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**BIOLOGY
HIGHER LEVEL
PAPER 1**

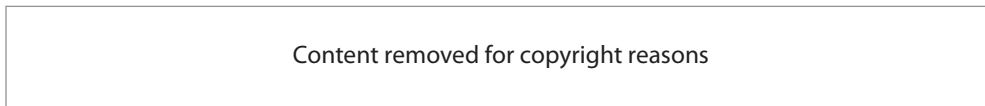
Wednesday 16 November 2011 (afternoon)

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.

Questions 1 and 2 refer to the following image of a liver cell.



1. What is the function of the organelles labelled X?
 - A. Glycolysis
 - B. Polypeptide formation
 - C. Aerobic cell respiration
 - D. Protein transport

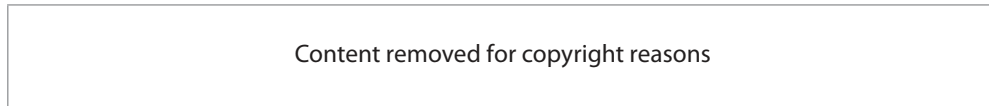
2. What is the approximate size of the nucleus?
 - A. 2 μm
 - B. 5 μm
 - C. 9 μm
 - D. 24 μm

3. Which statement is part of the cell theory?
- A. All cells have a cell wall.
 - B. Every cell shows emergent properties.
 - C. Every cell carries out all the functions of life.
 - D. All cells come from pre-existing cells.
4. What is phosphorus used for in plant cells?
- A. Structure of hemoglobin
 - B. Composition of long-term energy storage
 - C. Positive charge of membranes
 - D. Composition of nucleic acids
5. Which statement describes glycogen?
- A. It is a hormone involved in the control of blood glucose.
 - B. It is a component of the cell wall in plants.
 - C. It is a monosaccharide converted to pyruvate during cell respiration.
 - D. It is a polysaccharide found in animals.

8. Which of the following statements is/are correct for DNA replication?
- I. It occurs during interphase.
 - II. It is semi-conservative.
 - III. It is a stage in protein synthesis.
- A. I only
- B. II only
- C. I and II only
- D. I, II and III
9. Which of the following processes uses DNA ligase?
- A. Unwinding DNA
- B. Gene transfer using plasmids
- C. Adding primers
- D. Complementary base pairing
10. After which process are introns removed?
- A. Replication
- B. Transcription
- C. Translation
- D. Translocation
11. What is predicted by the induced-fit model?
- A. An inhibitor changes the shape of the active site.
- B. The substrate shape exactly fits the active site.
- C. The enzyme shape is changed by the substrate.
- D. The substrate is an inhibitor of the active site.

12. What is involved during oxidation?
- A. The loss of electrons
 - B. The gain of electrons
 - C. The gain of hydrogen
 - D. The loss of oxygen
13. What happens for each glucose during glycolysis?
- A. Four ATP are used.
 - B. Two three-carbon compounds are formed.
 - C. Two NADPH + H⁺ are formed.
 - D. Two pyruvates are decarboxylated.
14. Which of the following is a role of ATP in photosynthesis?
- A. It provides the energy to make carbohydrate molecules.
 - B. It splits water molecules to form oxygen and hydrogen.
 - C. It breaks down pyruvate into carbon dioxide.
 - D. It converts light energy into chemical energy.
15. What happens to triose phosphate (TP) in the light-independent reactions of photosynthesis?
- A. TP is reduced to glycerate-3-phosphate (GP).
 - B. TP is linked to CO₂ by ribulose biphosphate carboxylase (Rubisco).
 - C. TP is oxidized by NADPH + H⁺.
 - D. TP is regenerated into ribulose biphosphate (RuBP).

16. The following diagram shows a stage of meiosis.



What stage is represented in the diagram?

- A. Anaphase I
 - B. Metaphase I
 - C. Metaphase II
 - D. Anaphase II
17. When does an unequal division of cytoplasm occur?
- A. During meiosis in the apical meristem
 - B. During the division of Sertoli cells into spermatozoa
 - C. During binary fission of eukaryotic cells
 - D. During meiosis in the human ovary
18. In humans a V-shaped hair line is dominant to a straight hair line. A woman with a V-shaped hair line and a man with a straight hair line have children. The woman has a mother with a straight hair line. What is the proportion of children who are likely to have a V-shaped hair line?
- A. Half of the children
 - B. A quarter of the children
 - C. All of the children
 - D. None of the children

19. The following is a dihybrid cross involving linked genes.

$$\begin{array}{cc} \frac{F H}{f h} & \frac{f h}{f h} \end{array}$$

Which of the following offspring genotypes are recombinants?

I. $\frac{F h}{f h}$

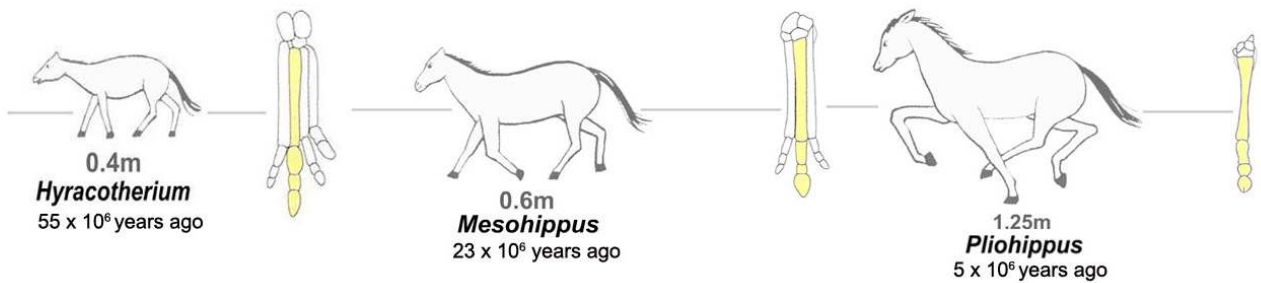
II. $\frac{f h}{f H}$

III. $\frac{f h}{F H}$

- A. I only
 - B. II only
 - C. I and II only
 - D. I, II and III
20. Which technique causes fragments of DNA to move in an electric field?
- A. Polymerase chain reaction (PCR)
 - B. Genetic modification
 - C. Therapeutic cloning
 - D. Gel electrophoresis

21. Which process occurs during cloning of animals using differentiated cells?
- A. The oocyte is exposed to UV light to destroy the donor cell nucleus.
 - B. An oocyte nucleus is replaced with a donor nucleus.
 - C. A secondary oocyte is injected into the receiver's oviduct.
 - D. The nucleus of a spermatocyte is injected into the oocyte with a micropipette.
22. Which term best defines a group of populations living and interacting with each other in an area?
- A. Ecology
 - B. Community
 - C. Species
 - D. Ecosystem
23. What is the purpose of calculating the standard deviation?
- A. To represent graphically the variability of data
 - B. To give a measure of the spread of values around the mean
 - C. To represent the range of 50% of the data
 - D. To give a measure of the correlation between two variables
24. What is most likely to result in a species if there is increased immigration?
- A. Decrease in emigration
 - B. Decrease in mortality
 - C. Increase in natality
 - D. Increase in population

25. What is a consequence of a global temperature rise on arctic ecosystems?
- A. Decrease in CO₂ released from decomposing detritus
 - B. Increase in the greenhouse effect
 - C. Decrease in ocean level
 - D. Increase in pest species
26. The following diagrams (not to scale) represent the fossilized forelimbs of three horses living at different times, none of which are alive today.



Images by Alex Brollo

The diagrams provide evidence for which of the following?

- A. Pentadactyl limb
- B. Domestication of animals
- C. Homologous structures
- D. Change in the characteristics of species

27. Where does **most** assimilation take place?
- A. In cells
 - B. In the mouth
 - C. In the small intestine
 - D. In the large intestine
28. What is the role of the pacemaker (SAN)?
- A. It controls the release of epinephrine (adrenaline).
 - B. It sends nerve impulses to the ventricles.
 - C. It regulates the activity of the medulla.
 - D. It changes the frequency of muscle contraction in the heart.
29. What occurs during the process of ventilation?
- A. Contraction of external intercostal muscles raises the ribcage.
 - B. Relaxation of the abdominal muscles decreases the air volume in the lungs.
 - C. Contraction of internal intercostal muscles raises the ribcage.
 - D. Relaxation of the diaphragm decreases the air pressure in the lungs.

- 30.** Which term describes the phase of rapid entry of sodium ions (Na^+) into an axon during an action potential?
- A. Active transport
 - B. Depolarization
 - C. Ion pumping
 - D. Repolarization
- 31.** What is excretion?
- A. Production of urea by the kidneys
 - B. Removal of waste products of metabolic pathways
 - C. Release of undigested substances through the anus
 - D. Release of molecules into the proximal convoluted tubule
- 32.** What occurs in the body after the injection of a vaccine containing antigens?
- A. Activated B-cells divide to form memory cells.
 - B. The receiver of the vaccine develops passive immunity.
 - C. Helper T-cells produce specific antibodies.
 - D. Macrophages are cloned and destroy the antigen.

33. What happens **immediately** after the penetration of the egg membrane by a sperm during fertilization?
- A. The acrosomal reaction
 - B. The secondary oocyte develops
 - C. The blastocyst divides by mitosis
 - D. The cortical reaction
34. Which hormone increases in concentration in the mother's blood during early pregnancy?
- A. ADH
 - B. FSH
 - C. HCG
 - D. LH
35. What is the role of ligaments in humans?
- A. Linking bones together at a joint
 - B. Preventing friction at a joint
 - C. Contracting to move a joint
 - D. Attaching muscles to bones
36. What is produced in the body during HIV infection?
- A. Anti-HIV antibiotics
 - B. Anti-HIV anticodons
 - C. Anti-HIV antibodies
 - D. Anti-HIV antigens

37. Which organisms have flowers?
- A. Bryophyta
 - B. Porifera
 - C. Angiospermophyta
 - D. Cnidaria
38. Which characteristic suggests that a plant is dicotyledonous?
- A. Flowers having five anthers
 - B. Cones producing seeds
 - C. Leaves having parallel venation
 - D. Flowers producing pollen
39. What is a role of xylem?
- A. It absorbs minerals from the soil by active transport.
 - B. It translocates amino acids from source to sink.
 - C. It carries glucose to the leaves.
 - D. It contributes to the plant support with lignified walls.
40. Which substance is synthesized by germinating seeds?
- A. Phytochrome
 - B. Gibberellin
 - C. Starch
 - D. Abscisic acid