EUNOIA JUNIOR COLLEGE
JC2 Preliminary Examinations 2023
General Certificate of Education Advanced Level
Higher 2

CANDIDATE NAME	

CIVICS GROUP	2	2	-		

REGISTRATION NUMBER		

H2 Biology 9744/03

Paper 3 Long Structured and Free-response Questions **19 September 2023**

2 hours

Additional Materials: 12-page Answer Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, civics group and registration number on all the work you hand in.
Write your answers in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use paper clips, highlighters, glue, or correction fluid/tape.

Section A
Answer **all** questions on the **Question Paper**.

Section B
Answer **one** question on the **12-page Answer Booklet** provided**.**

Write your answer to each part of the question on a fresh sheet of paper.

The use of an approved scientific calculator is expected, where appropriate.

The number of marks is given in brackets [ ] at the end of each question or part question.

At the end of the examination, ensure that you submit both the Question Paper and Answer Booklet.

For Examiner's Use	
Section A	
1	
2	
3	
Section B	
4 OR 5	
Total	**75**

This document consists of **12** printed pages.

Section A

Answer **all** questions on the Question Paper.

1 Scientists have produced structures known as virosomes, which are used in certain vaccines. Virosomes do not cause disease. Fig. 1.1 is a diagram of a section through a virosome used in some vaccines to protect against the influenza virus.

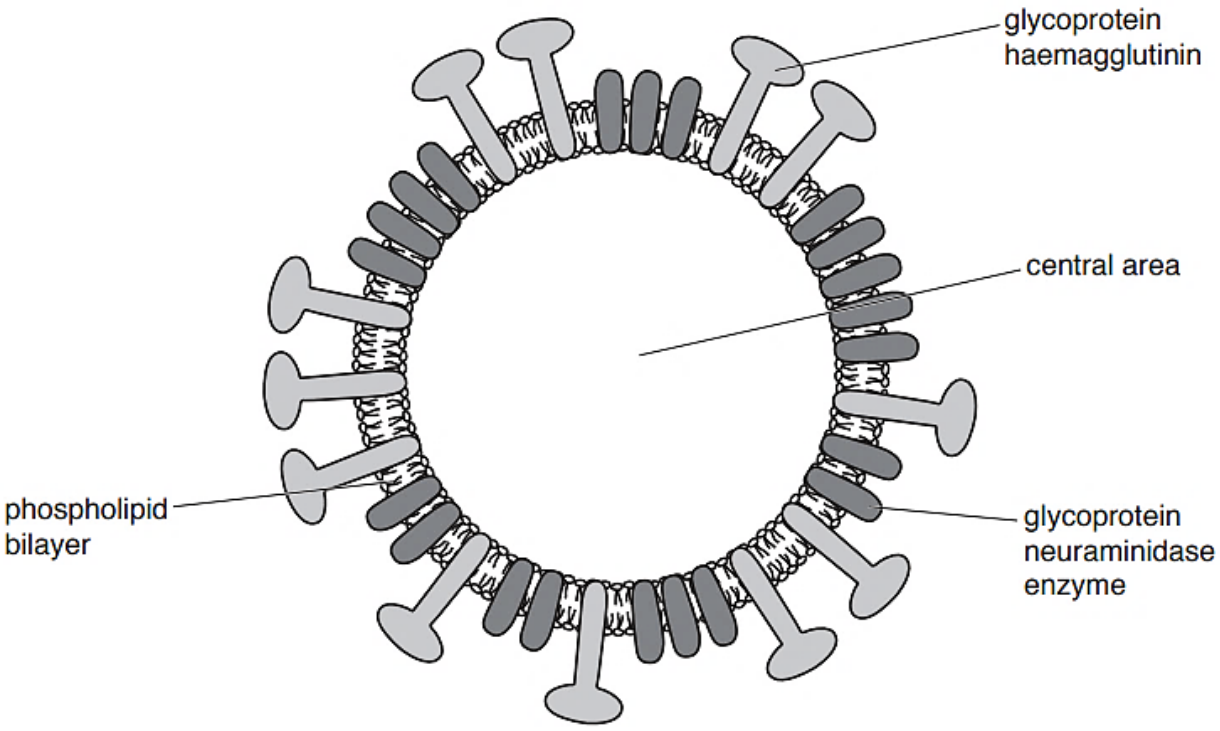

Fig. 1.1

(a) (i) State the structural differences between a virosome and a virus. [2]

Any 2
1. Virosome **does not have** any **nucleic acids / genetic material** whereas a virus **does**;
2. Virosome **does not have** a **capsid / capsomeres** whereas a virus **does**;
3. Virosome **has** a **phospholipid bilayer** as an envelope whereas some viruses like bacteriophages **do not**;
4. AVP (no nucleocapsid vs has nucleocapsid, no nucleoprotein vs has)

R: virosome has haemagglutinin vs HIV has gp120

(ii) Explain how the structure of the virosome shown in Fig. 1.1 suggests that the central area of the virosome is aqueous. [2]

1. The **phosphate head** of the **phospholipid** is charged and **hydrophilic**;
2. and is **facing/pointing towards** the **central area of the virosome**. Thus, the central area of the virosome must be aqueous;

OR
3. The **hydrocarbon tails** of the **phospholipids** are non-polar and **hydrophobic**;
4. and are **pointing away** from the **central area of the virosome**. Thus, the central area of the virosome must be aqueous;

(b) The glycoproteins haemagglutinin and neuraminidase found in the influenza virus are also found in the virosomes used in a vaccine against the influenza virus.

Briefly explain why haemagglutinin is present in virosomes used in the vaccine for influenza. [3]

1. Haemagglutinin acts as a **foreign / non-self antigen**;
2. It will trigger/stimulate the **primary immune response** to provide artificial active immunity; (A: phagocytosis and antigen presentation to activate naïve T and B cells)
3. This will lead to the **formation of memory cells** eventually;

any two from:

acts as a non-self / foreign, antigen ; triggers / stimulates, primary immune response or provides (artificial) active immunity ; (leads to) formation of antigen presenting cell ; A endocytosis / phagocytosis, to present antigen (by, macrophage neutrophil) activates, B lymphocytes / T lymphocytes ; A clonal selection formation of memory cells ;

Fig. 1.2 shows the antibody concentration in a patient's serum after he was vaccinated with the virosome.

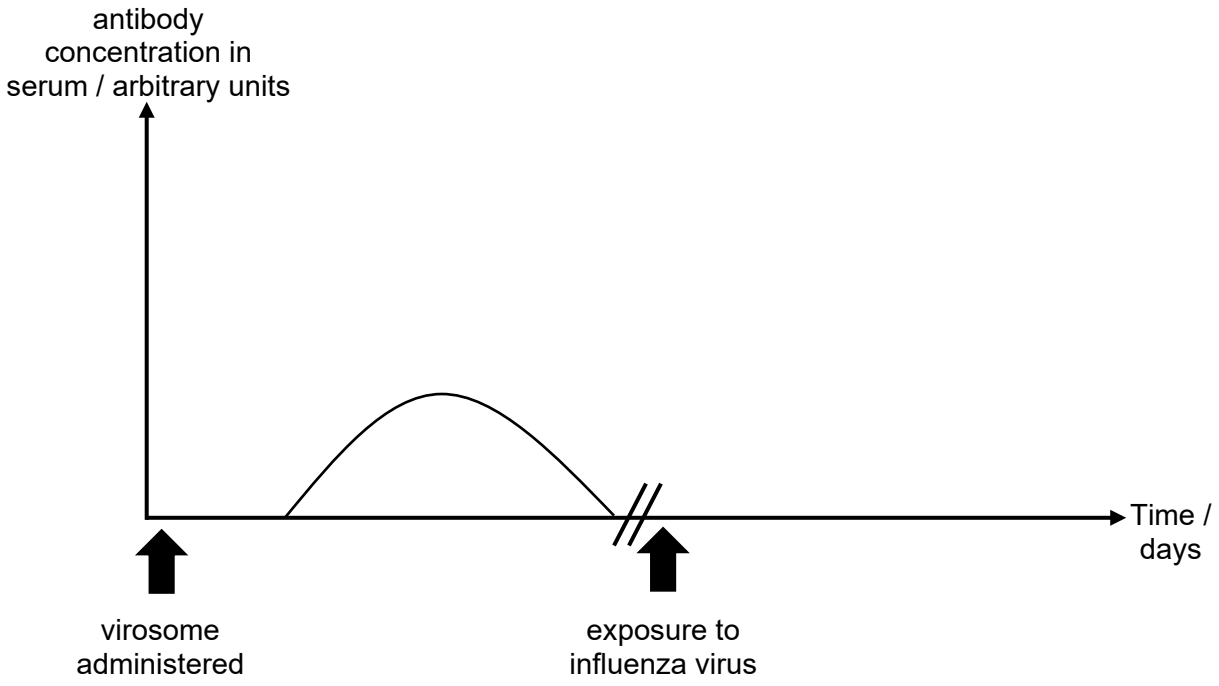

Fig. 1.2

(c) **(i)** On Fig. 1.2, illustrate the antibody concentration the patient's serum after he was exposed to an influenza virus with the same haemagglutinin and neuraminidase found on the virosome. [1]

Shorter time for antibody appearance + steeper gradient + higher peak for concentration of antibody

(ii) Explain your answer to **(c)(i)**. [3]

1. memory B cells are involved in the secondary immune response when re-exposed to the same haemagglutinin and neuraminidase;
2. These memory B cells undergo **faster** clonal expansion and differentiation into antibody-secreting plasma B cells; (R: "rapid" because lack idea of comparison with primary immune response)
3. which will result in the faster production of **greater concentration** of antibodies (A: more antibodies);
4. Note: Accept "for a **longer** period of time" as a point if it tallies with their graph.

(d) **(i)** The white blood cells that produce antibodies originate from a stem cell.

Identify the stem cells in the body that these white blood cells are derived from. [1]

lymphoid stem cell;

R: blood stem cell

(ii) Describe the differentiation potential of these stem cells. [2]

1. These stem cells are **multipotent**;
2. They have the ability to differentiate into several related specialised blood cell types; (R: have the ability to differentiate into WBCs)

(e) Due to the emergence of new strains of influenza virus, a new influenza vaccine has to be developed periodically.

Other than mutations, explain how new strains of influenza virus can come about. [4]

1. New strains of influenza can come about as a result of **antigenic shift**;
2. This happens when two or more strains of influenza viruses infect the **same** host cell;
3. Reassortment of the different RNA segments occur resulting in new combination of viral RNA segments in a virion;
4. New combination of hemagglutinin and neuraminidase embedded on the viral envelope;

Fig. 1.3 shows a stage of protein synthesis during the reproductive cycle of influenza virus. This takes place in the cytosol of a human cell.

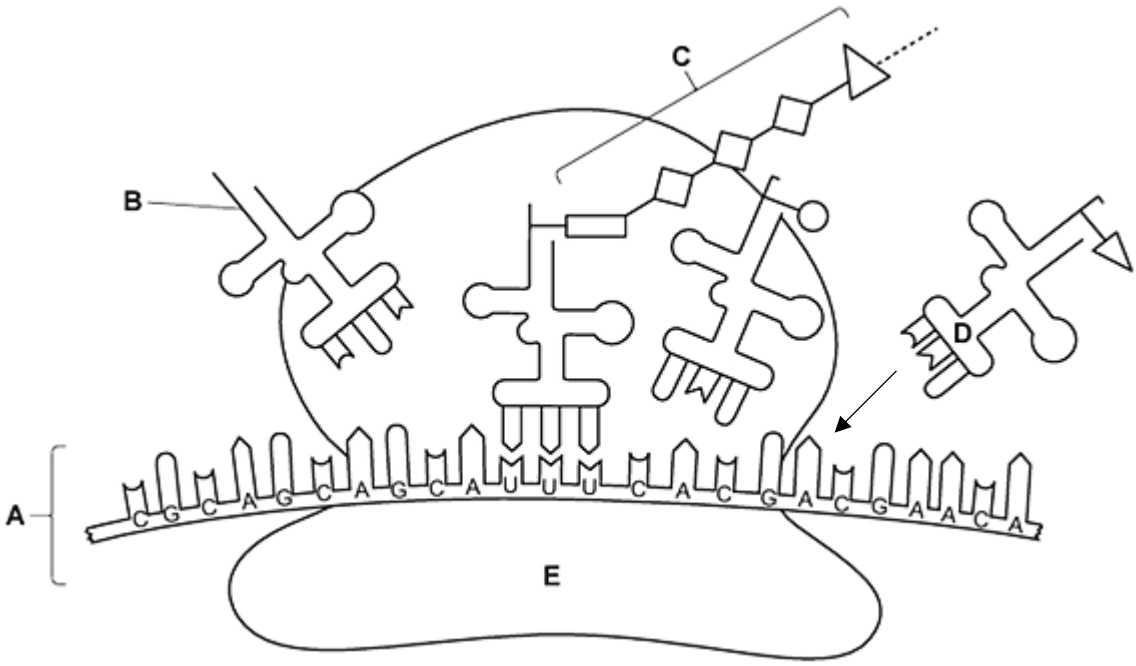

Fig. 1.3

(f) (i) Name the stage of protein synthesis shown in Fig. 1.3. [1]

Translation;
R: elongation

(ii) State the base sequence of the anticodon on structure **D**. [1]

3' CUG 5' / 5' GUC 3'

Note to marker: can accept "GUC" without directionality, but remove from mark scheme!

(iii) Explain the roles of structure **A** in the reproductive cycle of influenza virus. [3]

1. Structure A is **viral mRNA**;
2. It serves as the **template** for translation for the **synthesis of viral proteins**;
3. It also serves as the **template** for **synthesis of viral genome**;

Note to marker: "viral" must appear in points 2 and 3.

(iv) After the synthesis of structure **C** is completed, it will fold into a viral protein.

Suggest if this viral protein is likely to be haemagglutinin or RNA-dependent RNA polymerase. Explain your answer. [2]

1. The viral protein is likely to be **RNA-dependent RNA polymerase**;
2. This is because RNA-dependent RNA polymerase is synthesised by **free ribosomes** whereas haemagglutinin is synthesised by **ribosomes on the rough endoplasmic reticulum**;

(g)	In a human cell, proteins can undergo post-translational modifications. Explain the significance of such modifications. [2]
	Any 2: **1.** The protein can be **phosphorylated,** which either **activate / inactivate** the protein; **2.** The protein can be **glycosylated** whereby one or more sugar monomers are added, to form **glycoproteins**; **3.** The protein can be **ubiquitinated**, whereby the addition of ubiquitin allows **proteasomes** to identify the protein for **degradation**; **4.** **Removal of the inhibitory portions** of the polypeptide chain by **proteases,** which allows the protein to become **functional**; (A: protein undergoes **proteolytic cleavage** to become a **functional** protein)
(h)	Unlike eukaryotic cells, prokaryotic cells lack membrane bound organelles. Explain how this difference in structure results in a difference in protein synthesis between eukaryotic and prokaryotic cells. [3]
	1. Eukaryotic cells **have nuclear envelope** whereas prokaryotic cells **do not**; 2. As such, **transcription and translation** can **occur simultaneously** in prokaryotic cells while **translation** can only **occur after transcription is completed** in eukaryotic cells; 3. **Post-transcriptional modification** **occurs** in eukaryotic cells but **does not occur** in prokaryotic cells; AVP: 4. Eukaryotic cells **have rough endoplasmic reticulum** whereas prokaryotic cells **do not**; 5. Therefore, translation can take place on the **rough endoplasmic reticulum** in eukaryotes but only occurs in **cytoplasm** for prokaryotes;
	[Total: 30]

2 There are over 200 species of catfish. All catfish evolved from a common ancestor.

Fig. 2.1 shows how some species of catfish are classified. This phylogenetic tree is based on the evolutionary links between these species.

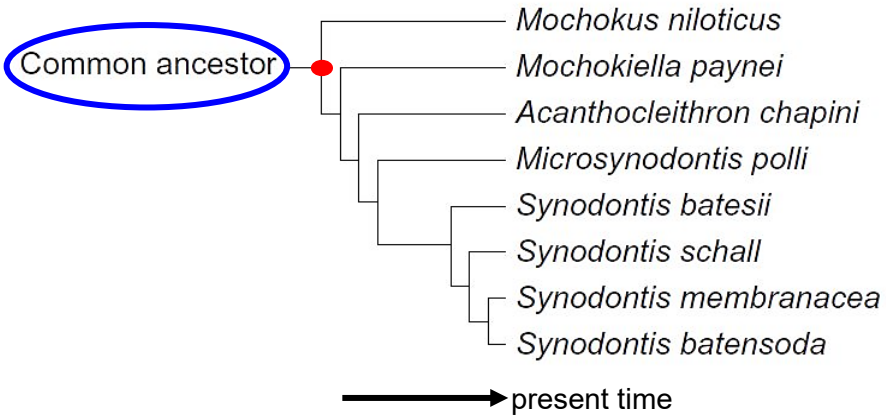

Fig. 2.1

(a) (i) A student who saw the phylogenetic tree in Fig. 2.1 wrote the following statement "*Synodontis batensoda* was descended from *Mochokus niloticus*".

Evaluate the validity of this statement. [2]

1. This statement is **not valid**;
2. This is because **both catfish species** had the **same common ancestor**, *Synodontis batensoda* was not descended from *Mochokus niloticus*;

   Note: Mochokus niloticus had **diverged** (see red circle) from that common ancestor **early** on in time, hence it has a position on the phylogenetic tree near to common ancestor;

(ii) The phylogenetic tree shown can be a useful aid in determining a phylogenetic species.

Define the phylogenetic species concept. [1]

A phylogenetic species is the **smallest group of organisms** that **share** a **most recent common ancestor** and can be distinguished from other such groups;

(iii) State two pieces of evidence that can be used in determining the phylogenetic history of a species. [1]

The phylogenetic history of a species can be obtained by comparing **homologous morphological structures** and **homologous molecular sequences**, with those of other organisms;

(iv) Suggest one advantage of using phylogenetic species concept for classification over another named species concepts. [1]

1. Using this definition to classify species will **avoid mistakenly classifying organisms** based on superficial **morphological similarities via morphological species concept** as the characteristics that are compared are based on **common ancestry / homology**;

   OR

   Morphological similarities may be due to **convergent evolution**;
2. It has the added advantage of **providing accurate historical information** about the **speciation event** that the **(another named species concept)** cannot;
3. To determine phylogeny, genetic, DNA sequences, amino acid sequences, morphological, fossil evidence, hybridization (mating) studies are conducted, so phylogenetic concept of the species **potentially** presents the **most accurate representation of a species (over other named species concepts);**

   Any one

   (R: if no named species concept was compared)

Regressive evolution is a change in a population over time that involves the **loss** of certain phenotypic characteristics. It is thought to be caused by either genetic drift or natural selection.

An example of regressive evolution is the loss of eyes in one form of the Mexican cavefish, *Astyanax mexicanus*. These eyeless cavefish live in caves that are in total darkness.

There are three theories to explain how the loss of eyes in the cavefish has occurred.

Theory A
There is no advantage to having eyes in a cave that is in total darkness, where energy sources are scarce. Having eyes is a disadvantage as there may be an energy cost.

Theory B
A mutation has occurred in a single gene. This mutation has two effects:
- a lack of eye development
- an increase in the number of chemoreceptors on the skin, for better detection of molecules released by other organisms in the surrounding.

Theory C
Various mutations occurred in the genes responsible for eye development over a period of time. Randomly, these mutations increased in frequency in small isolated populations. Eventually this produced a population of eyeless cavefish.

(b) State and explain which theories are based on natural selection as the cause of loss of eyes. [5]

1. **A and B**;

2. In A, **low availability of energy / food** to cave-dwelling fishes acts as a **selection pressure**;
3. **less energy used** (e.g. to synthesize proteins for eye development) means a **lower need for food**, which could be a **selective advantage**;

4. In B, **selective advantage** of having **more chemoreceptors**;
5. **More chemoreceptors** allow for **better detection of food / prey / mate** in caves; (WTTE)

[Total: 10]

3 The interpupillary distance (IPD) is the distance in millimetres between the centres of the pupils of the eyes. Fig. 3.1 shows how IPD is measured.

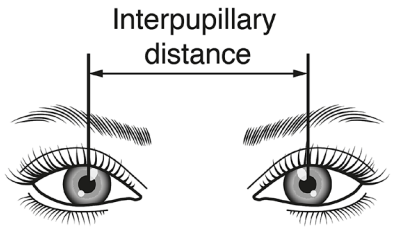

Fig. 3.1

IPD is one example of a characteristic of human facial structure that shows variation.

Fig. 3.2 shows the pattern of variation in IPD in a large sample of adults.

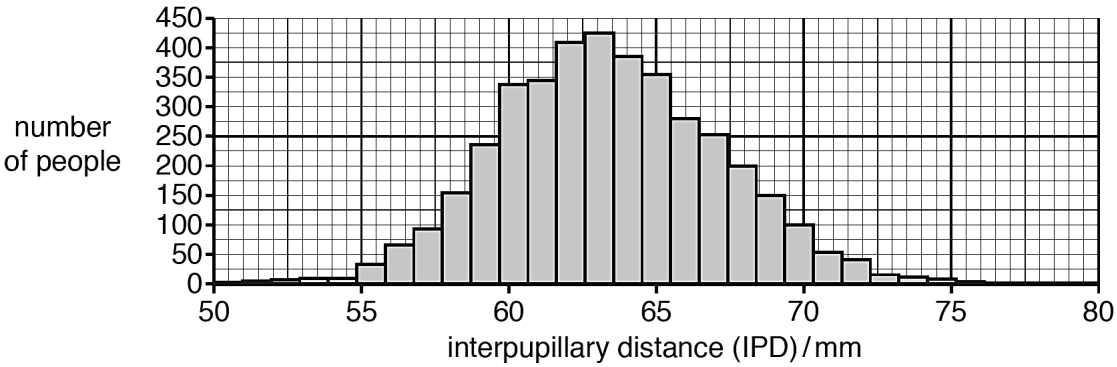

Fig. 3.2

(a) **(i)** Name the type of variation shown in Fig. 3.2. Explain your answer. [2]

1. **Continuous;**
2. Range of IPD between 50mm and 76mm as seen in Fig. 3.2 are due to **slight phenotypic differences** that vary along a **continuum**;

(ii) Explain **two** factors that contribute to variation in IPD in humans. [2]

1. The range of phenotypes indicates **polygenic inheritance**, where **multiple genes** are involved in determining IPD;
2. There may be an **additive effect** of multiple genes, where each gene has a small overall effect on IPD;
3. In addition, **environmental factors** may also affect IPD;
   Note: the environmental factors can include age, diet, disease, parasites, chemicals, mutagens, alcohol in utero, which can all affect embryonic growth/development;

CIE answer key:
Any three from: (1) several/many genes; (2) additive effect / gene products interact; (3) environment has big/significant effect; (named) environmental factors affects gene expression; e.g. age/diet/disease/parasites/chemicals/mutagens/alcohol in utero can affect development/growth/IPD/phenotype;

(b) Individuals with an IPD of 70 mm or more have a mutation in the *PAX3* gene that results in less PAX3 protein being made.

The normal role of the PAX3 protein is to increase the expression of many other genes involved in embryonic development. These genes affect a range of phenotypic features such as facial structure, hearing, and eye colour.

(i) Identify which type of specific transcription factor the PAX3 protein functions as. [1]

Activator

(ii) Describe how the PAX3 protein controls the expression of other genes. [3]

1. **PAX3 / activator binds to enhancer** region of other genes involved in embryonic development;
2. This causes **spacer DNA to bend** and bring the activator-enhancer complex in close proximity with the promoter region;
3. Thus, helping to **recruit general transcription factors and RNA polymerase** to bind to the **promoter** and form the **transcription initiation complex**;

The chimpanzee, *Pan troglodytes*, has DNA that is 98.5% similar to humans, including possession of the *PAX3* gene. Investigations show that chimpanzees express higher levels of the PAX3 protein during embryonic development than humans.

Fig. 3.3 shows a chimpanzee, *Pan troglodytes*.

Fig. 3.3

(iii) Suggest how knowledge of the *PAX3* gene helps scientists explain how humans and chimpanzees are very different in facial structure, even though they have very similar DNA. [2]

Any 2:

1. A small difference in *PAX3* gene expression has a **large effect** on phenotype / facial structure;
2. Because PAX3 protein **regulates/controls the expression** of many other genes involved in embryonic development;
3. This results in a difference in level/magnitude/intensity/pattern of gene expression of other genes in chimpanzees as compared to humans;

4. Also, higher level of PAX3 protein/expression during embryonic development decreases IPD in chimpanzees / decreases face width (OWTTE);

CIE answer key:
Any three from: (1) small genetic difference/one gene/*PAX3* gives rise to many/big phenotypic effects; (2) because PAX3 regulates/controls many other genes; (3) different level/magnitude/ intensity/pattern of gene expression compared to other genes in chimpanzees; (4) higher *PAX3* expression/protein levels makes chimpanzees eyes closer together / chimpanzee IPD smaller / decreases face width;

[Total: 10]

Modified from CIE 9700/41 May/June 2019 P4 Q2

Section B

Answer **one** question in this section.

Write your answers on the Answer Booklet provided.

Your answers should be illustrated by large, clearly labelled diagrams, where appropriate.

Your answers must be in continuous prose, where appropriate.

Your answers must be set out in parts **(a)** and **(b)**, as indicated in the question.

4 **(a)** Compare evolution by natural selection in asexually reproducing populations with evolution by natural selection in sexually reproducing populations. [10]

S – Similarities (max 5)

In both asexually reproducing and sexually reproducing populations:

1. Natural selection occurs due to preexisting **genetic variation** within the population;
2. Genetic variation can arise due to spontaneous / **random mutations**, which introduce **new** alleles into the population;
3. **Phenotypic variation** will therefore exist in the population;
4. Different niches/environments present **different selection pressures**, which act on phenotypic differences within the sub-populations;
5. Individuals with **favourable traits** for that niche/environment have a **selective advantage**, and hence are **selected for**; (ORA)
6. These individuals have a higher chance of **surviving and reproducing** to **pass on their alleles** to the next generation;
7. Thus, resulting in an **increase in frequency of favourable alleles** within the population;

D – Differences (max 4)

Feature of comparison	**in asexually reproducing populations:**	**in sexually reproducing populations:**
Extent of genetic variation*	1. There is **less genetic variation** in an asexually reproducing population as a result of **binary fission /budding/spore formation** (A: any example of asexual reproduction);	2. There is **greater genetic variation** in a sexually reproducing population as a result of **meiosis and fertilisation**;
Susceptibility to be wiped out*	3. The population will be **more susceptible to be wiped out** when the environment changes;	4. The population will be **less susceptible to be wiped out** when the environment changes;
Introduction of new combinations of alleles	5. New combinations of alleles in the bacterial chromosome may arise due to horizontal gene transfer: transduction and/or transformation;	6. New combinations of alleles in eukaryotic chromosomes arises due to crossing over during prophase I;
Transfer of genes;	7. New genes may also be introduced / transferred from one cell to another in the form of plasmid DNA during conjugation;	8. New genes are not introduced/transferred from one cell to another;

R:

- all individuals in asexually reproducing populations are **genetically identical**;
- natural selection occurs **at random / is a random process**;

QWC (1m):

- Describes **at least 2 relevant** similarities and differences (about natural selection);
- Includes **both** comparisons from the first two rows* (D1 to D4) for flow of points;

- Differences must be **point-for-point** + have **consistently clear features of comparison** (instead of one entire paragraph on asexually reproducing populations followed by another on sexually reproducing populations);

(b) Substances move in and out of cells via several ways.

Explain the significance of named transport processes to the functions of blood cells. [15]

R – Red blood cells (max 3)

transport process & substance	function of red blood cell
1. **Diffusion** of (dissolved) **gases**, such as oxygen and carbon dioxide, into and out of red blood cells;	2. Allows oxygen to bind with haemoglobin (A: formation of oxyhaemoglobin) for transport from the lungs to the rest of the body; 3. Allows carbon dioxide (A: formation of carboxyhaemoglobin) to be transported back to the lungs to be exhaled;
4. **Facilitated diffusion** of **glucose** via glucose transporters / carrier proteins into red blood cells;	5. for **glycolysis** to take place (A: ATP synthesis to continue); R: link reaction, Krebs cycle, oxidative phosphorylation – no mitochondria in RBCs

P – Phagocytes (max 6)

transport process & substance	function of phagocyte
1. **Phagocytosis** of pathogens or dead cells / cell debris by phagocytes, such as dendritic cells / neutrophils / macrophages;	2. Prevent healthy host cells from being **infected** by pathogens; 3. Digests/breaks down pathogen using hydrolytic enzymes in the lysosome; 4. Clears dead cells/cell debris to allow for tissue repair;
5. Phagocytes can also take in pathogens via **receptor-mediated endocytosis** when the Fc region of antibodies bound to an antigen binds to the Fc receptor on the phagocyte;	6. This **promotes phagocytosis** of the opsonised pathogen / toxin, which helps to clear the infection;
7. **Secretion** of cytokines / chemokines by phagocytes via **exocytosis**;	8. Induces inflammation + facilitates further **recruitment of phagocytes** to the site of infection;
9. **Secretion** of antimicrobial peptides by phagocytes (neutrophils, macrophages);	10. Antimicrobial peptides serve to kill bacteria cells; 11. e.g. **lysozyme** cleaves glycosidic bonds in the peptidoglycan cell wall, resulting in **osmotic lysis** of bacterial cells;

L – Lymphocytes (max 6)

transport process & substance	function of lymphocyte
1. **Granzymes and perforins** are released from cytotoxic T cells via **exocytosis**;	3. Perforins form pores in the infected cell's cell surface membrane, which leads to **cell lysis**;

2. Facilitated diffusion of granzymes into infected cells through pores formed by perforins;	4. Granzymes trigger **apoptosis** of the infected cell;
5. **Secretion** of cytokines by T helper cell via **exocytosis**;	6. Helps to activate naïve B cells; (mark once under **P** or **L**)
7. Naïve B cell takes in specific antigen bound to its B cell receptor via receptor-mediated **endocytosis**;	8. The antigen is processed and attached to MHC molecule, presented to helper T cells as part of a peptide:MHC complex;
9. **Antibodies** are secreted by **plasma cells** via **exocytosis**;	10. Antibodies bind to specific epitope of an antigen to **neutralise pathogen** / toxin; 11. Fc region of antibodies bound to an antigen binds to the Fc receptor on the phagocyte **promote phagocytosis** by opsonisation; (mark once under **P** or **L**)
12. AVP	

QWC (1m):

- Identifies the transport process that occurs in **at least 2 types of named blood cells**;
- Points clearly organised by either type of blood cell OR transport process;
- **Clear links** made between the named transport process and the function of the blood cell;

5 (a) In 1665, Robert Hooke discovered cells using one of the first microscopes ever invented. Subsequently, the biologists Matthias Schleiden and Theodor Schwann summarised a large number of observations by themselves and others.

Their conclusions have come to be known as the cell theory, and forms the foundation for understanding the reproduction and growth of all organisms.

Using knowledge of the cell theory as well as named examples and/or processes, describe the universal features of cells. Discuss ways to test the cell theory as well as how viruses challenge the cell theory. [10]

A) Universal Features of Cells

1. The cell is the **smallest unit of life**
2. with reference to named **unicellular** organisms like **bacteria**;

3. All **known living organisms** are **made up of cells**
4. with appropriate examples given e.g. multicellular **plant/animal**;

5. **All cells come from pre-existing cells**
6. illustrated by processes such as **mitosis / binary fission /budding**;

B) Ways to test cell theory

7. Employing use of tools like **light microscopes** to study if different cell types are found in multicellular organisms;
8. Employing use of tools like **light microscopes** to study if **cells undergo mitosis / binary fission / budding**;
9. AVP;

C) How viruses challenge cell theory

10. Viruses are **acellular** and **lack cellular organelles**;
11. Viruses **lack the ability to reproduce on their own independently** and can only undergo replication in **living cell** / **host**;
12. Viruses **do not grow**;
13. AVP;

QWC (1m):

1) Coverage of universal features of cells must be accompanied by named example or process.
2) Answer covers points from section A, B and C;

(b) Explain the significance of specificity during transcription and translation in eukaryotic organisms. [15]

A) **Transcription** (Total max 4)

Description		Significance	
Transcription initiation / regulation:			
1.	**General transcription factors** have a **DNA binding site** which is **complementary in shape and charge** to **promoter / TATA / GC / CAAT box**; OR **RNA polymerase** has a **DNA binding site** which is **complementary in shape and charge** to **promoter**;	2.	Specific binding of GTFs **recruits RNA polymerase** to **promoter** to form the **transcription initiation complex**; OR RNA polymerase **binds** to the **promoter** and the **transcription initiation complex** is formed eventually;
3.	**Activators** have a **DNA binding site** which is **complementary in shape and charge** to **enhancers** which have a specific sequence OR **Repressors** have a **DNA binding site** which is **complementary in shape and charge** to **silencers** which have a specific sequence	4.	**Promotes formation of transcription initiation complex** and hence **upregulates gene expression**; OR **Prevents formation of transcription initiation complex** and hence **downregulates gene expression;**
(R: if no / wrong explanation of significance)			
Transcription process:			
5.	**Active site of RNA polymerase** is **complementary in shape and charge** to **ribonucleotides**	6.	To form **phosphodiester bond** between existing strand and incoming ribonucleotide to **synthesise RNA**;
7.	**Complementary base pairing** between incoming ribonucleotide with **template DNA strand**, whereby **adenine base pairs with uracil, thymine with adenine, and guanine with cytosine**;	8.	To ensure **correct RNA is synthesised** / **DNA is transcribed correctly** (WTTE)**;**

B) **Translation** (Total max 10) (Ignore amino acid activation)

Description		Significance	
Translation initiation/ regulation:			
1.	**Eukaryotic initiation factors** have a **binding site complementary in conformation** to the **5' cap** and **3' poly-A tail**. OR **Eukaryotic initiation factors** have a **binding site complementary in conformation** to **small ribosomal subunit and initiator tRNA**;	2.	**The large ribosomal subunit** can also subsequently **bind**, resulting in the **formation** of the **translation initiation complex**;

Translation process:			
3.	The structure of each tRNA is made of a single stranded **RNA molecule folded** back on itself into a **specific 3D conformation** (A: reference to clover leaf shape) by **hydrogen bonding** between **complementary base pairs** at certain regions;	4.	The specific shape allows the tRNA to **bind** to the **specific aminoacyl tRNA synthetase and the E/P/A site** (WTTE) of the large ribosomal subunit and to perform its function in carrying **specific amino acids** to the ribosome;
5.	mRNA contains triplet base codes known as **codons which complementary base pairs** with **specific anticodon** on tRNA;	6.	Each mRNA **codon codes for a specific amino acid;** Or Specific reference to number and sequence of amino acids is the **primary structure** of a protein which determines the **secondary**, **tertiary** and quaternary (if applicable) structure of the protein and hence the **function** of the protein;
7.	**Start codon AUG complementary** to the **specific anticodons** of the **initiator tRNA** (bearing methionine)	8.	Determines the **start** of a polypeptide;
9.	**Release factors / proteins** have **specific binding sites** for **stop codons UAG, UAA, UGA**;	10.	Determines the **end** of a polypeptide;
11.	**mRNA specifically binds to mRNA binding site on small ribosomal subunit** via **complementary base pairing** whereby adenine base pairs with uracil and guanine base pairs with cytosine;	12.	For **correct positioning** of the adjacent tRNAs;
13.	Large ribosomal subunit has **specific sites** like **amino-acyl site** (A site) and **peptidyl site** (P site) for **binding** of **aminoacyl-tRNAs**;	14.	**A site holds the tRNA carrying the next amino acid** to be added to the polypeptide chain while **P site holds the tRNA attached to the growing polypeptide**;
15.	**Peptidyl transferase** on large ribosomal subunit has **active site complementary in shape and charge** to catalyse **peptide bonds** formation between amino acids	16.	To extend the chain of amino acids, forming a **polypeptide**;

QWC: 1) Transcription process must include **both initiation** and **elongation** processes.
2) Translation process must show **initiation** and **elongation processes**.
3) Clear description of transcription and translation stages with clear explanation of the significance of described stage.