

# BIOLOGY 12

## SAMPLE QUESTIONS

The following are examples of the cognitive levels: K (*Knowledge*), U (*Understanding and Application*) and H (*Higher Mental Processes*).

It should be noted that cognitive level does not necessarily reflect “level of difficulty.” For example, a certain K level question might be considered to be difficult by some and similarly an H level question may be considered to be easy.

In terms of cell structure, students should recognize cell parts from a diagram. They may be required to draw certain structures to demonstrate that they understand certain aspects of their structure i.e., phospholipid bilayer—two layers, tails in, heads out. This may also apply to human biology, e.g., structure of a villus.

When referring to biological molecules, students should be able to draw an amino acid. They should also understand peptide bonds, therefore they should be able to draw the formation of a dipeptide or a polypeptide.

All other biological molecules only need to be recognized. However, students should be expected to demonstrate a process by drawing if there are diagrams of molecules to copy.

### Cell Structure

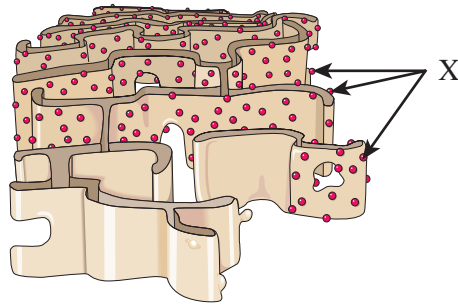
#### *Knowledge*

1. What are chromosomes composed of?
  - A. tRNA and DNA
  - B. tRNA and lipids
  - \* C. DNA and proteins
  - D. RNA and ribosomes

#### *Understanding*

2. How do the inner membrane of the mitochondria and the nuclear envelope differ?
  - A. The nuclear envelope has pores and the mitochondrial membrane does not.
  - B. The mitochondrial membrane is not permeable and the nuclear envelope is.
  - \* C. The mitochondrial membrane has many folds and the nuclear envelope does not.
  - D. The nuclear envelope has two phospholipid layers and the mitochondrial membrane does not.

Use the following diagram to answer question 3.

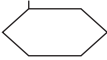
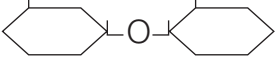

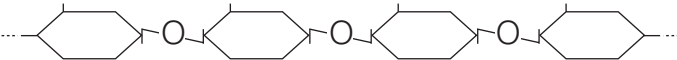


3. What produces the molecules of which structure **X** is composed?
- A. nucleus
  - B. vesicles
  - \* C. nucleolus
  - D. lysosomes

### Cell Compounds / Biological Molecules

#### Understanding

4. Which of the following diagrams represents glucose?

- \* A. 
- B. 
- C. 
- D. 

*Higher Mental Processes*

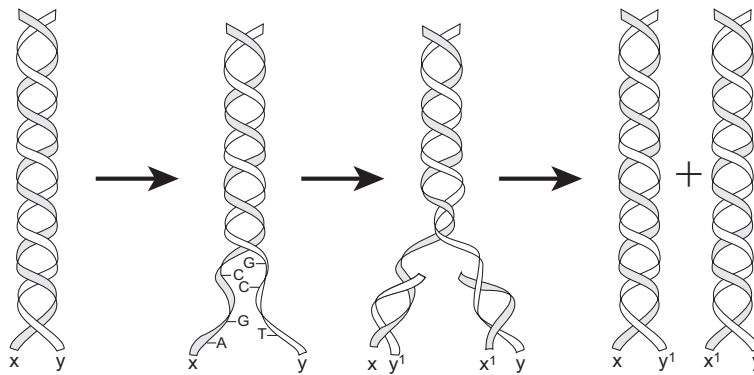
5. Why do neutral fats **not** dissolve in water?

- A. Water is non-polar.
- \* B. Water is polar and neutral fats are non-polar.
- C. Neutral fats are polar and form hydrogen bonds with water.
- D. Neutral fats break down into ions when combined with water.

**DNA**

*Understanding*

**Use the following diagram to answer question 6.**



6. What does the diagram above represent?

- \* A. DNA replication
- B. mRNA translation
- C. mRNA elongation
- D. DNA transcription

*Higher Mental Processes*

7. If 20% of the base molecules are guanine, how many thymine molecules are present in a DNA molecule with 1000 bases?
- A. 200
  - \* B. 300
  - C. 400
  - D. 600

**Protein Synthesis**

*Knowledge*

8. What is the role of ribosomes in protein synthesis?
- A. to split the two strands of DNA apart
  - B. to check for and replace the faulty codons
  - C. to carry amino acids to the site of translation
  - \* D. to provide a site for mRNA and tRNA to join together

*Understanding*

9. Give **one** role of each of the following nucleic acids in the production of an enzyme.

DNA: \_\_\_\_\_

mRNA: \_\_\_\_\_

rRNA: \_\_\_\_\_

tRNA: \_\_\_\_\_

**Response:**

DNA:

- **contains sequence of bases that codes for the enzyme**
- **contains triplet code / blueprint / recipe / genetic code**
- **transcription**
- **produces mRNA**

mRNA:

- **transcribes DNA sequence and travels to the site of enzyme production in the cytoplasm**
- **involved in translation**
- **carries triplet code / genetic code / codon from nucleus to ribosome / endoplasmic reticulum**

rRNA:

- **involved in translation as a component of ribosomes (along with protein)**
- **attaches to tRNA / mRNA**
- **reads mRNA**
- **site of codon / anticodon matching**

tRNA:

- **carries specific amino acids to rRNA**
- **translation**
- **attaches to ribosome / rRNA**
- **contains anticodon**
- **matches mRNA codon**

Use the following table to answer question 10.

mRNA Codon	Amino Acid Coded for
CCU	proline
CCC	proline
CCA	proline
CCG	proline

10. Which of the following mutations will **not** result in the incorporation of the amino acid proline in a protein?
- A. a mutation of the DNA from G A A to G G A
  - B. the use of a G G U anticodon during translation
  - C. a substitution error changing the DNA from G G G to G G T
  - \* D. the substitution of the first base in the DNA triplet for proline

### Transport Across Cell Membrane

#### Knowledge

11. List **four** factors that would affect the rate of diffusion of molecules crossing a cell membrane.

#### Response:

- size of molecule
- electrical charge
- mass of molecule diffusing
- cytoplasmic streaming (cyclosis)
- number of protein pores / carriers
- pressure (e.g., blood / atmospheric / hydrostatic)
- temperature / speed of molecules / kinetic energy
- concentration gradient / tonicity / osmotic pressure
- specific hormonal effects (e.g., antidiuretic hormone, thyroxin, insulin)
- chemical composition of the molecule (e.g., lipid solubility)
- chemical and physical properties of the cell membrane (permeability)

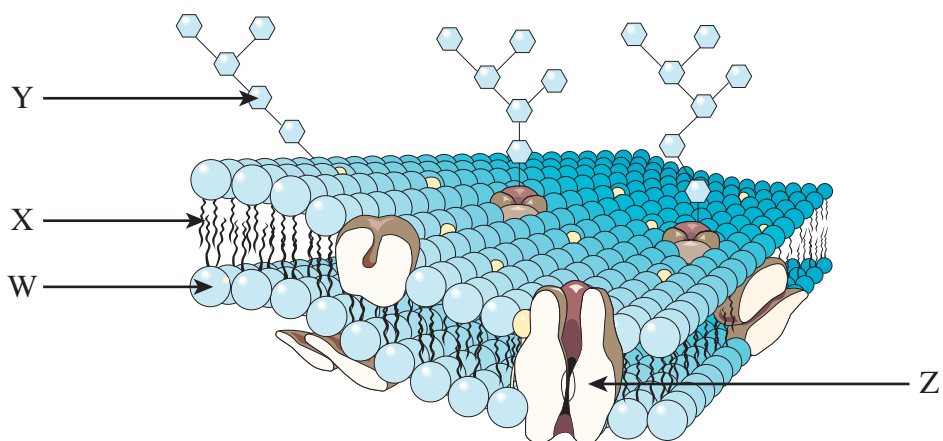
*Understanding*

12. If a 0.9% solution is isotonic to a certain type of animal cell, the cell will lose mass if it is placed in which of the following liquids?

- A. 0.5% salt solution
- B. 0.9% salt solution
- \* C. 1.2% salt solution
- D. distilled (pure) water

*Higher Mental Processes*

**Use the following diagram to answer question 13.**



13. Which of the following represents the part of a cell membrane that requires the breakdown of ATP for the transport of sodium ions?

- A. W
- B. X
- C. Y
- \* D. Z

## Enzymes

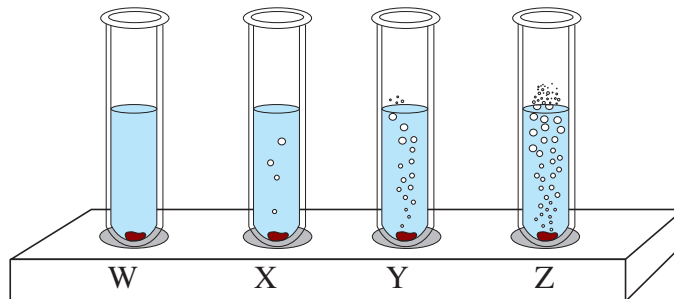
### Understanding

14. Which hormone increases the rate at which cells release energy from carbohydrates?

- A. ATP
- \* B. thyroxin
- C. aldosterone
- D. antidiuretic hormone

### Higher Mental Processes

15. An experiment was set up to measure the effect of temperature on catalase, an enzyme found in the liver that breaks down hydrogen peroxide into water and oxygen gas. Four labelled test tubes, each containing similar amounts of catalase and 2 mL of hydrogen peroxide, were incubated at different temperatures.



Which of the following matches each test tube with its correct temperature?

	W	X	Y	Z
A.	70°C	37°C	20°C	5°C
B.	5°C	20°C	37°C	70°C
* C.	70°C	5°C	20°C	37°C
D.	5°C	70°C	37°C	20°C



## Digestive System

### Knowledge

16. Which structure secretes digestive enzymes and bicarbonate ions?

- A. liver
- B. stomach
- \* C. pancreas
- D. small intestine

### Understanding

17. A bacterial infection inhibits the absorption of water in the digestive system. Where is the infection located?

- A. liver
- B. stomach
- C. duodenum
- \* D. large intestine

### Higher Mental Processes

**Use the following information to answer question 18.**

- |  |
|--|
| <ul style="list-style-type: none"><li>• Bacteria cells are destroyed.</li><li>• Amylase becomes denatured.</li><li>• Pepsinogen becomes activated.</li><li>• Trypsinogen changes into trypsin.</li></ul> |
|--|

18. How many of the above result from the action of gastric juice?

- A. one
- B. two
- \* C. three
- D. four

## Circulatory System: Circulation and Blood / Heart Structure and Function

### Knowledge

19. What blood vessels have thin, permeable walls?

- A. veins
- B. venules
- C. arterioles
- \* D. capillaries

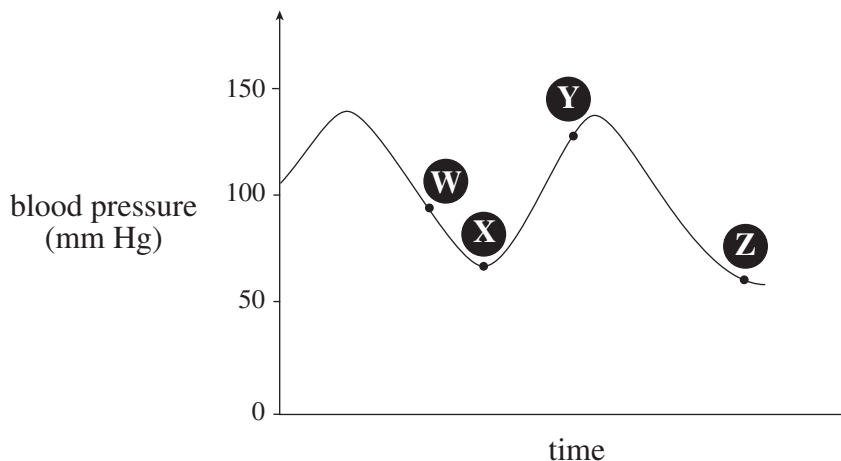
### Understanding

20. What structure prevents blood from moving back into the left ventricle?

- A. the cardiac sphincter
- B. the chordae tendineae
- C. the atrioventricular valve
- \* D. the aortic semilunar valve

### Higher Mental Processes

Use the following graph to answer question 21.



21. The graph shows changes in blood pressure in the aorta over time. Which letter would indicate when ventricular systole is occurring?

- A. W
- B. X
- \* C. Y
- D. Z

## Respiratory System

### Knowledge

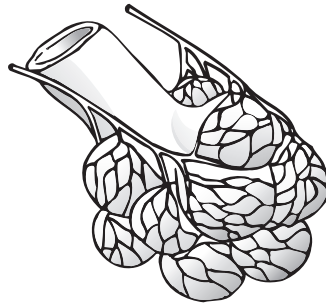
22. What traps particles and moves them up the trachea?
- A. villi and mucus
  - \* B. mucus and cilia
  - C. alveoli and villi
  - D. cilia and alveoli

### Understanding

23. Which of the following substances, formed during internal respiration, counteracts a decrease in blood pH?
- A. oxyhemoglobin
  - B. carbonic anhydrase
  - \* C. reduced hemoglobin
  - D. carbaminohemoglobin

### Higher Mental Processes

Use the following diagram to answer question 24.



24. Which of the following pairs of reactions occurs most frequently in the blood surrounding the structure shown?
- \* A.  $\text{Hb} + \text{O}_2 \rightarrow \text{HbO}_2$  **and**  $\text{HHb} \rightarrow \text{Hb} + \text{H}^+$
  - B.  $\text{HbO}_2 \rightarrow \text{Hb} + \text{O}_2$  **and**  $\text{Hb} + \text{H}^+ \rightarrow \text{HHb}$
  - C.  $\text{H}^+ + \text{Hb} \rightarrow \text{HHb}$  **and**  $\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}^+$
  - D.  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$  **and**  $\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}^+$

## Nervous System: Neuron, Impulse Generation and Reflex Arc / Divisions of the Nervous System and the Brain

### Knowledge

25. How do neurotransmitters move across the synaptic cleft?

- A. by osmosis
- \* B. by diffusion
- C. by active transport
- D. by facilitated transport

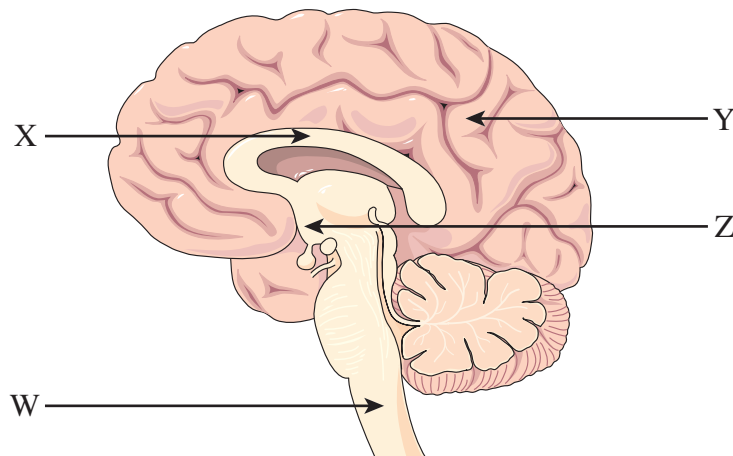
### Understanding

26. What results from stimulation of the parasympathetic nervous system?

- A. the pupils to dilate
- B. peristalsis to decrease
- C. the bronchioles to dilate
- \* D. the heart rate to decrease

### Higher Mental Processes

Use the following diagram to answer question 27.



27. Which labelled structure is responsible for increasing body temperature as a result of infection?

- A. W
- B. X
- C. Y
- \* D. Z

## Urinary System

### *Knowledge*

28. The collecting ducts are located in which of the following structures?
- A. ureter
  - B. urethra
  - C. renal pelvis
  - \* D. renal medulla

### *Understanding*

29. Which structure absorbs glucose by active transport?
- A. glomerulus
  - B. collecting duct
  - C. Bowman's capsule
  - \* D. proximal convoluted tubule

### *Higher Mental Processes*

30. Which of the following results from damage to the glomeruli?
- A. excess glucose in the urine
  - \* B. red blood cells in the filtrate
  - C. an increase of urea in the renal cortex
  - D. a decrease of nitrogenous waste in the filtrate

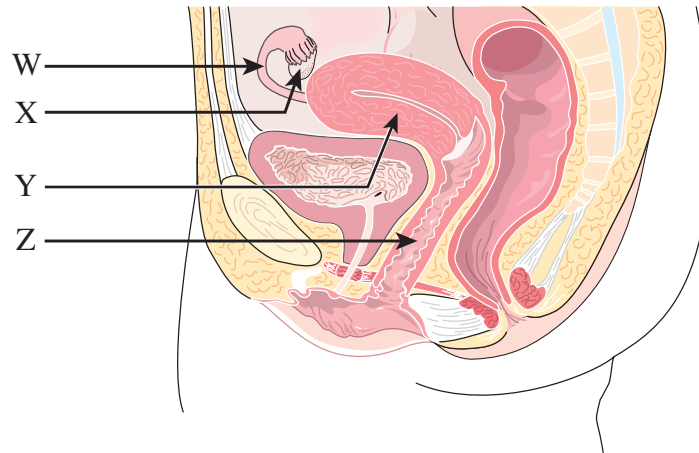
## Reproductive System

### *Knowledge*

31. Where does spermatogenesis occur?
- A. interstitial cells
  - B. seminal vesicles
  - \* C. seminiferous tubules
  - D. ductus (vas) deferens

*Understanding*

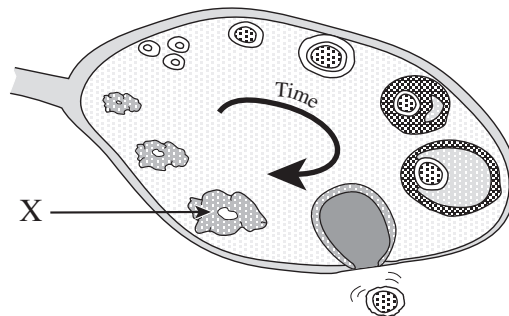
Use the following diagram to answer question 32.



32. Which labelled structure secretes hormones that cause the changes that occur in the female body during puberty?

- A. W
- \* B. X
- C. Y
- D. Z

Use the following diagram to answer question 33.



*Higher Mental Processes*

33. What do the secretions from structure X cause?

- A. uterine lining to slough off
- B. ovaries to produce a mature egg
- \* C. uterine lining to produce a thick mucus
- D. production of human chorionic gonadotropin (HCG)