



Biology

Higher Level

Paper 1A — Mock Examination

Mock Exam 2

Calculator required

Time allowed: **1 hour 5 minutes**

Maximum mark: **40 marks**

Candidate information

Candidate name:

Session number:

Date:

Topic emphasis: unity and diversity of living organisms, form and function at the molecular, cellular and organism level, interaction and interdependence within organisms and ecosystems, and continuity and change through inheritance, evolution and ecological succession.

Instructions to candidates

- Write your session number in the box on the cover.
- Do not open this examination paper until you are told to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.

The mark allocation is shown in square brackets at the end of each question; every question in this paper is worth one mark **[1]**. There is no penalty for an incorrect answer, so you should attempt every question. Where a numerical answer is required, show no working on the answer sheet — record only the letter of the option you have chosen.

Assume standard conditions of temperature and pressure unless the question states otherwise. Where a formula is needed, it is given in the question.

Mark allocation

Questions 1–20	[20 marks]
Questions 21–40	[20 marks]
Total	[40 marks]

Section A

Answer all questions. The maximum mark for each question is given in square brackets.

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- 1.** Which property of water results from hydrogen bonding between water molecules? **[1]**
- A.** A low specific heat capacity, which allows rapid temperature change
 - B.** Cohesion, which allows an unbroken column of water to be pulled up a stem
 - C.** The ability to dissolve non-polar substances such as lipids
 - D.** A higher density as a solid than as a liquid
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- 2.** Two monosaccharides react in a condensation reaction. What is formed? **[1]**
- A.** A glycosidic bond, with the release of a molecule of water
 - B.** A peptide bond, with the release of a molecule of water
 - C.** An ester bond, with the uptake of a molecule of water
 - D.** A glycosidic bond, with the uptake of a molecule of water
-
- 3.** How does a phospholipid differ in structure from a triglyceride? **[1]**
- A.** It contains glycerol instead of fatty acids.
 - B.** It contains only saturated fatty acid chains.
 - C.** One fatty acid is replaced by a phosphate group, making the molecule amphipathic.
 - D.** It contains four hydrocarbon rings instead of a glycerol backbone.

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- 4.** How does a non-competitive inhibitor reduce the rate of an enzyme-catalysed reaction? **[1]**
- A.** It binds to the active site and prevents the substrate from entering.
 - B.** It binds to a site away from the active site and alters the shape of the active site.
 - C.** It raises the temperature of the reaction mixture above the optimum.
 - D.** It converts the substrate into a product that cannot be released.
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- 5.** Cells from a plant epidermis were placed in a concentrated sucrose solution. The cytoplasm shrank away from the cell walls. What has happened? **[1]**
- A.** Sucrose has been actively transported out of the cells.
 - B.** The cell walls have been digested by enzymes in the solution.
 - C.** Water has entered the cells by osmosis and burst the vacuoles.
 - D.** Water has left the cells by osmosis, because the solution has a lower water potential.
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- 6.** The sodium–potassium pump moves three sodium ions out of an axon for every two potassium ions moved in. What is the consequence of this? **[1]**
- A.** The inside of the axon becomes negative relative to the outside.
 - B.** The inside of the axon becomes positive relative to the outside.
 - C.** The concentrations of sodium and potassium ions become equal on both sides.
 - D.** An action potential is generated along the whole length of the axon.

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- 7.** What is the net yield of adenosine triphosphate (ATP) from one molecule of glucose during glycolysis? **[1]**
- A.** Two ATP are used and two are produced, giving no net gain.
 - B.** No ATP is used and two are produced, giving a net gain of two.
 - C.** Two ATP are used and four are produced, giving a net gain of two.
 - D.** Two ATP are used and thirty-eight are produced, giving a net gain of thirty-six.
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- 8.** Yeast cells respiring anaerobically convert pyruvate into ethanol and carbon dioxide. What is the purpose of this conversion? **[1]**
- A.** To generate ATP directly from pyruvate
 - B.** To regenerate NAD so that glycolysis can continue
 - C.** To supply electrons to the electron transport chain
 - D.** To remove the oxygen that would otherwise inhibit the enzymes
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- 9.** Which products of the light-dependent reactions are needed to convert glycerate-3-phosphate (GP) into triose phosphate (TP)? **[1]**
- A.** Oxygen and water
 - B.** Carbon dioxide and RuBP
 - C.** ATP and oxygen
 - D.** ATP and reduced NADP

10. Why do the leaves of most plants appear green? **[1]**

- A.** Chlorophyll absorbs green light most strongly of all wavelengths.
- B.** Green light provides the energy used to split water in photosystem II.
- C.** Chlorophyll converts other wavelengths of light into green light.
- D.** Green light is reflected and transmitted, while red and blue light are absorbed.

11. In which direction does DNA polymerase III add nucleotides to a growing strand, and to what does it add them? **[1]**

- A.** In the 5' to 3' direction, to the free 3' end of an existing chain
- B.** In the 3' to 5' direction, to the free 5' end of an existing chain
- C.** In either direction, depending on the template strand used
- D.** In the 5' to 3' direction, to the free 5' end of the template strand

12. Which enzyme carries out transcription, and which strand of DNA is used as the template? **[1]**

- A.** DNA polymerase, using the sense strand
- B.** RNA polymerase, using the antisense strand
- C.** RNA polymerase, using both strands at the same time
- D.** Helicase, using the antisense strand

13. What is the role of transfer RNA (tRNA) in translation? **[1]**

- A.** It carries a specific amino acid and has an anticodon complementary to a codon on the mRNA.
- B.** It catalyses the formation of peptide bonds between adjacent amino acids.
- C.** It carries the coded instructions from the nucleus to the cytoplasm.
- D.** It removes the introns from the primary transcript before translation begins.

14. What is the usual effect of the methylation of the DNA of a gene? **[1]**

- A.** The base sequence of the gene is permanently changed.
- B.** The gene is transcribed more rapidly than before.
- C.** Transcription of the gene is reduced or prevented.
- D.** The gene is copied and inserted elsewhere in the genome.

15. What is a single-nucleotide polymorphism (SNP)? **[1]**

- A.** The loss of a single chromosome from a gamete
- B.** A single base that varies between individuals at one position in the genome
- C.** A repeated sequence of bases that varies in length between individuals
- D.** A single gene that codes for more than one polypeptide

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- 16.** A human gene inserted into a plasmid can be expressed by a bacterium. What makes this possible? **[1]**
- A.** Bacteria and humans have the same number of genes.
 - B.** Bacteria can carry out alternative splicing of the transcript.
 - C.** The genetic code is universal, so the same codons specify the same amino acids.
 - D.** Plasmids convert human DNA into bacterial DNA.
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- 17.** Which regions of the genome are compared when DNA profiles are produced? **[1]**
- A.** Regions of repeating sequences that vary in length between individuals
 - B.** The base sequences of genes coding for enzymes
 - C.** The sequences of the promoters of highly expressed genes
 - D.** The sequences of ribosomal RNA genes
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- 18.** Which observation is an exception to the principle that living organisms are composed of individual cells? **[1]**
- A.** Red blood cells lose their nucleus as they mature.
 - B.** Prokaryotes have no nucleus or membrane-bound organelles.
 - C.** Phloem sieve tube elements are connected to companion cells.
 - D.** Striated muscle fibres contain many nuclei within one continuous cytoplasm.

19. What is the ratio of surface area to volume of a cube of side 3 mm? **[1]**

- A.** 0.5 : 1
- B.** 1 : 1
- C.** 2 : 1
- D.** 3 : 1

20. Which occurs during binary fission in a prokaryote but not during mitosis in a eukaryote? **[1]**

- A.** Replication of the DNA before division
- B.** Division of the cytoplasm to give two cells
- C.** Production of two genetically identical daughter cells
- D.** Separation of the copies of the DNA without a spindle of microtubules

21. What is the role of cyclins in the cell cycle? **[1]**

- A.** They bind to cyclin-dependent kinases and trigger progression to the next stage.
- B.** They attach the chromosomes to the spindle microtubules.
- C.** They break down the nuclear envelope at the start of mitosis.
- D.** They supply the ATP required for the separation of chromatids.

22. What is the likely consequence of a mutation that makes a proto-oncogene permanently active? **[1]**

- A.** The cell enters a permanent resting state.
 - B.** The cell divides in an uncontrolled way, which may lead to tumour formation.
 - C.** The cell can no longer replicate its DNA.
 - D.** The cell undergoes meiosis instead of mitosis.
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23. Which feature of the alveoli increases the rate of gas exchange in the human lung? **[1]**

- A.** A thick layer of muscle in the alveolar wall
 - B.** A dry inner surface that prevents gases from dissolving
 - C.** A layer of cartilage that holds each alveolus open
 - D.** A wall of a single layer of very thin cells, giving a short diffusion distance
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24. What happens in the thorax during inhalation? **[1]**

- A.** The diaphragm relaxes and the internal intercostal muscles contract.
- B.** The volume of the thorax decreases and the pressure inside it rises.
- C.** The diaphragm contracts and flattens, and the pressure in the thorax falls.
- D.** The abdominal muscles contract to force the diaphragm upwards.

25. Why do arteries have thick walls containing elastic fibres and muscle?
[1]

- A.** To allow substances to be exchanged with the surrounding tissue
 - B.** To prevent the backflow of blood towards the heart
 - C.** To slow the flow of blood so that gas exchange can occur
 - D.** To withstand and smooth out the surges of high pressure produced by the heart
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26. What is the function of the sinoatrial node? [1]

- A.** It initiates each heartbeat and sets the rate of contraction.
 - B.** It closes the semilunar valves at the end of ventricular systole.
 - C.** It carries oxygenated blood to the muscle of the heart wall.
 - D.** It prevents the impulse from spreading to the ventricles.
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27. Why are antibiotics not effective against viral diseases? [1]

- A.** Viruses are much larger than bacteria and cannot be absorbed.
- B.** Viruses lack the metabolic pathways and structures that antibiotics disrupt.
- C.** Viruses are always found inside the bloodstream, where antibiotics cannot act.
- D.** Viruses reproduce too slowly to be affected by antibiotics.

28. How does infection with human immunodeficiency virus (HIV) lead to the symptoms of AIDS? **[1]**

- A.** The virus destroys red blood cells, so less oxygen is carried.
- B.** The virus produces a toxin that damages the lining of the lungs.
- C.** The virus prevents blood from clotting after an injury.
- D.** The virus destroys helper T-cells, so antibody production is reduced.

29. How does myelination increase the speed of conduction of a nerve impulse? **[1]**

- A.** It increases the diameter of the axon along its whole length.
- B.** It allows depolarization to occur only at the nodes of Ranvier, so the impulse jumps between them.
- C.** It increases the number of sodium–potassium pumps in the axon membrane.
- D.** It allows the impulse to travel in both directions at once.

30. What causes vesicles of neurotransmitter to fuse with the presynaptic membrane? **[1]**

- A.** The influx of calcium ions through voltage-gated channels
- B.** The binding of neurotransmitter to postsynaptic receptors
- C.** The action of the enzyme that breaks down the neurotransmitter
- D.** The outflow of potassium ions from the presynaptic neuron

31. How does signalling by hormones differ from signalling by neurons? **[1]**

- A.** It is faster and affects only one target organ.
- B.** It is slower, more widespread and generally longer lasting.
- C.** It depends on electrical impulses travelling along the blood vessels.
- D.** It produces effects that are always under conscious control.

32. What is the effect of antidiuretic hormone (ADH) on the kidney? **[1]**

- A.** More aquaporins are placed in the collecting duct membrane, so more water is reabsorbed.
- B.** Fewer aquaporins are placed in the collecting duct membrane, so a dilute urine is produced.
- C.** More glucose is reabsorbed in the proximal convoluted tubule.
- D.** More sodium ions are actively pumped into the filtrate.

33. Cystic fibrosis is caused by a recessive allele. Both parents of a child are heterozygous carriers. What is the probability that a child of theirs will be a carrier but not affected? **[1]**

- A.** $\frac{1}{4}$
- B.** $\frac{1}{2}$
- C.** $\frac{2}{3}$
- D.** $\frac{3}{4}$

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- 34.** A woman who is colour blind has children with a man who has normal colour vision. Colour blindness is caused by a recessive allele carried on the X chromosome. What are the expected phenotypes of their children? **[1]**
- A.** All the sons and all the daughters will be colour blind.
 - B.** All the daughters will be colour blind and all the sons will have normal vision.
 - C.** Half of the sons and half of the daughters will be colour blind.
 - D.** All the sons will be colour blind and all the daughters will be carriers.
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- 35.** Which characteristic shows continuous variation? **[1]**
- A.** Human ABO blood group
 - B.** The ability to roll the tongue
 - C.** Height in an adult human population
 - D.** Sex in humans
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- 36.** A population of bacteria is repeatedly exposed to an antibiotic. How does resistance become common in the population? **[1]**
- A.** Individual bacteria develop resistance because they need it to survive.
 - B.** Bacteria that already carry a resistance allele survive and reproduce, passing it on.
 - C.** The antibiotic causes all the bacteria to mutate in the same way.
 - D.** Resistant bacteria are produced only by sexual reproduction between species.

37. Two closely related species of frog live in the same pond but one breeds in early spring and the other in mid-summer. What type of isolation is this? **[1]**

- A.** Geographical
- B.** Behavioural
- C.** Temporal
- D.** Hybrid sterility

38. Which sequence of taxonomic ranks is arranged from the largest to the smallest group? **[1]**

- A.** Domain, kingdom, phylum, class, order, family, genus, species
- B.** Kingdom, domain, class, phylum, family, order, species, genus
- C.** Domain, phylum, kingdom, order, class, genus, family, species
- D.** Kingdom, phylum, class, domain, family, order, genus, species

39. What is the role of saprotrophic bacteria and fungi in the carbon cycle? **[1]**

- A.** They fix carbon dioxide into carbon compounds in dead organisms.
- B.** They convert methane in the soil into carbon dioxide during photosynthesis.
- C.** They prevent the formation of fossil fuels by removing carbon from the soil.
- D.** They digest dead organic matter externally and release carbon dioxide in respiration.

- 40.** The size of a population of woodlice was estimated by capture–mark–release–recapture. Sixty woodlice were caught, marked and released. In a second sample of eighty woodlice, twelve were marked. What is the estimated size of the population? **[1]**
- A.** 152
 - B.** 240
 - C.** 400
 - D.** 960

End of examination.

Total: 40 marks

Answer sheet

Write the letter of your chosen answer in the box next to each question number.

Q	Ans		Q	Ans		Q	Ans		Q	Ans
1			11			21			31	
2			12			22			32	
3			13			23			33	
4			14			24			34	
5			15			25			35	
6			16			26			36	
7			17			27			37	
8			18			28			38	
9			19			29			39	
10			20			30			40	

Candidate name:

Session number:

Total mark: / 40