

Answers for LOGIC TUTORIAL CENTER BIO MOCK 2025

Paper 1A

1 A	2 B	3B	4B	5A	6B	7D	8D	9D	10C	11C	12B	13D
14C	15A	16C	17A	18C	19C	20C	21C	22C	23B	24C	25D	26B
27C	28A	29B	30D	31C	32D	33D	34C	35D	36B			

Paper 1B

1. (a) A (b) B (c) D 1 m@
- 2.
- 2.a. Photochemical reactions of photosynthesis occur in the thylakoids of the grana. (1)
Without grana, photochemical reactions did not occur in tube X. No NADPH and ATP were produced. (1)
The 3-C compound could not be reduced into triose phosphate and the 5-C compound could not be regenerated. (1)
Less 5-C compound was present to accept carbon dioxide, thus the rate of carbon dioxide uptake was much lower. (1)
- 2b The rate of carbon dioxide uptake would decrease to about 4000 arbitrary units. (1)
- 3a Primary succession 1
This is because the species composition of the habitat changes over a relatively long period of time in a barren area. 1
- 3b B: lichens / mosses 1
D: trees 1
- 3c The lupins can survive on the nitrogen-deficient volcanic rock because they can convert nitrogen from the air into ammonium compounds. 1
The volcanic soil is also enriched with ammonium compounds as they are released from the dead remains of nitrogen-fixing bacteria in the lupins. 1
- 3d Herbivores can enrich the soil by leaving behind organic waste and dead remains. 1
Herbivores consume plants and directly reduce their abundance, thus slowing down the rate at which the plants can recolonize and modify the area. 1
- 4a The healthy mother can metabolize phenylalanine to tyrosine, so phenylalanine will not accumulate to harmful level in the foetal blood. /
The healthy mother can metabolize phenylalanine to tyrosine, so the foetus can obtain enough tyrosine from the mother's blood. [1]
- 4b The children who suffer from PKU must each have at least one allele for PKU 1
They must have inherited the allele for PKU from at least one of their parents. Either of the parents must have at least one allele for PKU, but both of them are healthy. 1
Hence, it can be deduced that the allele for PKU must be recessive. [1]
- 4c A change in the amino acid sequence may cause a change in the shape of the active site of the enzyme. [1]
The enzyme with abnormal shape can no longer bind specifically to the substrates. [1]
- 4d In Europe where the mould is commonly found, pregnant women carrying an allele for PKU have a higher chance of giving birth to a viable baby. [1]
They have a higher chance of passing their PKU alleles on to the offspring. [1]

- 5a Individual P [1]
because hepatitis B antigen is already present in the blood, suggesting the individual had contacted hepatitis B virus. [1]
- 5b Vaccine containing hepatitis B antigens stimulate the production of antibodies against hepatitis B antigens by B lymphocytes. [1]
Some of the B lymphocytes develop into memory cells. [1]
When the same hepatitis B antigens enter the body, the memory cells can lead to production of a large amount of antibodies in a short period of time. [1]
- 5c Hepatitis B virus damages liver cells (1)
which lead to reduced bile production by liver. [1]
Less bile salts to emulsify fat into oil droplets / to increase the surface area of fat for lipase to act on. [1]
- 5d Bile pigment/the pigment formed in the breakdown of haemoglobin enters blood due to the death or lysis of liver cells or impaired excretion of bile. (1)
The pigment is then deposited / accumulates in skin. [1]
- 6a The accumulation of fluid in the air sacs will reduce the efficiency of gas exchange [1]
because the accumulation of fluid will increase the diffusion distance of respiratory gases. [1]
- 6b At high altitude, the air pressure is lower and the oxygen level/content in air is lower. [1]
It is more difficult for humans to obtain enough oxygen from the surroundings for respiration. [1]
More blood is pumped to the lungs to increase the rate of oxygen transport. [1]
The higher blood flow in lung capillaries can help maintain the concentration gradient of oxygen between the air in air sacs and the blood in lung capillaries. [1]
- 6c The higher blood pressure in the lung capillaries surrounding the air sacs will cause an increase in the amount of tissue fluid formed. [1]
Due to the higher pressure in capillaries, less tissue fluid can return to the blood capillaries. [1]
The rate of formation of tissue fluid is higher than that of the return /
The large amount of tissue fluid will accumulate in the air sacs, [1]
causing high altitude pulmonary edema.
- 7a cut the end of the leafy shoot under water / red ink solution (1)
to prevent the blockage of xylem vessels by air bubbles (1)
- 7b cut from the bottom of the shoot until the cross-section of the shoot is not stained (1)
the length of the shoot that has cut away divided by time taken / 30 minutes
is the rate of transpiration of the leafy shoot (1)
OR
cut from the top of the shoot until the cross-section of the shoot is stained (1)
the length of the shoot remained divided by time taken / 30 minutes
is the rate of transpiration of the leafy shoot (1)
- 7c all the water absorbed by the leafy shoot is lost by transpiration / the rates of water absorption and transpiration are the same (1)
- 7d stomata open more widely under light (1) - the surface area for water vapour to diffuse out from the air space through the stomata is greater (1)

thus more water vapour diffuses out of the leafy shoot (1)
the rate of transpiration becomes higher (1)

8a P and S (1)

8b it is inelastic (1)
which can transmit most of the contraction force of muscle P to the lower leg (1)
to cause the leg to bend (1)

8c the cerebrum helps decide when to jump / interprets the nerve impulses from the eyes into the sensation of sight / sends nerve impulses to the leg muscles to jump (1)
the cerebellum coordinates muscular contraction to maintain body balance (1)
the medulla causes increase in the rate of breathing / heart rate (1)

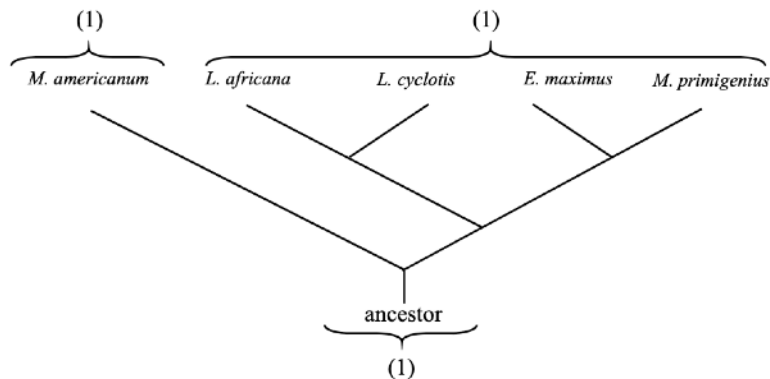
9a

Eukarya	0.5
Phylum	0.5
Class	0.5
Order	0.5
<i>Elephas</i>	0.5
<i>(E.) maximus</i>	0.5

9b Genetic variation existed in the elephant population and individuals have difference in length of trunk (1).
Individuals with longer trunk can reach for and obtain more food than those with shorter trunk (1), so they have a higher chance of survival and reproduction (1).
The proportion of elephants with longer trunk increases in subsequent generations (1).

9c Organisms change their characters in response to environmental changes
OR
Acquired characters can be passed on to offspring or subsequent generations (1).

9d



9e Species with closer phylogenetic relationship have less difference between the base sequences in their common genes (1)
because they evolve from their common ancestral species with fewer mutations (1).

10.

Transfer of Gametes (Max. 5 Marks)

- Human Transfer of Male Gametes:
- Male gametes are transferred directly into the female body by inserting the penis into the female vagina (1).
- The male gametes exhibit active movement, swimming up the vagina and uterus to reach the ovum in the oviduct (1).
- No digestion of human tissue is involved in this transfer process (1).
- The contraction of the muscular wall of the uterus facilitates the transfer of male gametes (1).

Plant Transfer of Male Gametes:

- Male gametes are transferred indirectly into the female reproductive part by releasing pollen grains into the environment (1).
- The male and female reproductive parts in plants are separated during the transfer of gametes (1).
- Pollen grains are carried by various external agents, such as wind or insects, to reach the female reproductive part of the plant (1).
- The movement of male gametes occurs passively through the development of a pollen tube along the style, carrying them towards the ovule (1).
- During this process, the tissue of the female reproductive part (style) is digested (1).

Adaptation to Achieve Sexual Reproduction (Max. 3 Marks)

- A large number of male gametes are produced to increase the chances of successful fertilization, compensating for potential loss or death during transfer (1).
- Male gametes are relatively smaller than female gametes to enhance movement and facilitate transfer (1).
- Additionally, pollen tubes and water mediums (e.g., semen and vaginal secretions) aid in transferring male gametes, addressing issues like desiccation and distance between male and female gametes (1).
- Female gametes are larger in size and produced in fewer numbers to ensure a greater food reserve is available for embryo development (1).

Effective communication (0-3)

Paper 2

SECTION A: HUMAN PHYSIOLOGY

- (a-i) Thermoreceptors in the hypothalamus detect an increase in the blood/internal body temperature (1) **[No marks for thermoreceptors in the skin.]**
and they send nerve impulses to stimulate the heat loss centre (1)
The heat loss centre sends nerve impulses to the arterioles near the skin surface causing vasodilation/them to dilate. (1)
Hence their diameter increases during period A.

- (ii) This allows more blood to flow through the arterioles near skin (1)
to bring more heat to the skin surface (1)
to promote heat loss by conduction, convection and radiation. (1)

- (iii) *Concept for mark award:*
Vasoconstriction under cold condition (1). Effect of hot water bath on skin arterioles (1)
Change in blood flow to skin surface (1) Reduced blood supply to the brain (1)

On a very cold day, skin arterioles constrict to minimise heat loss (1)
Having a very hot water bath results in the dilation of skin arterioles (1)
The blood flow to the skin surface increases drastically. (1)
Fainting may occur when the blood supply to the brain is reduced suddenly. (1)

- (b-i) Aerobic respiration alone **cannot provide enough energy** to meet the increase in energy demand as the intensity of exercise increases (1)
The skeletal muscles have to undergo anaerobic respiration to produce **additional energy** to support the body's need and lactic acid is formed (1)
The lactic acid diffuses from the muscle tissues and enters the bloodstream (1)
leading to a rise in the blood lactate concentration.

- (b-ii) It can be an increase in mitochondria level. (1)
This increases the energy output by aerobic respiration and delays anaerobic respiration and lactic acid production. (1)

- (iii) *Concept for mark award:*
Correct identification of
-control variable (1) (e.g. same type of exercise and increase in intensity)
-independent variable (1) (e.g. two groups of volunteers: athletes/untrained)
-dependent variable (1)
(e.g. collection of blood sample and test for the concentration of lactic acids at regular time interval)

Two groups/individuals (athlete and untrained person) should be monitored under the same conditions (1) [accept using an example e.g. same room temperature] and treated with the same increase in exercise intensity. (1)
When the exercise intensity increases, the blood sample of each group is collected at regular time interval and tested for the concentration of lactic acid in the blood (1)

- (iv) Athletes may have higher stroke volume / higher cardiac output (1)
to supply more blood to the muscles and maintain a **steep concentration gradient** for lactic acid to diffuse into the bloodstream more efficiently. (1)

SECTION B : APPLIED ECOLOGY

- 2a-i** Dense vegetation in forests captures a significant amount of **light energy** and converts it into **chemical energy** in the form of complex organic compounds through the process of **photosynthesis**. (1)

This chemical energy stored in organic compounds is subsequently transferred to other organisms via the **food chain** or **food web through feeding interactions**. (1)

- ii** In tropical rainforests, the combination of **warmth and high humidity** creates favorable conditions for the growth of **decomposers** in the soil. (1)
These decomposers accelerate the **breakdown of organic matter into inorganic matter**, (1)
which can then be **reused by plants** to support their growth. (1)

- iii** Trees planted along the edges of croplands serve as barriers, protecting the soil from **being blown away by wind**. (1)

OR

Trees planted near streams play a crucial role in **absorbing excessive fertilizers** from croplands, thereby reducing nutrient runoff that could otherwise pollute nearby water bodies. (1)

OR

The roots of trees help bind soil particles together, **preventing soil erosion** and decreasing sedimentation downstream. (1) (ANY 2)

- 2b-i** Mikania blocks sunlight and prevents the plants from undergoing photosynthesis. (1)

- ii** Increases in species number after 14 months of drug application indicate that the **biodiversity** of the plant community **improved**. (1)
This is because the removal of Mikania results in **better light penetration** of the area, (1)
allowing the **establishment of sun plants or new species** which require high light intensity for photosynthesis. (1)

- iii** Plant species X effectively suppresses the growth of Mikania, as indicated by consistently **lower biomass** in experimental groups compared to control groups. (1)

Plant species X is specific to Mikania; it does not inhibit the growth of other plant species, which showed significantly higher **biomass** in experimental groups. (1)

Plant species X did not exhibit uncontrolled growth or become invasive, suggesting that it can be managed effectively without becoming a weed itself. (1)

The data supports the conclusion that plant species X is an effective agent for the biological control of Mikania.

- iv** Both methods are specific to Mikania and caused no apparent harm to other plant species. (1)
Biodiversity increased after using the herbicide.
The biomass of other plants increased with the use of species X. (1)

- V** There is no problem of **leaching** and hence cause **no contamination** of nearby water bodies. and hence non-toxic, there is no problem of bioaccumulation of toxins along the food chain. There is no problem of development of **resistance** to plants species X among Mikania.

SECTION C : MICROORGANISM AND HUMAN

- 3a i** The binding of the drug to the surface protein of an infected cell can cause the inhibition of protein synthesis. (1)
New viruses cannot be produced in the cell. (1)
This prevents the virus from spreading in the body. (1)
- ii** In the absence of viral RNA in healthy cells, (1)
PKR remains inactive and cannot inhibit protein synthesis. (1)
- iii** That surface protein of HCV may bind to PKR. (1)
This stops PKR from binding to its substrate. (1)
The action of PKR is inhibited.
Therefore, HCV with that surface protein can multiply in the cells.
The drug is ineffective. (1)
- iv** Since HCV multiplies very rapidly, there is a high chance that a gene that causes resistance to the drug appears due to mutation.(1)
HCV may evolve quickly to become resistant to the drug. (1)
- 3b i** It is to sterilize the discs to prevent other microorganisms from contaminating the agar plates. (1)
The microorganisms may compete with X and Y for nutrients / affect the growth of X and Y.
This affects the results. (1)
- ii** Enzymes that are needed for the reproduction of bacteria are not present in human cells.
Human cells can break down allicin while bacteria cannot. (or other reasonable answers)
- iii** 20%, 40% and 60% garlic extracts are more effective in killing Y. (1)
The clear zones around the discs soaked with these extracts are larger on the agar plate spread with Y than those on the agar plate spread with X. (1)
The effectiveness of 80% and 100% garlic extracts in killing X and Y is the same. (1)
The diameters of the clear zones on the two agar plates are the same. (1)
- iv** Repeat the investigation using onion extracts. (1)
If the results are similar to the results obtained using garlic extracts,
the results of the investigation are likely to be valid. (1)

SECTION D BIOTECHNOLOGY

- 4a-i** DNA molecules are denatured / separated to form single strands (at the DNA denaturation stage). (1)
Primers with complementary bases as β -globin gene anneal to the single-stranded DNA (at the primer annealing stage). (1)
Complementary free nucleotides join to the primers accordingly to extend the DNA molecule (at the extension stage). (1)
- ii-1** X is homozygous recessive. (1)
X has only one band containing the longest DNA fragment (1.3 kb) (1)
This indicates that she has mutated alleles only. (1)
- ii-2** Y has three bands with different lengths (1.3 kb, 1.1 kb and 0.2kb). (1)
This indicates that she has one mutated allele and one normal allele / she is a carrier of sickle cell anaemia / heterozygote. (1)
The child of Y may inherit one mutated allele from Y. (1)
Y's husband should be tested for the mutated allele so as to find out the chance of having a child with sickle cell anaemia.
- 4b-i** The genetically modified sheep is developed from a fertilized ovum (1)
which is formed by the fusion of gametes / fertilization in sexual reproduction. (1)
- ii** Use specific primers to amplify the gene using PCR
OR
Use specific restriction enzyme to obtain the target gene (1)
Select the DNA fragment with the right size using gel electrophoresis
- iii** Pros: precise delivery to the target cell / no immune response from viral infection (1)
Cons: cause damage / only one cell is targeted per injection / time consuming / high failure rate (1)
- iv** The human blood clotting factors are less likely to be contaminated with pathogens in milk / less likely to have blood clumping. (1)
Large amounts of pure human blood clotting factors can be produced at a lower cost. (1)
- V** The genetically modified organisms may out-compete the wild types if they are released into the natural environment. This would reduce biodiversity / upset the ecological balance. (1)

The genetically modified organisms may transfer their genes to the wild types through sexual reproduction. These genes may have unexpected / unknown and dangerous effects. (1)

(or other reasonable answers)

*****End of Marking Scheme *****