

ANALYSIS OF THE SPM BIOLOGY PAPER 3 (2003 – 2008)

| CHAPTER | NUMBER OF QUESTIONS | | | | | |
|---|---------------------|------|------|------|------|------|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| 1. Introduction to Biology | | | | | | |
| 2. Cell structure and cell organisation | | | | | | |
| 3. Movement of substance across the plasma membrane | | | 1 | 1 | | 1 |
| 4. Chemical composition of the cell | | | | 1 | | |
| 5. Cell division | | | | | | |
| 6. Nutrition | 1 | 1 | 1 | | 1 | |
| 7. Respiration | | | | | 1 | |
| 8. Dynamic ecosystem | ½ | 1 | | | | 1 |
| 9. Endangered ecosystem | | | | | | |
| 10. Transport | | | | | | |
| 11. Locomotion and support | | | | | | |
| 12. Coordination and response | | | | | | |
| 13. Reproduction and growth | | | | | | |
| 14. Inheritance | | | | | | |
| 15. Variation | ½ | | | | | |

BIOLOGY PAPER 3 : OVERVIEW

- Consist of 2 Questions- 1½ hours
- Compulsory-Answer ALL- (50 Marks)
- 2 parts: Part 1 : 33 Marks (11 Skills)
Part 2 : 17 Marks (9 aspects)
- Test on Scientific Skills
- Based on Practical /experiments /field works.

BIOLOGY : LIST OF EXPERIMENTS

| No. | EXPERIMENTS | NOTES | VARIABLES | TECHNIQUE |
|-----|--|----------------------------|-----------|-----------|
| 1 | <p>Carry out activities to study the effect of hypotonic and hypertonic solutions on plant and animal cells:</p> <p>Plasmolysis and deplasmolysis in plant cells. Haemolysis and crenation in red blood cells</p> | | | |
| 2 | <p>Conduct an experiment using starch suspension and glucose to study the movement of substances across egg membrane or Visking tubing</p> | | | |
| 3 | <p>Carry out an activity to show osmosis using a simple osmometer</p> | | | |
| 4 | <p>Carry out an investigation using various concentration of salt or sugar solution to determine the concentration of external solution which is isotonic to the cell sap of plant tissues.</p> | | | |
| 5 | <p>Discuss and make an inference on the concentration of cell sap in plant tissues which is equivalent to the concentration of isotonic solution.</p> <p>Discuss and correlate the movement of substances across the plasma membrane with the difference in concentration of the external solution and that of the cell sap.</p> | <p>Q2 2005 Q2 2006</p> | | |
| 6 | <p>Conduct experiments to study the effects of</p> <ol style="list-style-type: none"> i. pH ii. temperature on the activities of amylase and pepsin. | | | |

| No. | EXPERIMENTS | NOTES | VARIABLES | TECHNIQUE |
|-----|---|---------|-----------|-----------|
| 7 | Discuss the effects of enzyme substrate concentration on enzyme activity. | Q1 2006 | | |
| 8 | Design activities to test for the presence of starch, reducing sugar, non-reducing sugar, protein and lipid in food samples. | | | |
| 9 | Conduct an activity to determine the energy value in food samples. | Q1 2005 | | |
| 10 | Conduct an experiment to determine the vitamin C content in various fruit juices | Q1 2004 | | |
| 11 | Design experiments to study the digestion of starch and proteins Carry out an activity to study the movement of substances through the Visking tubing Correlate the movement of substances through the Visking tubing with nutrient absorption in the small intestine | | | |
| 12 | Design an experiment to study the effects of macronutrient deficiency in plants, | | | |
| 13 | Design an experiment to investigate the effect of light intensity on the rate of photosynthesis, | | | |
| 14 | Carry out a small group discussion on the effects of : i. light intensity ii. temperature and iii. concentration of carbon dioxide on rate of photosynthesis. | Q1 2007 | | |

| No. | EXPERIMENTS | NOTES | VARIABLES | TECHNIQUE |
|-----|--|---------|-----------|-----------|
| 15 | Carry out an experiment to investigate anaerobic respiration in yeast. i. The effect of temperature on the rate of anaerobic respiration in yeast | Q2 2007 | | |
| 16 | Conduct an experiment to investigate the differences between inhale and exhale air | | | |
| 17 | Conduct an experiment to study the effect of a vigorous exercise on the rate of respiration and heart beat. | | | |
| 18 | Discuss and conduct an experiment to show the effects of cigarette smoke on white cotton wool and draw an analogy between the lung and the white cotton wool. | | | |
| 19 | Conduct an experiment to study the intraspecific competition and interspecific competition of plants, e.g. maize and rice | | | |
| 20 | Conduct a field study or use an appropriate analogy to: i. estimate the population size of animals such as garden snail and wood lice. ii. investigate the distribution of plants using the quadrat sampling technique. | Q2 2004 | | |
| 21 | Plan and conduct an experiment to study the relationship of population distribution of an organism with changes in any one of the abiotic factors such as pH, temperature, light intensity and humidity. Suggested organisms: <i>Pleurococcus</i> , <i>Lemna</i> | | | |

| No. | EXPERIMENTS | NOTES | VARIABLES | TECHNIQUE |
|-----|---|-------|-----------|-----------|
| 22 | <p>Conduct an experiment to study the effects of temperature, pH, light and nutrients on the activity of microorganisms e.g. <i>Bacillus subtilis</i> or yeast</p> | | | |
| 23 | <p>Conduct an activity to analyse data on air pollution index of some cities within and outside the country, and make an inference on the sources of pollution.</p> <p>Conduct an activity to analyse data on water pollution, such as Oxygen Demand (BOD) value and content to heavy metals in some rivers, and make an inference on the sources of pollution.</p> | | | |
| 24 | <p>Correlate different sizes of cubes to total surface area / volume (TSA/V) ratio. Discuss how the (TSA/V) ratio affects the movement of solutes to the interior of cubes,</p> | | | |
| 25 | <p>Design and conduct experiments to study factors affecting the rate of transpiration, i.e.:</p> <ul style="list-style-type: none"> a) air movement, b) temperature, c) light intensity, d) relative humidity. <p>Carry out an activity to show the following:</p> <ul style="list-style-type: none"> a) root pressure, b) cohesion and adhesion of water. | | | |
| 26 | <p>To show the presence of xylem as a continuous tube system to transport water and minerals,</p> | | | |

| No. | EXPERIMENTS | NOTES | VARIABLES | TECHNIQUE |
|-----|--|-------|-----------|-----------|
| 27 | Design an experiment to show the effect of different quantities of water intake on urine output. | | | |
| 28 | Conduct an activity to study the growth of a plant, e.g. onion, maize, or balsam. | | | |
| 29 | Conduct an activity using coloured buttons/beans to illustrate Mendel's First Law. | | | |
| 30 | Conduct an activity to investigate variation in humans and present the data graphically | | | |

BIOLOGY PAPER 3

GUIDELINES

QUESTION 1 (11 SKILLS - 33 MARKS)

Question is in a form of experiment done in the lab or field work.
Apparatus will be given in a question. Apparatus usually have scales / values to read or measure
(Examples: stop watch, ruler, measuring cylinder, burette, pipette, thermometer..)

1. OBSERVATION

- State **two extreme and meaningful** observations
- Observations can be in parallel / vertical form
- Write in a form of sentences which state the **VALUES** read from the given apparatus.
- Example: At the temperature of 0° C, time taken for the starch to hydrolysed is 20 minutes.

2. MAKING INFERENCE

- Inference is an early conclusion based on the experimental observations.
- Inference 1 is for the observation 1
- Inference 2 is for the observation 2

3. MEASURING AND USING NUMBERS

- Record the reading of thermometer, stopwatch, measuring tools , ruler ect. from the given diagram.
- Do not forget the **UNITS**.
- Up to 2 decimal points .

4. COMMUNICATING DATA (construct table)

- Table must be completed with **UNITS and titles for column and row**.
- Fill up the complete information given
- Transfer the informations correctly
- If there is calculation, show the method with a complete units/ State the formula.
- Up to two decimal points

5. INTERPRETING DATA (Explain / State The Relationship)

- Construct sentence that shows relationship between variables mentioned in a question.
- State the details of relationship.

6. CONTROLLING VARIABLES

- State **only ONE variable for each type**.
- State how the variables are operated
- Examples:
Manipulated variable:
Temperature: By using /adjusting a different temperature (10°C,20°C,30°C)

Fixed variable: (THE VALUE THAT IS MAINTAINED CONSTANT)

Time: By fixing/maintaining time taken for 20 minutes.

Volume: By using the same volume of water that is 10 ml.

Responding variable: (THE APPARATUS USED ?)

Distance : Measure and record the changes in distance using a ruler

Time : Record the time taken to....using a stop watch

7. STATE HYPHOTHESIS

- Able to state the hypothesis correctly based on the following criteria:
P1 : State the Manipulated variable (MV)
P2 : State the Responding variable (RV)
H : Relate P1 and P2
- Examples :
 1. The more MV....., the less RV
 2. IF.....

8. PREDICTING

- If the experiment is **repeated**, **predict** the observation
- Predict by stating whether there will be an **increase?** or a **decrease?** **more?** or **less?** or **same ?**
- May state the **values** which are suitable and will be accepted within the range.
- And **give reason for predicting** it so.

9. DEFINING OPERATIONALLY

- Based on the results of the experiment, what can you deduce about ?
- Must be done related to the experiment given in a question.(Score 3M)
- If it is a theoretical definition (Score 2M)

10. CLASSIFYING

- Complete the given table according to the **title**
- If the table is not provided, construct the table according to the **classification** given

11. CORRELATING TIME AND SPACE

- Able to draw the graph correctly :
Axis : correct title with units, uniform scale.
All points plotted correctly
Able to join points to form a smooth graph.

material + apparatus ✓

BIOLOGY PAPER 3

GUIDELINES

QUESTION 2 (9 ASPECTS - 17 MARKS)

After reading a Question:

- Step 1: Identify all the variables involved.
- Step 2: Construct Hypothesis.
- Step 3: Construct Problem Statement
- Step 4: Prepare Planning

1. AIM OF INVESTIGATION

- Write down the aim as in the question.
- To investigate.../ To study .../ To determine...

2. PROBLEM STATEMENT

- Must be in a question form. (?) .
- What is the effect of.. MV .. on ... RV ?
- How does?

3. HYPOTHESIS

- Able to state the hypothesis correctly based on the following criteria:
 - P1 : State the manipulated variable (MV)
 - P2 : State the responding variable (RV)
 - H : Relate P1 and P2
 - (A statement that shows relationship between the two variables: MV and RV)
- The more MVthe more/the less RV ?
- If

4. VARIABLES

- Write down all 3 variables (one for each variable)

5. LIST OF APPARATUS MATERIALS

- All must be included

6. TECHNIQUE

- Measuring / Recording / Weighing RVby using .. APPARATUS.
- (Verb + RV + Apparatus)

7. EXPERIMENTAL PROCEDURE OR METHOD

P1- Steps to prepare materials and apparatus.

P2- Method to maintain / fix FV

P3- Method to adjust/ control MV

P4- Method to operate/ record RV

P5- Safety precautions / accuracy

- Write down **each step clearly and systematically.**

- Meaningful sentences :

:

1. Repeat steps 1-5 by using.....

2. Record result / mass/ temperature in a Table

8. PRESENTATION OF DATA (RESULTS)

- Construct the **table** with the **correct titles and units.**
- **No result/data is required** in the Table

9. CONCLUSION

- Hypothesis is accepted / rejected and repeat or modify the hypothesis sentence.