/> | Parent | <input type="text" value="3"/> |
| Child | <input type="text" value="E"/> | Parent | <input type="text" value="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 | <input type="text" value="C"/> | <input type="text" value="I&lt;sup&gt;B&lt;/sup&gt;i"/>                         | Parent                  | <input type="text" value="1"/> | <input type="text" value="I&lt;sup&gt;A&lt;/sup&gt;I&lt;sup&gt;B&lt;/sup&gt;"/> | <input type="text" value="ii"/>   |
| Child | <input type="text" value="D"/> | <input type="text" value="I&lt;sup&gt;A&lt;/sup&gt;I&lt;sup&gt;B&lt;/sup&gt;"/> | Parent                  | <input type="text" value="3"/> | <input type="text" value="I&lt;sup&gt;A&lt;/sup&gt;I&lt;sup&gt;B&lt;/sup&gt;"/> | <input type="text" value="I&lt;sup&gt;A&lt;/sup&gt;i or I&lt;sup&gt;A&lt;/sup&gt;I&lt;sup&gt;A&lt;/sup&gt;"/> |
| Child | <input type="text" value="E"/> | <input type="text" value="ii"/>   | Parent                  | <input type="text" value="2"/> | <input type="text" value="I&lt;sup&gt;A&lt;/sup&gt;i"/>                         | <input type="text" value="I&lt;sup&gt;B&lt;/sup&gt;i"/>   |

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

0.5 point (no partial marking)

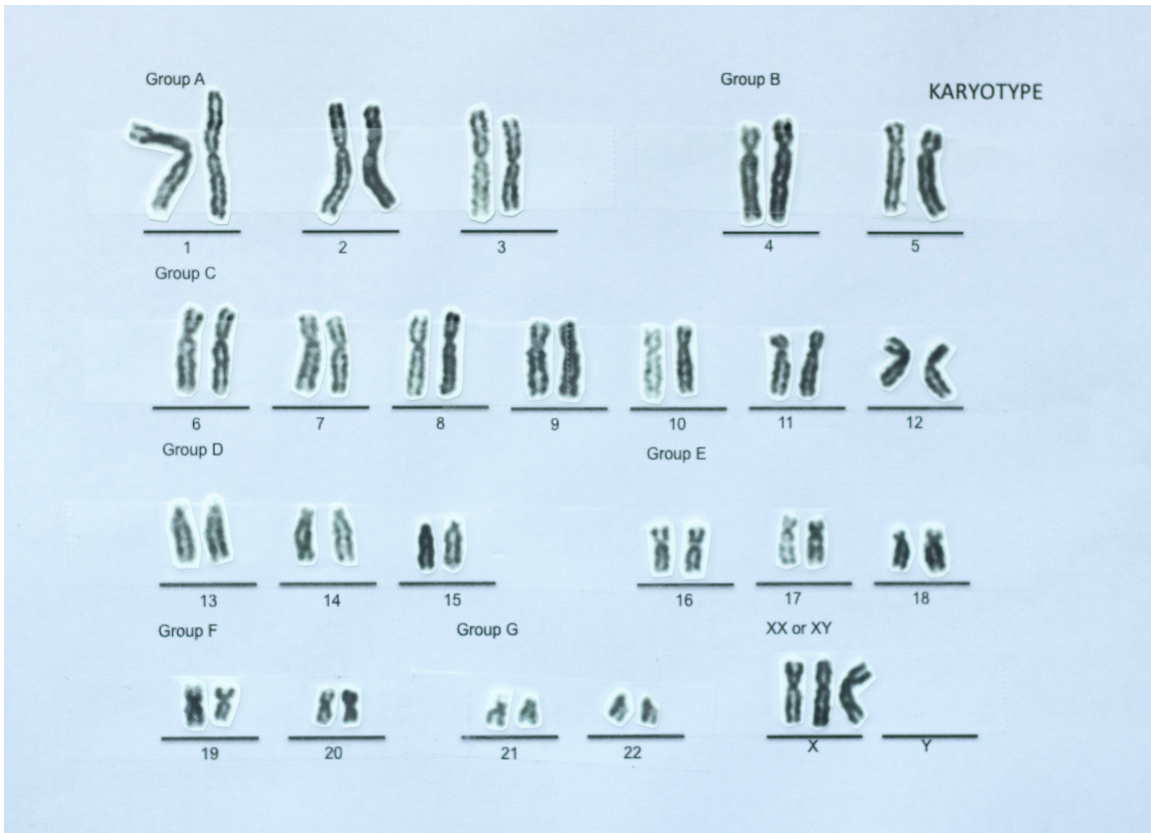
| Table for evaluators |                               |                               |                               |                               |                               |                               |
|----------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 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 <sup>A</sup> i              | I <sup>B</sup> i              |                               |
|                      |                               | O                             | A                             | ii                            | I <sup>A</sup> i              |                               |
|                      |                               | O                             | B                             | ii                            | I <sup>B</sup> i              |                               |
| A                    | I <sup>A</sup> I <sup>A</sup> | A                             | A                             | I <sup>A</sup> i              | I <sup>A</sup> i              |                               |
|                      |                               |                               |                               | I <sup>A</sup> I <sup>A</sup> | I <sup>A</sup> I <sup>A</sup> |                               |
|                      |                               |                               |                               | I <sup>A</sup> I <sup>A</sup> | I <sup>A</sup> i              |                               |
|                      | I <sup>A</sup> i              | A                             | O                             | I <sup>A</sup> i              | ii                            |                               |
|                      |                               |                               |                               | I <sup>A</sup> I <sup>A</sup> | ii                            |                               |
|                      |                               | A                             | B                             | I <sup>A</sup> i              | I <sup>B</sup> i              |                               |
|                      |                               |                               |                               | I <sup>A</sup> I <sup>A</sup> | I <sup>B</sup> i              |                               |
|                      |                               | A                             | AB                            | I <sup>A</sup> i              | I <sup>A</sup> I <sup>B</sup> |                               |
| B                    | I <sup>B</sup> I <sup>B</sup> | B                             | B                             | I <sup>B</sup> i              | I <sup>B</sup> i              |                               |
|                      |                               |                               |                               | I <sup>B</sup> I <sup>B</sup> | I <sup>B</sup> I <sup>B</sup> |                               |
|                      |                               |                               |                               | I <sup>B</sup> I <sup>B</sup> | I <sup>B</sup> i              |                               |
|                      | I <sup>B</sup> i              | B                             | O                             | I <sup>B</sup> i              | ii                            |                               |
|                      |                               |                               |                               | I <sup>B</sup> I <sup>B</sup> | ii                            |                               |
|                      |                               | B                             | A                             | I <sup>B</sup> i              | I <sup>A</sup> i              |                               |
|                      |                               |                               |                               | I <sup>B</sup> I <sup>B</sup> | I <sup>A</sup> i              |                               |
|                      |                               | B                             | AB                            | I <sup>B</sup> i              | I <sup>A</sup> I <sup>B</sup> |                               |
| AB                   | I <sup>A</sup> I <sup>B</sup> | AB                            | AB                            | I <sup>A</sup> I <sup>B</sup> | I <sup>A</sup> I <sup>B</sup> |                               |
|                      |                               |                               |                               | AB                            | A                             | I <sup>A</sup> I <sup>B</sup> |
|                      |                               | I <sup>A</sup> I <sup>B</sup> | I <sup>A</sup> I <sup>A</sup> |                               |                               |                               |
|                      |                               | AB                            | B                             | I <sup>A</sup> I <sup>B</sup> | I <sup>B</sup> i              |                               |
|                      |                               |                               |                               | I <sup>A</sup> I <sup>B</sup> | I <sup>B</sup> I <sup>B</sup> |                               |
|                      |                               | A                             | B                             | B                             | I <sup>A</sup> I <sup>A</sup> | I <sup>B</sup> i              |
|                      |                               |                               |                               |                               | I <sup>A</sup> I <sup>A</sup> | I <sup>B</sup> I <sup>B</sup> |
|                      |                               |                               |                               |                               | I <sup>A</sup> i              | I <sup>B</sup> i              |
| I <sup>A</sup> i     | I <sup>B</sup> I <sup>B</sup> |                               |                               |                               |                               |                               |

**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<br>RBC |             | <del></del> |
| 2.    | Lymphocyte<br>WBC  | <del></del> |             |

**2.3.2 (0.25 points)**

| S.No. | Plant parts | Yes          | No           |
|-------|-------------|--------------|--------------|
| 1.    | Leaf blade  |              | <del>X</del> |
| 2.    | Anther      |              | <del>X</del> |
| 3.    | Root tip    | <del>X</del> |              |

**2.3.3 (0.25 points)**

| Stage of division    | Yes          | No           |
|----------------------|--------------|--------------|
| Mitotic Metaphase    |              | <del>X</del> |
| Mitotic Anaphase     |              | <del>X</del> |
| Meiotic Metaphase I  |              | <del>X</del> |
| Meiotic Anaphase I   | <del>X</del> |              |
| Meiotic Metaphase II |              | <del>X</del> |
| Meiotic Anaphase II  |              | <del>X</del> |