M11/4/BIOLO/HPM/ENG/TZ1/XX

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BIOLOGY
HIGHER LEVEL
PAPER 1

Wednesday 18 May 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.

1. The table below shows the level of hemoglobin measured in two different groups of athletes.

	Hemoglobin / grams per 100 cm^3	**Number of athletes tested**	**Standard deviation / grams per 100 cm^3**
Group A	12.6	200	0.8
Group B	11.9	220	3.2

Which of the following statements is correct?

A. Results from group B are more accurate because more athletes were tested.

B. Results from group B are more reliable because it has a higher standard deviation.

C. More athletes have their hemoglobin concentration close to the mean in group A than in group B.

D. These results indicate that the level of hemoglobin follows a normal distribution.

2. A red blood cell is 8 μm in diameter. If drawn 100 times larger than its actual size, what diameter will the drawing be in mm?

A. 0.08 mm

B. 0.8 mm

C. 8 mm

D. 80 mm

3. An unknown cell is observed using a microscope. A cell wall, ribosomes and DNA are identified. What can be concluded from these observations?

A. It can only be a prokaryotic cell.

B. It can only be a eukaryotic cell.

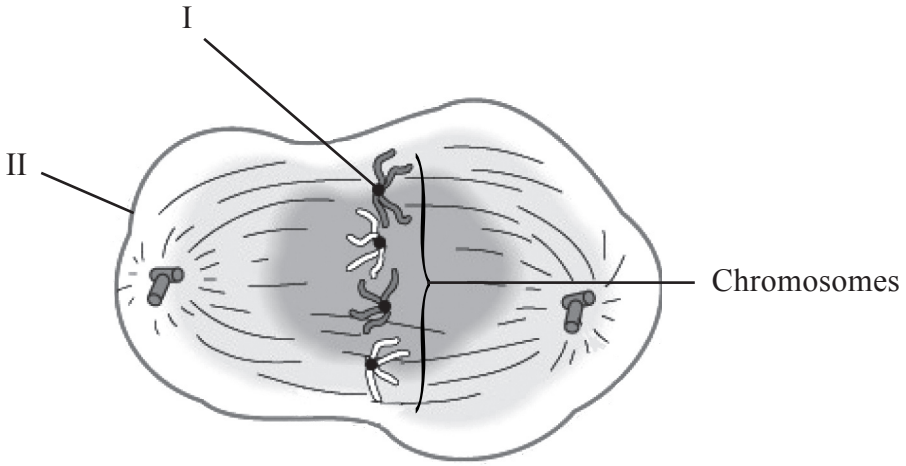
C. It could be a prokaryotic or eukaryotic cell.

D. It can only be a plant cell.

4. Which pair of features is correct for both diffusion and osmosis?

	Diffusion	Osmosis
A.	net movement of particles from high to low concentration	active transport of water across a partially permeable membrane
B.	net movement of particles from low to high concentration	active transport of water across a partially permeable membrane
C.	net movement of particles from low to high concentration	passive movement of water across a partially permeable membrane
D.	net movement of particles from high to low concentration	passive movement of water across a partially permeable membrane

5. The diagram below shows a cell during mitosis.



What are the structures and stage of mitosis?

	Stage of mitosis	Structure I	Structure II
A.	metaphase	chromatid	nuclear membrane
B.	anaphase	centromere	plasma membrane
C.	anaphase	chromatid	nuclear membrane
D.	metaphase	centromere	plasma membrane

6. Which statement about water is correct?

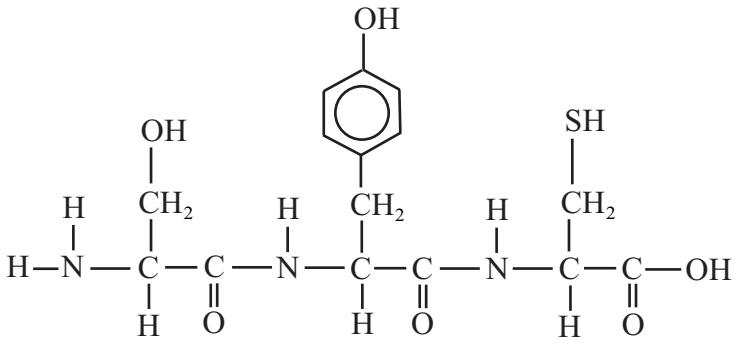
A. The atoms within a molecule of water are held together by hydrogen bonds.

B. Water has a low heat capacity allowing enzymatic reactions to happen at a wide range of temperatures.

C. Water molecules are polar, therefore fatty acids do not dissolve.

D. Ice has a higher density than liquid water, therefore some organisms can live under the ice.

7. Which type of molecule is shown in the diagram below?



A. Peptide

B. Carbohydrate

C. Lipid

D. Nucleic acid

8. The percentage of thymine in the DNA of an organism is approximately 30 %. What is the percentage of guanine?

A. 70 %

B. 30 %

C. 40 %

D. 20 %

9. Which of the following are involved in **both** replication and transcription?

A. DNA only

B. DNA and RNA

C. DNA and ribosomes

D. DNA, RNA and ribosomes

10. What is the source of the oxygen released into the air as a product of photosynthesis?

A. Chlorophyll

B. Carbon dioxide only

C. Water only

D. Both water and carbon dioxide

11. What is the difference between the alleles of a gene?

A. Their position on the chromosome

B. Their amino acid sequence

C. Their pentose sugars

D. Their base sequence

12. Which of the following statements about homologous chromosomes is correct?

A. Each gene is at the same locus on both chromosomes.

B. They are two identical copies of a parent chromosome which are attached to one another at the centromere.

C. They always produce identical phenotypes.

D. They are chromosomes that have identical genes and alleles.

13. A new allele that provides herbicide resistance is identified in soybean plants. The allele is dominant. Which of the following would be carried out in a herbicide-resistant plant to find out if it is homozygous or heterozygous for the gene?

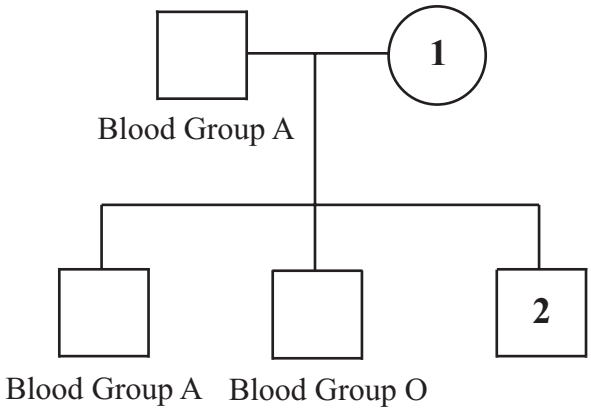
A. Gel electrophoresis

B. Karyotyping

C. Test cross

D. DNA profiling

14. The pedigree chart below shows the blood types of three members of a family.



Which could be the blood types of individuals 1 and 2?

	Individual 1	Individual 2
A.	A	AB
B.	AB	B
C.	O	B
D.	B	A

15. Which statement about the polymerase chain reaction (PCR) is correct?

A. PCR allows DNA to be cloned in a test tube and millions of copies can be made in hours.

B. PCR allows the synthesis of RNA from DNA molecules.

C. PCR is a natural process carried out by some viruses to amplify DNA molecules.

D. PCR is a man-made technique used to identify the nucleotide sequence of DNA.

16. What is a community composed of?

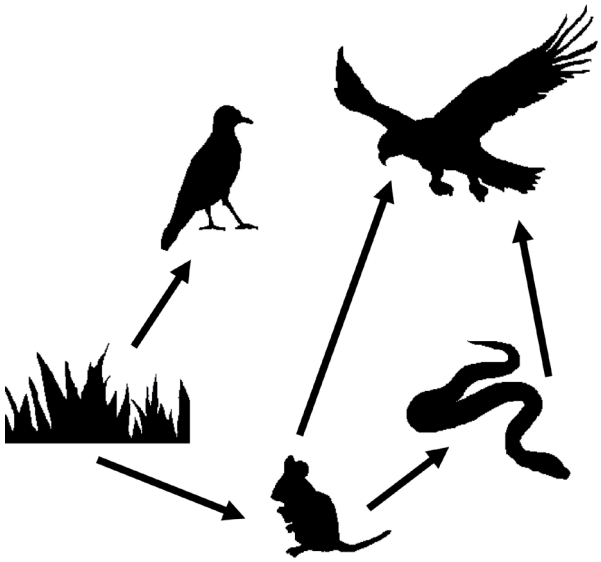
A. Habitats

B. Populations

C. Abiotic factors

D. Biotic and abiotic factors

17. The diagram below shows a simplified food web.



How many trophic levels are in this food web?

A. 2

B. 3

C. 4

D. 5

18. Which of the following are greenhouse gases?

I. Oxides of nitrogen

II. Carbon dioxide

III. Methane

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

19. The population of white-tailed deer in Nova Scotia (Canada) suffered a significant decline in the late 1970s. Which of the following is most likely to have caused the decline?

A. The population had depleted resources in the environment

B. A decrease in hunting

C. A decrease in predation

D. Natality and immigration exceeded mortality and emigration

20. Two different trees have been classified as *Pinus pinea* and *Pinus nigra*. Which of the following statements is correct?

A. Both trees belong to the same class but a different genus.

B. Both trees belong to the same family and same genus.

C. The species name of both trees is *Pinus*.

D. The family names are *pinea* and *nigra*.

21. Celiac disease causes the destruction of the villi cells. Which of the following is most likely to happen to people with celiac disease?

A. Incomplete digestion of fats

B. Poor absorption of calcium

C. Increased levels of glucose in blood

D. Damage in the esophagus caused by increase in acid content of the stomach

22. Is the blood in the aorta, left ventricle and pulmonary artery oxygenated or deoxygenated?

	Aorta	Left ventricle	Pulmonary artery
A.	oxygenated	deoxygenated	deoxygenated
B.	deoxygenated	oxygenated	oxygenated
C.	oxygenated	oxygenated	deoxygenated
D.	oxygenated	oxygenated	oxygenated

23. Which of the following statements about antibodies is correct?

A. Antibodies are polypeptides.

B. Antibodies are produced by the bone marrow.

C. Antibodies are pathogenic foreign substances.

D. Antibodies kill bacteria but not viruses.

24. What will be happening in a person after eight hours of sleep?

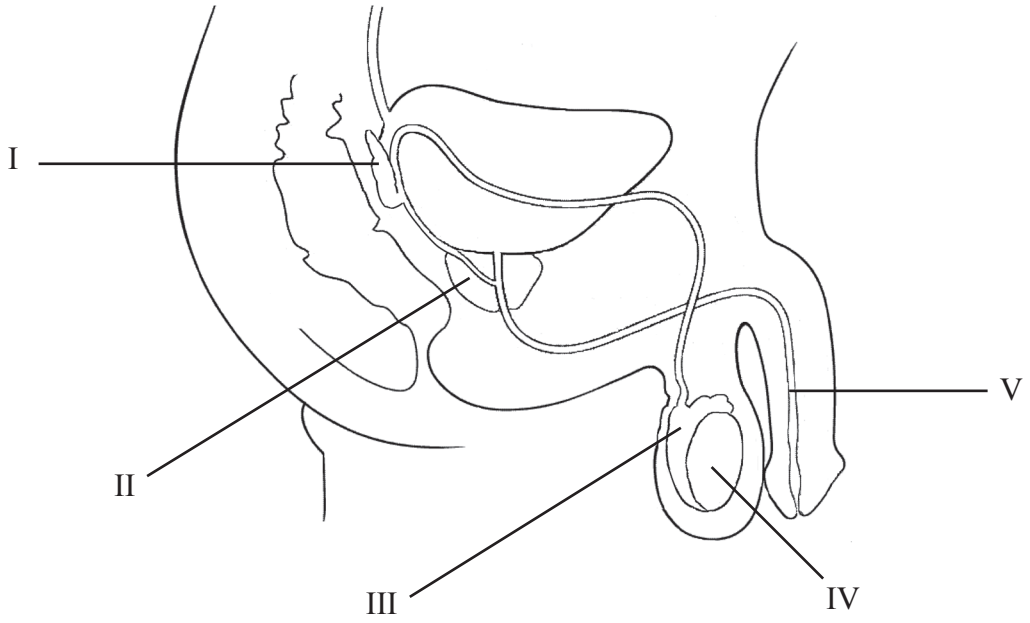
A. β cells in the pancreas will be producing insulin.

B. Glucose will be converted into glucagon.

C. α cells in the pancreas will be producing glucagon.

D. Glycogen is being produced and stored in the liver and muscle cells.

25. The diagram below shows the male reproductive system.



Which are the epididymis and the seminal vesicle in the diagram?

	Epididymis	Seminal vesicle
A.	IV	I
B.	III	II
C.	I	V
D.	III	I

26. What does a nucleosome consist of?

A. DNA and histones

B. DNA and chromatin

C. Chromatin and nucleotides

D. Mature RNA and histones

27. What are Okazaki fragments?

A. Short lengths of RNA primase attached to the DNA during replication

B. Short sections of DNA formed during DNA replication

C. Nucleotides added by DNA polymerase I in the same direction as the replication fork

D. Sections of RNA removed by DNA polymerase III and replaced with DNA

28. The sequence of nucleotides in a section of RNA is:

GCCAUACGAUCG

What is the base sequence of the DNA sense strand?

A. CGGUAUGCUAGC

B. GCCATACGATCG

C. CGGTATGCTAGC

D. GCCAUACGAUCG

29. The electron micrograph below shows an organelle in a eukaryotic cell. What is the area labelled X and what is the type of reaction occurring there?

[Source: http://scienceblogs.com/clock/2006/11/cell_structure.php]

	X	Reaction
A.	matrix	photolysis
B.	stroma	Krebs cycle
C.	stroma	photolysis
D.	matrix	Krebs cycle

30. Where is chlorophyll found in a plant cell?

A. Thylakoid membranes

B. Stroma

C. Matrix

D. Cristae

31. What is produced by the light-dependent reactions of photosynthesis and used in the Calvin cycle?

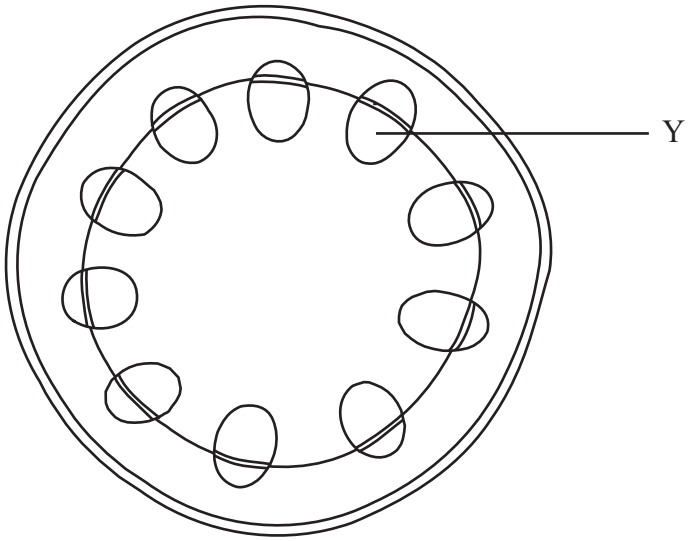
A. Hydrogen and oxygen

B. ATP and NADPH

C. NADPH and oxygen

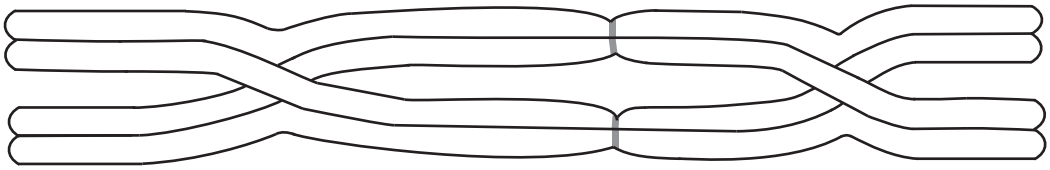
D. ATP and CO_2

32. The diagram below shows a cross section of a stem. What is the structure labelled Y and one of its functions?



	Structure Y	Function
A.	phloem	storage of water and starch
B.	xylem	mechanical support
C.	phloem	gas exchange
D.	xylem	transport of sugars

33. The diagram below shows chromosomes during meiosis.



How many chromosomes and chiasmata are visible?

	Chromosomes	Chiasmata
A.	4	4
B.	2	4
C.	2	2
D.	4	2

34. Genes A and B are located on the same chromosome. If two individuals with the genotype shown below are crossed, which genotype could be formed?

$$\frac{aB}{Ab} \times \frac{ab}{ab}$$

A. $\frac{AB}{ab}$

B. $\frac{Ab}{Ab}$

C. $\frac{aB}{aB}$

D. $\frac{AB}{Ab}$

35. Which of the following statements is **incorrect**?

A. Active immunity is the stimulation of the immune system to produce antigen-specific antibodies.

B. Vaccines produce immunological memory similar to that acquired by having the natural disease.

C. The most common way to acquire passive immunity is to have the natural disease.

D. Killed forms of a microorganism can act as an antigen.

36. Which is the sequence of events in muscle contraction?

I. Use of ATP

II. Formation of cross bridges

III. Release of calcium ions from the sarcoplasmic reticulum

IV. Actin filament moves towards the centre of the sarcomere

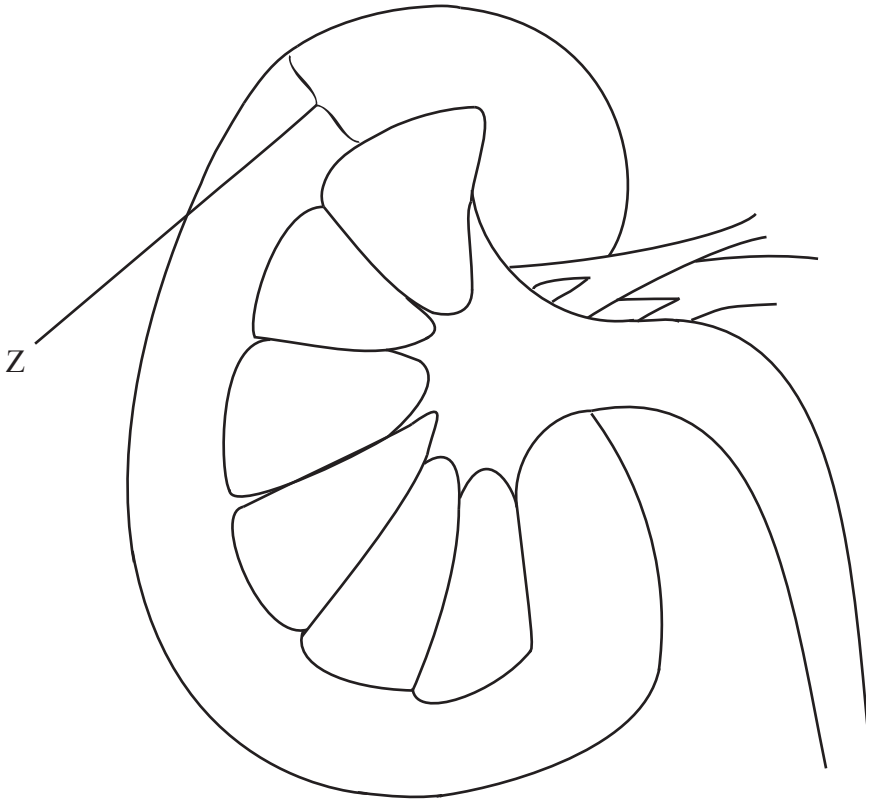
A. I → II → III → IV

B. III → II → IV → I

C. IV → I → II → III

D. II → IV → I → III

37. The diagram below shows a longitudinal section through a kidney. What is the structure labelled Z and what is its function?



	Structure Z	Function
A.	cortex	osmoregulation
B.	medulla	ultrafiltration
C.	cortex	ultrafiltration
D.	pelvis	osmoregulation

38. During urine production, what happens if the water content of the blood is too low?

A. Membrane channels are produced in the cells of the collecting duct.

B. The pituitary gland stops secreting ADH.

C. The collecting duct becomes less permeable to water.

D. Large volumes of dilute urine are formed.

39. A process occurs in which the inside of a neuron develops a net positive charge compared with the outside. What is the name of this process?

A. Resting potential

B. Repolarization

C. Depolarization

D. Hyperpolarization

40. Which of these statements about the human placenta is **incorrect**?

A. The placenta is the site of nutrient and gas exchange between the mother and fetus.

B. The placenta produces hormones, such as estrogen.

C. The placenta begins to develop after implantation of the blastocyst.

D. The mother's blood and the baby's blood mix in the placenta.