

Biology
Higher level
Paper 1

Wednesday 6 May 2015 (morning)

1 hour

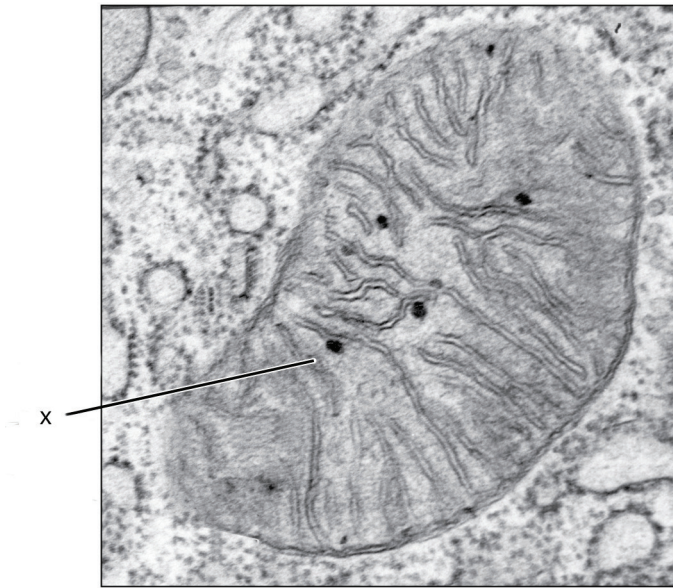
Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[40 marks]**.

1. A frog jumped 80 times and each time the length of the jump was recorded. The mean length of the jumps was 38 cm with a standard deviation of 10 cm. What can be deduced from this information?
- A. The frog did not jump more than 48 cm.
 - B. The number of jumps more than 38 cm is the same as the number less than 38 cm.
 - C. Approximately 32 % of the jumps were less than 28 cm.
 - D. Approximately 68 % of the jumps were between 28 and 48 cm.
2. What structures are part of an *Escherichia coli* cell?
- A. Ribosomes, nucleoid and Golgi apparatus
 - B. Ribosomes, mitochondria and pili
 - C. Cell wall, plasma membrane and nuclear membrane
 - D. Pili, flagella and cytoplasm
3. A botanist measures a leaf and finds it is 24 cm long and 8 cm wide. His drawing of the leaf is 4 cm wide. Which was the magnification and length of his drawing, assuming that the proportions of the drawing were correct?

| | Scale | Length / cm |
|----|-------|-------------|
| A. | ×2 | 48 |
| B. | ×2 | 12 |
| C. | ×0.5 | 48 |
| D. | ×0.5 | 12 |

4. What is the structure labeled X in the electron micrograph of a rat liver cell?



[Source: "0315 Mitochondrion new" by OpenStax College - Anatomy & Physiology, Connexions Web site. <http://cnx.org/content/col11496/1.6/>, Jun 19, 2013.. Licensed under CC BY 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:0315_Mitochondrion_new.jpg#/media/File:0315_Mitochondrion_new.jpg]

- A. Ribosome
 - B. Lysosome
 - C. Mitochondrion
 - D. Nucleus
5. Which events occur during both mitosis and meiosis?
- A. Production of haploid cells from diploid cells
 - B. Crossing over
 - C. Separation of the chromatids from each chromosome
 - D. Production of genetically different cells
6. What property of water makes it suitable as a coolant?
- A. It takes a lot of energy to increase the temperature of water.
 - B. It takes a lot of energy for water to evaporate.
 - C. Water molecules are cohesive and stick to the skin.
 - D. Water is a good solvent so it can transport heat from the body.

7. Molecules A and B are amino acids and C is a dipeptide. Which reaction represents a condensation reaction?

- A. $A + B + H_2O \rightarrow C$
- B. $A + B \rightarrow C + H_2O$
- C. $C + H_2O \rightarrow A + B$
- D. $C \rightarrow A + B + H_2O$

8. Which sugars are examples of a monosaccharide and disaccharide?

| | Monosaccharide | Disaccharide |
|----|-----------------------|---------------------|
| A. | fructose | galactose |
| B. | lactose | maltose |
| C. | sucrose | fructose |
| D. | galactose | lactose |

9. Why does exposure to high temperatures cause an enzyme to lose its biological properties?

- A. The substrate blocks the active site at high temperatures.
- B. The three dimensional structure of the enzyme becomes changed.
- C. Chemical reactions cannot take place at high temperatures.
- D. High temperatures increase the activation energy of reactions.

10. The feather colour of a certain breed of chicken is controlled by codominant alleles. A cross between a homozygous black-feathered chicken and a homozygous white-feathered chicken produces all speckled chickens. What phenotypic ratios would be expected from a cross between two speckled chickens?

- A. All speckled
- B. 1 black feathers : 1 white feathers
- C. Speckled, black feathers and white feathers in equal numbers
- D. 1 black feathers : 2 speckled feathers : 1 white feathers

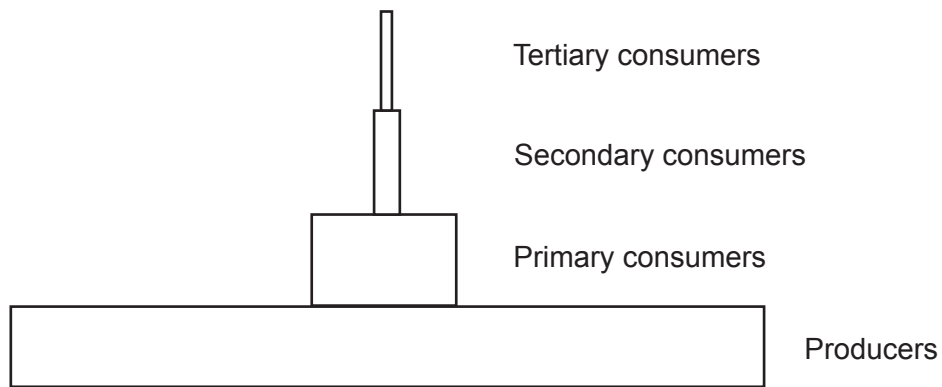
11. The presence of freckles is a characteristic controlled by a dominant gene. Two parents who are heterozygous for the characteristic have three children, all of whom have freckles. Which statement is true if they have a fourth child?
- A. There is a 100% chance that their next child will have freckles.
 - B. There is a 75% chance that their next child will have freckles.
 - C. There is a 50% chance that their next child will have freckles.
 - D. The next child will have no freckles as the ratio is 3 with freckles to 1 without freckles.

12. What maximum number of different genotypes and phenotypes are possible among the children of a mother with blood group A and a father with blood group B?

| | Genotypes | Phenotypes |
|----|-----------|------------|
| A. | 2 | 2 |
| B. | 2 | 4 |
| C. | 4 | 4 |
| D. | 4 | 2 |

13. The allele for tall T is dominant to the allele for dwarf t. Which of the following represents a test cross?
- A. $tt \times tt$
 - B. $TT \times Tt$
 - C. $Tt \times tt$
 - D. $Tt \times Tt$
14. Which process can be used to amplify small fragments of DNA?
- A. Gel electrophoresis
 - B. Polymerase chain reaction
 - C. DNA profiling
 - D. Electron microscopy

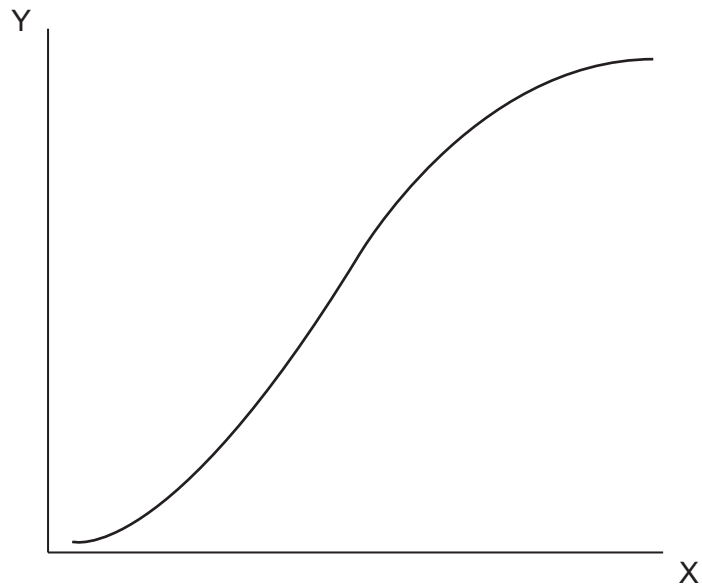
15. The diagram shows a pyramid of energy for a forest ecosystem.



What conclusion can be drawn from the pyramid?

- A. The number of organisms drops by 90% in each trophic level.
 - B. Suitable units are $\text{Kg m}^{-2} \text{yr}^{-1}$.
 - C. The biggest energy loss is between producers and primary consumers.
 - D. The energy is recycled.
16. What is the best definition of the greenhouse effect in the Earth's atmosphere?
- A. A naturally occurring effect by which shorter wavelength radiation is trapped
 - B. A naturally occurring effect by which longer wavelength radiation is trapped
 - C. An effect of pollution by which shorter wavelength radiation is trapped
 - D. An effect of pollution by which longer wavelength radiation is trapped

17. The graph shows the growth of a population of rabbits inhabiting a new area.



What would be suitable labels for the axes X and Y?

| | X | Y |
|----|-----------------------|-----------------------|
| A. | number of rabbits | time |
| B. | time | birth rate of rabbits |
| C. | birth rate of rabbits | time |
| D. | time | number of rabbits |

18. Human activity leading to the emission of greenhouse gases may be a cause of global warming. According to the precautionary principle, what should be done about greenhouse gas emission?

- A. Analyse historical records from monitoring stations to see the trends in carbon dioxide emissions
- B. Obtain more evidence by carrying out research on greenhouse gas emission
- C. Take measures to lower greenhouse gas emission without further evidence
- D. Develop strategies for coping with higher global temperatures

19. The photograph shows an animal of the species *Eisenia fetida*.



[Source: "Redwiggler1" by Mihai Duguleana; - Transferred from en.wikipedia to Commons. Licensed under Public Domain via Wikimedia Commons - <https://commons.wikimedia.org/wiki/File:Redwiggler1.jpg#/media/File:Redwiggler1.jpg>]

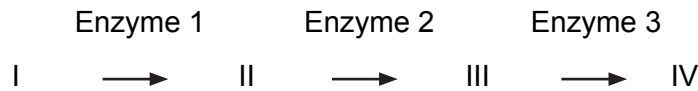
Which phylum does it belong to?

- A. Cnidaria
 - B. Platyhelminthes
 - C. Annelida
 - D. Arthropoda
20. Some egg white protein was heated until it turned solid. It was then cooled and cut into four cubes of equal size. Each cube was placed in a test tube containing water and a peptidase which was extracted from the stomach of a mammal. Hydrochloric acid was added to two of the tubes. The tubes were kept at constant temperature for 30 minutes. In which tube was the cube of egg white smallest after 30 minutes?

| Test Tube | pH | Temperature / °C |
|-----------|----|------------------|
| A. | 2 | 90 |
| B. | 7 | 37 |
| C. | 2 | 37 |
| D. | 7 | 90 |

- 21.** What is a feature of neurons?
- A. Relay neurons transmit impulses from motor to sensory neurons.
 - B. The cell body of a motor neuron is in the CNS.
 - C. Sensory neurons carry impulses away from the CNS.
 - D. Relay neurons form synapses with receptors.
- 22.** What is a feature of the human circulatory system?
- A. The wall of the right ventricle of the heart is the thickest of the four chambers.
 - B. The pulmonary artery and vena cava both carry deoxygenated blood.
 - C. Valves are found in arteries and veins but not capillaries.
 - D. Epinephrine acts on the pacemaker to reduce heart rate.
- 23.** Which describes the secretion of hormones in the pancreas in response to low levels of glucose in the blood?
- A. Secretion of glucagon from α cells
 - B. Secretion of glucagon from β cells
 - C. Secretion of insulin from α cells
 - D. Secretion of insulin from β cells
- 24.** Which hormone shows the greatest fall in blood concentration just before menstruation?
- A. FSH (follicle stimulating hormone)
 - B. LH (luteinizing hormone)
 - C. Progesterone
 - D. Estrogen

25. What is a feature of transcription?
- A. Both strands of a DNA molecule act as a template for mRNA.
 - B. Nucleoside triphosphates become nucleotides by losing three phosphates.
 - C. RNA polymerase binds to the promoter region.
 - D. The sense strand acts as a template for mRNA.
26. Which describes the role of amino acids in the channels of membrane proteins used for facilitated diffusion?
- A. Polar amino acids create a channel through which hydrophilic molecules can pass.
 - B. Polar amino acids create a channel through which hydrophobic molecules can pass.
 - C. Non-polar amino acids create a channel through which hydrophilic molecules can pass.
 - D. Non-polar amino acids create a channel through which hydrophobic molecules can pass.
27. The following metabolic pathway is regulated by end-product inhibition.



Which substances could represent the inhibitor and the substance it inhibits?

| | Inhibitor | Substance which is inhibited |
|----|-----------|------------------------------|
| A. | IV | Enzyme 1 |
| B. | Enzyme 3 | I |
| C. | Enzyme 3 | Enzyme 1 |
| D. | IV | I |

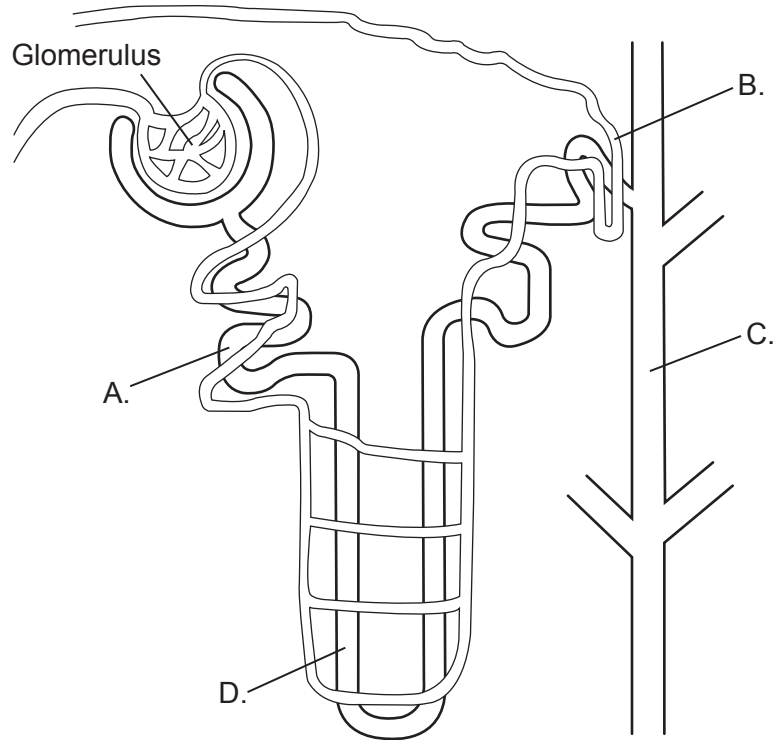
28. Where in a eukaryotic cell does the Krebs cycle take place?
- A. In the cytoplasm
 - B. Between the inner and outer membranes of the mitochondria
 - C. In the matrix of the mitochondria
 - D. On the surface of the cristae

29. What process occurs during the light-independent reactions of photosynthesis?
- A. Oxygen is released into the atmosphere.
 - B. Protons are pumped from the thylakoid space to the stroma.
 - C. RuBP is carboxylated then regenerated in the Calvin cycle.
 - D. Triose phosphate is converted to glycerate 3-phosphate.
30. How do auxins cause plant shoots to grow towards light?
- A. Increase cell division on the side of the stem near the light source
 - B. Increase cell division on the side of the stem away from the light source
 - C. Increase cell elongation on the side of the stem near the light source
 - D. Increase cell elongation on the side of the stem away from the light source
31. What is transported in xylem tissue?
- A. Sucrose from leaves to fruits
 - B. Starch from leaves to storage organs
 - C. Water from roots to leaves
 - D. Salts from soil to roots
32. What is the effect of long periods of daylight on phytochrome and flowering in short day plants?

| | Effect of daylight on phytochrome | Effect on short day plants |
|----|-----------------------------------|----------------------------|
| A. | converts Pr → Pfr | promotes flowering |
| B. | converts Pr → Pfr | inhibits flowering |
| C. | converts Pfr → Pr | promotes flowering |
| D. | converts Pfr → Pr | inhibits flowering |

- 33.** What prevents independent assortment of genes?
- A. Genes on separate chromosomes
 - B. Crossing over between chromosomes
 - C. Genes close together on the same chromosome
 - D. Genes located on autosomes
- 34.** Skin colour is a trait controlled by polygenic inheritance. Which statement is correct?
- A. Skin colour shows discontinuous variation
 - B. Individuals show a wide range of phenotypes for skin colour
 - C. No two people have the same skin colour
 - D. Children always have the same skin colour as one of their parents

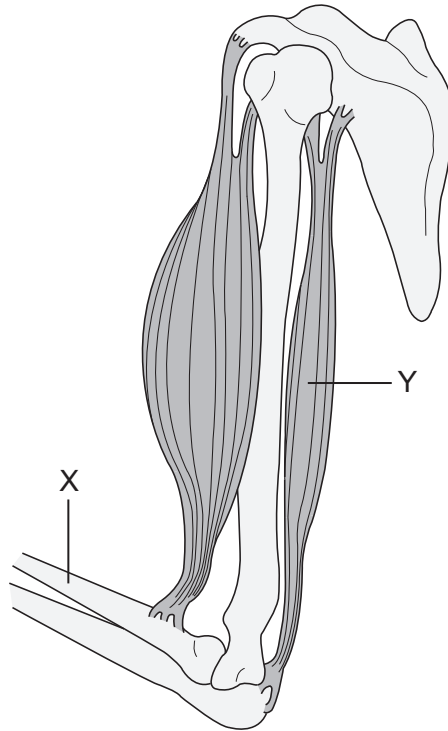
35. The diagram shows a nephron from a human kidney. In what part of the nephron would most glucose be reabsorbed?



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36. In which region of the kidney is the glomerulus found?
- A. Cortex only
 - B. Medulla only
 - C. Cortex and medulla
 - D. Pelvis
37. What is an example of active immunity?
- A. Antibodies passed from the mother to fetus across the placenta
 - B. Antibodies produced by another organism and injected to protect against a disease
 - C. Antibodies passed from the mother in colostrum during breastfeeding
 - D. Antibodies produced after the defence mechanisms have been stimulated by antigens

38. What is bone X and muscle Y in the diagram of the elbow joint?



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| | Bone X | Muscle Y |
|----|---------------|-----------------|
| A. | radius | biceps |
| B. | radius | triceps |
| C. | ulna | biceps |
| D. | ulna | triceps |

39. What is the function of the epididymis in the male reproduction system?

- A. To stimulate sperm production by secreting testosterone
- B. To store the sperm in the final stages of maturation
- C. To provide fluids to nourish the sperm
- D. To transport the sperm from the testes to the urethra

40. From where is human chorionic gonadotropin (HCG) secreted in early pregnancy?
- A. Embryo
 - B. Corpus luteum
 - C. Ovary
 - D. Pituitary gland
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