

FORM TP 2022050



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CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE\*  
EXAMINATION

BIOLOGY

Paper 02 – General Proficiency

*2 hours 30 minutes*

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of SIX questions in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, answers should be illustrated with diagrams.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
6. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.**

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# SECTION A

Answer ALL questions.

1. Germination involves the breakdown of food stores in a seed. Figure 1 shows the results of an experiment, where 50 germinating seeds were exposed to varying concentrations of pollutants in water.

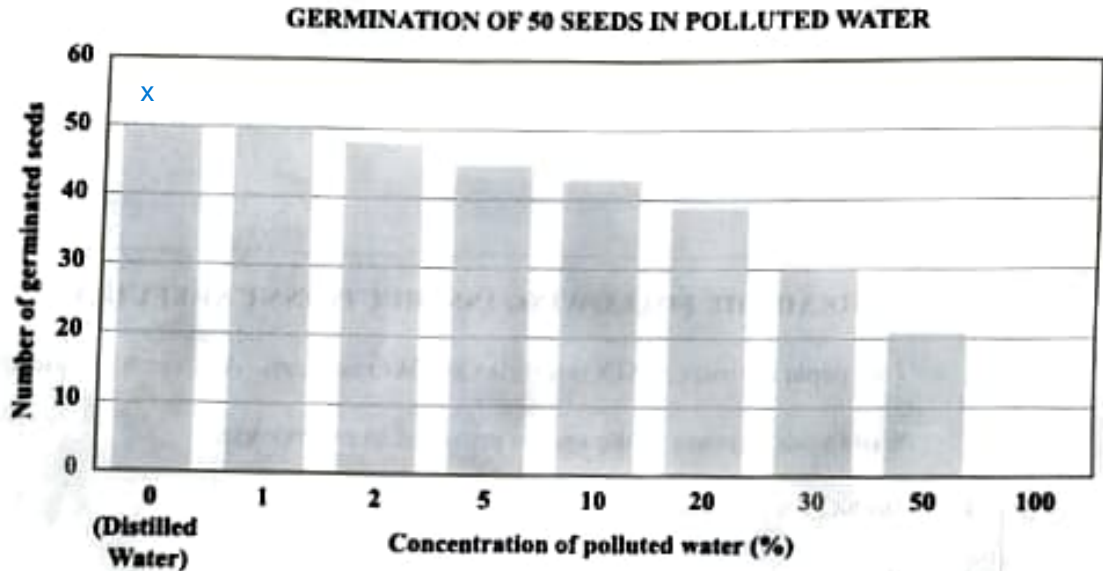


Figure 1. Germination of 50 seeds in different concentrations of polluted water

- (a) List FOUR factors, other than pollution, that can affect the germination of seeds.

Temperature

Oxygen

pH

Water

(4 marks)

- (b) State the aim of the experiment.

to determine how the level of pollutant concentration in water affects the germination of seeds

(1 mark)



(c) Using Figure 1, explain how the concentration of polluted water affects germination at EACH of the following concentrations:

(i) 1%

There is little to no effect on the germination of the seeds. Almost all of the 50 seeds germinated. The pollutant concentration was low. Hence, there was no effect on the chemical or physical processes of germination

(2 marks)

(ii) 50%

The percentage germination is low at 50% pollutant concentration. Germination might have been low due to the high concentration of pollutant affecting the chemical processes of germination. At 50% pollutant only 20% of the seeds germinated.

(2 marks)

(d) The research team provided the results of the experiment to a farmer. State TWO ways in which the farmer can use the data to improve his farming practices.

1. Improve seed germination by reducing contamination of pollution of water on the farm.
2. Predict the outcome of the percentage germination based on the type of water used on the farm.
3. Maximize yield based on the number of seeds sowed vs. actual number of seedlings needed for planting.
4. Faster/higher germination rate
5. Reduce seed wastage
6. Healthier seedlings

(2 marks)

(e) (i) On Figure 1, clearly place an X on the bar that represents the results of the control. (1 mark)

(ii) Give ONE reason for your answer in (e) (i).

There was no pollutant present in that experiment. A standard or control it can be used to compare the other results of what would have happened under normal conditions.

(1 mark)

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- (f) Meena investigated the growth of some seedlings and made comparisons with growth patterns in a human baby over a 30-day period. The data are provided in Table 1.

**TABLE 1: DATA COLLECTED TO INVESTIGATE GROWTH IN SEEDLINGS AND HUMAN BABY**

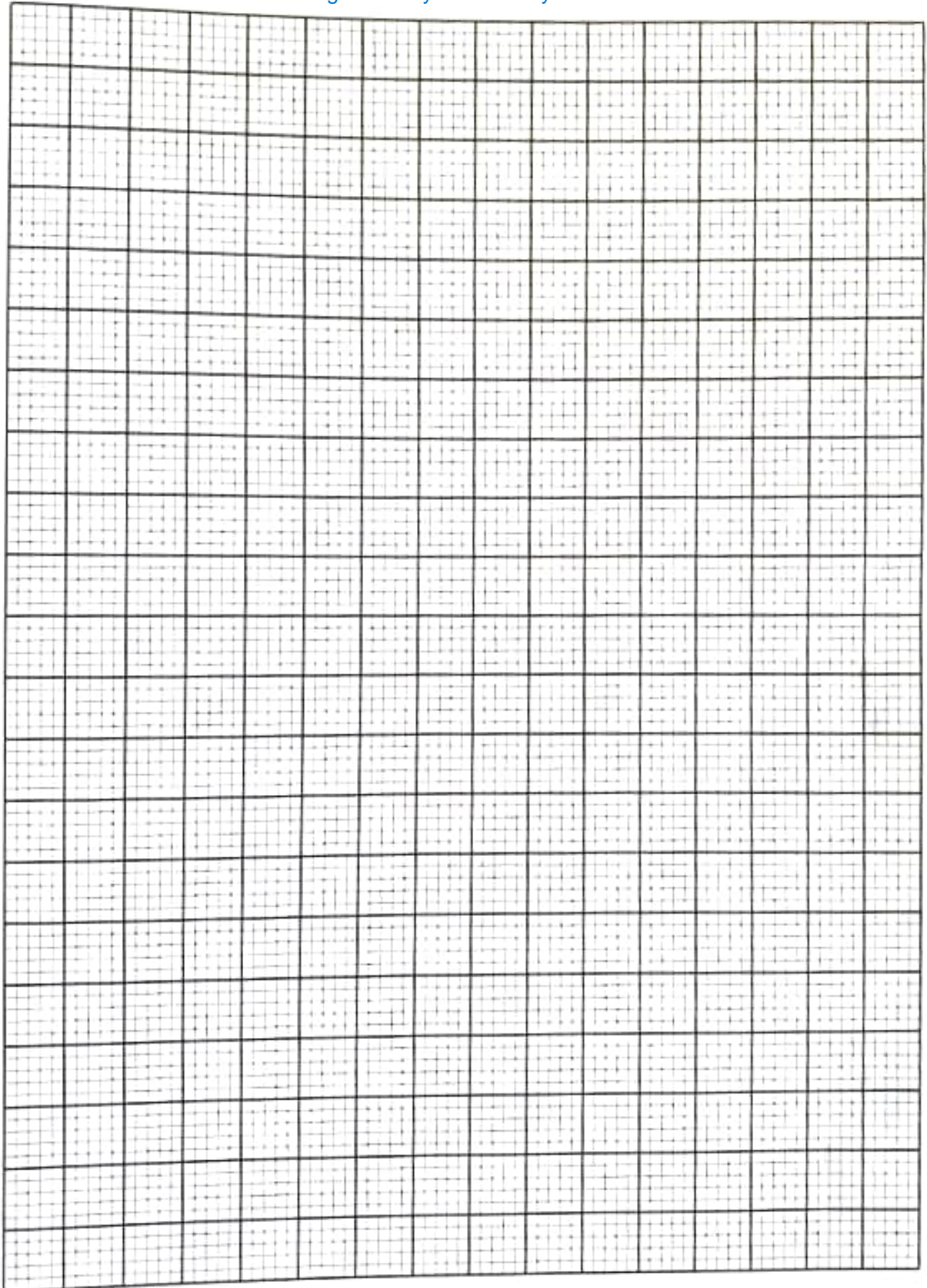
Day	Height of Seedling (cm)	Length of Human Baby (cm)
5	10	45
10	13	48
15	16	52
20	20	58
25	25	61
30	30	64

On the grid provided on page 7, plot the data obtained for both the seedling and the baby, using the same scales and axes. Provide a suitable title for the graph. **(6 marks)**





Title for graph: A Graph showing the comparison of the height of the seedling and the length of baby over 30 days.



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- (g) (i) Suggest TWO ways in which the growth of the baby differs from the growth of the seedlings.

1. The baby's lengths are higher than the heights of the seedling for the same time periods.

2. The average incremental change of the heights if the seedling is more than that of the baby's height.

(2 marks)

- (ii) Suggest ONE similarity between the growth of the baby and the growth of the seedlings.

They both increase with time.

(1 mark)

- (h) Describe how the seedlings' height is measured using a ruler.

By placing the centimeter ruler against the seedling with the zero mark on the surface of the soil.

(1 mark)

- (i) Suggest ONE example that shows that an increase in cells is NOT always due to growth.

Cells increase in size but not in the number of cells.

1. Binary fission 2. Meiosis = Number of cells increase, but not organism

1. Water entering the cells by osmosis

2. increase in turgor pressure

(1 mark)

3. Storage of nutrients such as fats, carbohydrates and amino acids.

- (j) Suggest ONE factor that should be considered before making a conclusion from the data in Table 1.

1. Starting length/height

2. Nutrient requirement/difference in needs

3. The time during the day when data are collected.

(1 mark)

Total 25 marks



2. (a) Define EACH of the following terms:

(i) Saprophytic nutrition

Obtaining nutrients from dead and decaying organisms/ matter.

(1 mark)

(ii) Heterotrophic nutrition

Obtaining nutrients from other organisms

\*\*Intake and breaking down of organic substances

(1 mark)

(iii) Autotrophic nutrition

Producing own food or nutrients

Self-feeders

Using inorganic substances with either light or chemical energy to synthesize food

\*\*\*Phototrophs and Chemotrophs

(1 mark)

(b) Complete Table 2 identifying TWO saprophytes and their food sources.

**TABLE 2: SAPROPHYTES AND THEIR FOOD SOURCES**

	Saprophyte	Food Source
1.	Mushroom, Yeast (Fungi)	Dead plant materials Sugary materials (Ripe fruits)
2.	Some bacteria Mould	Dead plant materials

Carbohydrate rich food like stale bread

(4 marks)

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- (c) Explain TWO processes by which the raw materials required for making nutrients reach the leaves of a plant.

1. Transpiration: Water is being pulled from the soil by the root hair cells through the process of osmosis. Due to the capillary action, water molecules climb into the narrow xylem vessels. As temperature increased, water molecules evaporate creating a continuous pull (transpiration pull) on other water molecules resulting in a continuous stream of water from the soil to the leaves.

2. Diffusion: When the guard cells become turgid, they result in the opening of the stomata. Carbon dioxide from the atmosphere then diffuses from the higher concentration to a lower concentration in the leaves.

3. Radiation: Sunlight travel from the sun in the form of rays (light rays). When light rays hit the plant leaves, they travel inside and then are absorbed by chlorophyll in the chloroplast.

(4 marks)

- (d) Young seedlings use all the nutrients stored in their cotyledons to start their growth. Explain the process by which the seedlings make more nutrients to continue their growth.

1. Once growth start taking place, the seedlings will start to have their first leaves.

2. The seedlings start making food by photosynthesis.

3. Sunlight is absorbed by the chlorophyll in the leaves.

4. Water is absorbed by the roots (radicle) and sent to the leaves through the xylem.

5. Carbon dioxide is taken into the leaves through the stomata.

6. The absorbed light splits water molecules producing hydrogen ions and oxygen gas.

7. Hydrogen ions react with carbon dioxide to produce glucose (sugar).

(4 marks)

Total 15 marks



3. Figure 2 below shows a typical plant cell and a typical animal cell.

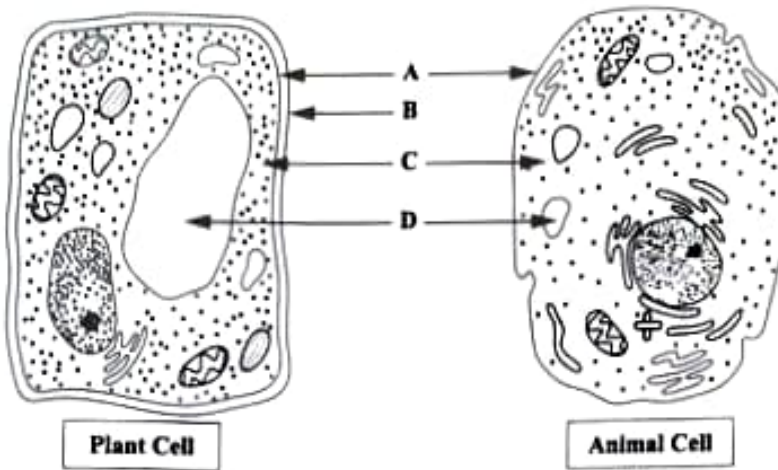


Figure 2. Typical plant cell and typical animal cell

(a) Identify the structures labelled A, B, C and D.

- (i) A... Cell membrane or Plasma Membrane
- B... Cell wall
- C... Cytoplasm
- D... Vacuole

(4 marks)

(ii) State the function of any THREE of the structures identified in (a) (i).

Cell membrane: Controls what enters and leaves the cell

Cell wall: maintains the shape of the cell

Cytoplasm: Holds the organelles in place, site for most chemical reactions

Vacuole: store water, nutrients (food) and waste materials

(3 marks)

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- (b) A student collected two specimens, A and B, from a seashore during her Biology field trip. She used a microscope to determine which structures were present in the specimens and found that Specimen A contained more mitochondria than Specimen B.

Suggest TWO reasons why Specimen A had more mitochondria than Specimen B.

1. Specimen A may move more than Specimen B. More movement requires more energy. Hence a greater number of mitochondria in Specimen A.
2. Specimen A may be larger than specimen B. Larger cells or larger organisms tend to carry out more cellular activities. Most cellular activities require energy.
3. More frequent reproduction/growth means more energy is required for cells to divide.
4. A carnivore hunts for food; more energy is needed.

(4 marks)

- (c) Using TWO named examples, explain why cell specialization is important for cells to function effectively. Transforming of cells to perform specific funtions.

1. Sperm cells: These cells are specialized by developing flagella which enables them to swim effectively through the female reproductive system.
2. Ciliated cells: cells of the nasal cavity and trachea develop cilia to sweep unwanted substances out of the breathing system.
3. Muscle cells: They are adapted to contract and relax to bring about movement,
4. Phagocytes: They are adapted to induce specific shape to engulf microbes by phagocytosis.
5. Nerve cells/ Neurons: They are adapted to transmit electrical messages (impulses) around the body.

(4 marks)

Total 15 marks



**SECTION B**

**Answer ALL questions.**

4. (a) Define EACH of the following terms:

(i) **Climate change**

The long-term changes in factors such as temperature that affect climatic conditions.

(1 mark)

(ii) **Population**

The total number of the same species that live and interact within the same area at the same time.

(1 mark)

(b) State FOUR methods that may be used to conserve the environment.

1. Reduce, reuse and recycle

2. Reforestation (planting of trees)

3. Use of renewable energy (solar panels) instead of non-renewable energy

4. Reduce the use of non-biodegradable materials

5. Designate areas such as breeding grounds and nurseries as protected areas

6. Implement and reinforce open and close seasons for specific organisms

7. Reduce the use of automobiles - carpool

8. Practice good solid waste and sewage disposal

(4 marks)

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- (c) The earth's climate has warmed considerably over the past few decades. Using THREE examples, explain how global warming may lead to an increase in infectious diseases within the Caribbean region.

Infectious diseases are diseases caused by pathogens that enter the body

1. Dengue fever: it is a viral infection caused by the dengue virus, transmitted to humans through the bite of infected aedes aegypti mosquitos. This may increase due to global warming because warmer temperatures may increase the time which these mosquitoes reproduce.

2. Chikungunya: it is a viral infection transmitted to humans through the bite of infected aedes aegypti and albopictus mosquitoes. This may increase due to global warming because warmer temperatures may increase the time which these mosquitoes produce.

3. Zika virus: It is a viral infection transmitted to humans through the bite of infected aedes aegypti and albopictus mosquitoes. This may increase due to global warming because warmer temperatures may increase the time which these mosquitoes produce.

4. Cholera: It is caused by consuming contaminated water. It is a bacterial infection caused by the Vibrio cholerae bacteria. Even though it is caused by contaminated water, warmer temperatures may increase the replication of bacteria cells. Therefore, increasing the number of cells per volume and the probability of infection.

5. Malaria: It is caused by a parasite transmitted to humans through the bite of an infected female anopheles mosquito. Warmer temperatures may increase the reproduction and spread of the parasite.

6. Corona Flu and Airbone Diseases: Warmer temperatures may increase the movement and activities of most pathogens that cause airborne diseases.

Note:

1. Global warming caused changes in rainfall, storms, floods and extreme events.
2. Increased contamination of food and water.
3. Increased pathogens and their activities.
4. Expansion of infested areas.

(6 marks)





(d) Climate change can severely impact Small Island Developing States (SIDS) within the Caribbean. Suggest THREE possible actions that can be taken to reduce the effects of climate change.

1. Invest in electrical cars to reduce the dependency of fossil fuel

2. Invest in renewable energy - Encourage individuals to participate in renewable energy projects.

3. Encourage and promote tree planting efforts

4. Encourage coastal cleanups and proper waste disposal.

5. Ban the importation and use of specific chemicals such as pesticides, commercial fertilizers, aerosols and corrosive substances.

6. Place sanctions on the proper disposal of derelict vehicles.

7. Encourage backyard farming and other sustainable efforts.

(3 marks)

Total 15 marks

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5. (a) Ellis received a blood test from his doctor. His test results showed that his white blood cell and platelet levels were normal while his red blood cell levels were not normal.
- (i) Complete Table 3 below to show ONE function of EACH of the blood components.

**TABLE 3: BLOOD COMPONENTS AND FUNCTIONS**

Blood Component	Function
Red blood cell	Transports oxygen to the cells of the body
White blood cell	Helps to protect the body from pathogens/diseases
Platelet	Aids with blood clotting to prevent blood loss.

(3 marks)

Major categories

1. Nutrients
2. Gases (ii)
3. Hormones
4. Wastes
5. Electrolytes
6. Proteins
7. Antibodies

Name **THREE other** substances which are found in the blood.

Plasma, Hemoglobin, oxygen, carbon dioxide, amino acids, hormones, glucose, ions, antibodies, water and urea.

(3 marks)

- (b) Ellis received additional tests which revealed that he has sickle-cell anaemia. Suggest **ONE** way in which Ellis' red blood cells may differ from a person who does NOT have sickle-cell anaemia.

1. Crescent shape instead of biconcave - the red blood cells can get stuck and reduce blood flow, depriving cells of oxygen.

2. Less flexible - reduce movement/flow

3. More sticky - reduce movement/flow

(2 marks)

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- (c) Ellis becomes concerned that his child may also develop sickle-cell anaemia. His doctor tested his wife's blood and told Ellis that it is unlikely that he will have a child with sickle-cell anaemia. With the use of a genetic diagram, explain why it is NOT possible for Ellis to have a child with sickle-cell anaemia.

In your answer, let S denote the allele for the sickle-cell trait and A the allele for the normal trait.

Phenotype (father): Sickle-cell      Phenotype (mother): Normal blood  
 Genotype (father): SS      Phenotype (mother): AA  
 Genetic cross:

Handwritten genetic cross diagram:

	A	A
S	AS	AS
S	AS	AS

Explanation:

All the offspring will have a copy of the allele for normal blood. Since sickle-cell is the recessive trait, then all the offspring will have normal red blood cells. However, all of the offspring will be sickle-cell carriers.

(7 marks)

Total 15 marks

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6. Anna has a 28-day menstrual cycle. Figure 3 shows the changes which occur in Anna's uterine lining during her menstrual cycle.

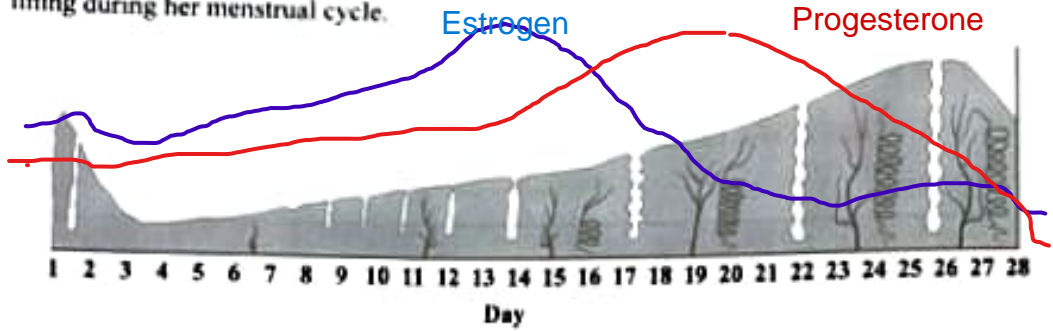


Figure 3. Changes occurring in Anna's uterine lining

- (a) (i) Name the TWO sex hormones which are associated with the menstrual cycle.
- Estrogen
- Progesterone
- (2 marks)
- (ii) On Figure 3, sketch a line for EACH hormone to show how the levels of the sex hormones named in (a) (i) change over the 28-day cycle. Label EACH line.
- (2 marks)

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- (b) Anna recently became pregnant. Explain the effect that pregnancy will have on the TWO sex hormones named in (a) (i).

1. Estrogen: Gradually increase during pregnancy until it peaks  
Increases blood flow to the uterus,  
enlargement of the uterus (maintains the uterine lining),  
stimulates mammary gland development/ enlargement,  
stimulate secretion of prolactin (breast growth and milk),  
relaxes pelvic ligaments and  
prompts uterine contractions.
2. Progesterone: Gradually increase during pregnancy until it peaks  
prepares the endometrium for implantation  
maintains pregnancy  
enlargement of the uterus  
prevents other eggs from maturing (prevents menstruation)  
prevents uterine contractions (relaxes muscles and muscles miscarriage)  
strengthens muscles in preparation for labour.

(4 marks)

- (c) After the delivery of a healthy baby boy, Anna decides that she does not want to have any other children at this time. She, however, wishes to have another child in the future.

- (i) Recommend ONE suitable birth control method which Anna could use to prevent pregnancy.

Condoms, pills, abstinence, injections, IUD, rhythm method, coitus interruptions (withdrawal)

(1 mark)

- (ii) State TWO advantages and ONE disadvantage of the birth control method recommended in (c) (i).

Condoms:

Advantage- readily available and prevents STDs

Disadvantage - can burst, allergy, reduces pleasure

Pills and injections

Advantages- effective and does not affect intercourse

Disadvantage - STDs is possible, needs prescription, has side effects

Abstinence:

Advantage- effective, no cost, no STD

Disadvantage - may be difficult, domestic conflicts

(3 marks)

IUD:

Advantage- Effective, long term

Disadvantage - bleeding and STD is possible

Rhythm method:

Advantage - inexpensive, no side effects

Disadvantage - unreliable, STD possible

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Withdrawal:

Advantages: inexpensive, no side effects

Disadvantage: Unreliable, STD possible



- (d) Not all birth control methods can prevent both pregnancy and infections from sexually transmitted diseases.

- (i) State TWO sexually transmitted diseases.

HIV, Herpes, Gonorrhea, Syphilis, Chlamydia.....

(2 marks)

- (ii) Identify a birth control method which would be effective at preventing pregnancy AND infections from sexually transmitted infections.

Condoms.....

(1 mark)

**Total 15 marks**

**END OF TEST**

**IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.**



EXTRA SPACE

If you use this extra page, you **MUST** write the question number clearly in the box provided.

Question No.

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