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Biology, 2013 EC, natural science, entrance exam

Grade 12 · Biology · 2013 E.C.

MARKING KEY — CONFIDENTIAL

Time allowed: 120 minutes | **Questions:** 30 | **Total marks:** 30

1. Which one of the following is true about the importance of Lucy in resolving debates about human evolution? (1)

A. Big brains came before bipedalism.

B. Lucy had a brain size of 18% of her body mass.

C. ✓ **Bipedalism came before big brains.**

D. Lucy was partially an arboreal primate.

Answer: C

Lucy is a fossil of *Australopithecus afarensis* found in Ethiopia in 1974. Her leg, pelvis and spine show that she walked upright on two legs, yet her brain was still small, close to the size of a chimpanzee's brain.

Before her discovery, scientists argued about which came first: a big brain or upright walking. Lucy settled that debate. Bipedalism came before big brains, so option C is correct.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.5 Human evolution (page 200).

2. Which one of the following can best explain behavior? It is (1)

A. ✓ **the co-ordinated response of an organism to an internal or externalstimuli.**

B. the tendency for parts of plants to grow towards light.

C. the actions or reactions of a person or animal in response to external or internal stimuli.

D. a cell or group of cells that receives and processes stimuli.

Answer: A

In biology, behavior is the coordinated response of an organism to internal or external stimuli. The word "organism" matters here: all living things behave, not only people and animals. Plants also respond to stimuli, for example by growing toward light.

Option C is tempting, but it limits behavior to persons and animals, so it is too narrow. Option B is only one plant example, and option D defines a receptor, not behavior.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.5 Animal behavior.

3. The quick withdrawal of your hand from a hot plate is an example of (1)

A. fixed action pattern.

B. ✓ **innate behavior.**

C. biological clock.

D. key stimulus.

Answer: B

Pulling your hand away from a hot plate is a simple reflex: a sudden, involuntary response that does not have to be learned. Reflexes belong to innate (inborn) behavior, so B is correct.

A fixed action pattern is a complete sequence of instinctive actions, such as web building in spiders, not a single quick response. A biological clock controls repeating rhythms, and a key stimulus is the trigger of a behavior, not the behavior itself.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.5.1 Types of animal behavior.

4. Which one of the following processes describes a biological clock? (1)

A. Removal of one's thumb from hot objects quickly

B. The growing of plants towards light

C. ✓ **Circannual migration of birds from temperature to tropical areas**

D. Kinenis and taxes of woodlice and other simple animals

> **Answer:** C
> A biological clock is an internal timer that makes a behavior repeat on a regular cycle. Bird migration from temperate to tropical areas happens once every year, on a yearly rhythm called a circannual rhythm, so it is driven by a biological clock.
>
> Hand withdrawal is a reflex, growth toward light is a plant tropism, and kinesis and taxis are simple orientation movements. None of these run on a timed cycle.
>
> **Textbook:** Biology Grade 11, Unit 2 Animals, section 2.5.2 Patterns of behavior.

5. Identify learned behavior from the following. (1)

A. ✓ **Dog trained to hunt.**

B. Honey bee making honey.

C. Child withdrawals hand from hot things.

D. Ants making nest.

> **Answer:** A
> Learned behavior is gained through experience or training during an animal's own life. A dog hunts on command only because a person trained it, so this is learned behavior.
>
> Making honey, pulling a hand away from heat and building nests are inborn abilities. The animals do them correctly the first time, without any training, so they are innate.
>
> **Textbook:** Biology Grade 11, Unit 2 Animals, section 2.5.1 Types of animal behavior.

6. Which one of the following features is unique to bacteria? (1)

A. Presence of permeable membrane

B. Being unicellular

C. ✓ **Absence of nuclear membrane**

D. Having flagella for location

> **Answer:** C
> Bacteria are prokaryotes. Their DNA lies free in the cytoplasm because there is no nuclear membrane around it. Among the choices, this is the feature that separates bacteria from eukaryotic cells.
>
> The other options are shared with many organisms: every cell has a selectively permeable membrane, protozoa and some algae are also unicellular, and sperm cells and many protists also move with flagella.
>
> **Textbook:** Biology Grade 12, Unit 2 Microorganisms, section 2.1 Eubacteria (page 43).

7. It is possible to produce human insulin in a bacteria strain. The insulin gene should be inserted in a plasmid and the recombinant DNA plasmid should be inserted into a bacterium. What is the role of bacterium in this process? (1)

A. The source of insulin and modification

B. The source of plasmid and insulin production

C. ✓ **Multiplying the recombinant DNA molecule**

D. Joining the gene of insulin with the gene of plasmid

> **Answer:** C
> The joining step happens in the laboratory before any bacterium is involved: restriction enzymes cut the plasmid and the insulin gene, and DNA ligase joins them into a recombinant plasmid. Only after that is the plasmid put into a bacterium.
>
> Inside the cell, the bacterium copies the recombinant plasmid every time it divides. This multiplies the inserted gene into millions of copies and lets the bacterial culture make insulin in large amounts. So the bacterium's role is multiplying the recombinant DNA molecule, option C.
>
> **Textbook:** Biology Grade 12, Unit 1 Application of biology, section 1.4 Applications in biotechnology.

8. Bacteria can cause diseases in all of the following mechanisms EXCEPT (1)

A. ✓ **changing the genetic structure of host cells.**

B. entering living cells and disrupting metabolic systems.

C. releasing toxins as they multiply.

D. invading and growing on the tissues of organs.

> **Answer:** A
> Bacteria make us sick in three main ways: they invade and grow on the tissues of organs, they release toxins as they multiply, and they enter living cells and upset the cell's metabolism.
>
> Changing the genetic structure of host cells is not a bacterial method. That is how some viruses act, for example when viral DNA is inserted into the host's DNA. The question asks for the exception, so A is correct.
>
> **Textbook:** Biology Grade 12, Unit 2 Microorganisms.

9. Functional diseases differ from infection discases in that they (1)

A. are caused by microorganisms.

B. occur in the brain and heart.

C. are common in females than males.

D. ✓ **show no signs of damage on the organ of organ system**

> **Answer:** D
> An infectious disease is caused by a germ and usually leaves visible damage in the infected organ or tissue. A functional disease is different: the organ or system stops working properly, but examination shows no clear physical damage in it. That is what option D says.
>
> Option A describes infectious diseases, not functional ones. Options B and C are not defining features of either group.
>
> **Textbook:** Biology Grade 9, Unit 5 Human health, nutrition and diseases, section 5.8 Infectious and noninfectious diseases (page 125).

10. The social impact of AIDS can be mainly revealed by (1)

A. ✓ **fear of stigmatization.**

B. loss of appetite.

C. reduced labor force.

D. loss of body weight.

> **Answer:** A
> The impacts of AIDS fall into groups. Loss of appetite and loss of body weight are effects on the patient's own body. A reduced labor force is an economic effect on the country.
>
> The social impact is about how people treat one another. Fear of stigmatization, meaning fear of being shamed, isolated or rejected by the community, is the main social effect, so A is correct.
>
> **Textbook:** Biology Grade 9, Unit 4 Reproduction, section 4.11 Sexually transmitted infections (page 95).

11. Which one of the following is a DNA virus? (1)

A. ✓ **Herpes complex**

B. HIV

C. Hepatitis C

D. HINI

> **Answer:** A
> Viruses are grouped by the type of genetic material they carry. Herpes simplex virus stores its genes as DNA, so it is a DNA virus.
>
> HIV and hepatitis C virus carry RNA, and H1N1, an influenza virus, also carries RNA. So options B, C and D are all RNA viruses.
>
> **Textbook:** Biology Grade 12, Unit 2 Microorganisms, section 2.5.3 Classification of viruses (page 84).

12. Which one of the following is a correct comparison of lytic and lysogenic cycles of virus multiplication? (1)

A. Lysogenic cycle releases new viruses using only chronic cycle.

B. Lytic cycle involves incorporation of viral DNA into the host DN

C. ✓ **Lytic cycle releases new viruses only by splitting the host cell.**

D. Both cycles damage the host cell DNA following infection.

> **Answer:** C
> In the lytic cycle the virus takes over the cell, builds new virus particles, and then bursts (lyses) the host cell to set them free. Release by splitting the cell is the mark of the lytic cycle, so option C is the correct comparison.
>
> Option B is reversed: it is the lysogenic cycle that inserts viral DNA into the host DNA. Option D is also wrong because in the lysogenic cycle the host DNA is not broken down; the viral DNA simply sits inside it as a prophage while the cell keeps dividing.
>
> **Textbook:** Biology Grade 12, Unit 2 Microorganisms, section 2.5 Viruses (comparison table on page 87).

13. In an HIV/AIDS community screening were asked to take part in voluntary testing. The following discussion presents the views of four grade 12 students named A, B, C and D towards HIV testing. (1)

#Students A: I should not take the testing; it is simply boring.
#Students B: We should take the testing, since we are educated, we should be exemplary.
#Student C: If we get tested and got positive, what should we do? So, lets us not get tested.
#Student D: You know, this HIV/AIDS testing is simply a business.

We should not be cheated. Which student do you think is correct?

A. ✓ **Student B**

B. Student A

C. Student D

D. Student C

> **Answer:** A
> Voluntary HIV testing is the responsible choice. Knowing your status early means treatment can start early, and it protects your partners and your community. Student B supports testing and wants educated students to set an example, so Student B is right. That is option A.
>
> Students A, C and D all avoid testing because of boredom, fear or suspicion. These are exactly the barriers that health education works to remove.
>
> **Textbook:** Biology Grade 9, Unit 4 Reproduction, section 4.11 Sexually transmitted infections (page 95).

14. Which event of cellular respiration takes place in the cytoplasm of eukaryotic cell? (1)

A. ✓ **Production of pyruvate from glucose**

B. Reaction of acetyl CoA with oxaloacetate

C. Production of ATP through chemiosmosis

D. Reaction of pyruvate with coenzyme A

> **Answer:** A
> Glycolysis is the first stage of cellular respiration and the only stage listed here that runs in the cytoplasm. In glycolysis, one glucose molecule is split into two molecules of pyruvate.
>
> The other events happen inside the mitochondrion: pyruvate reacts with coenzyme A in the matrix, acetyl CoA joins oxaloacetate in the Krebs cycle, and chemiosmosis makes ATP on the inner mitochondrial membrane.
>
> **Textbook:** Biology Grade 12, Unit 3 Energy transformation, section 3.4 Cellular respiration (page 136).

15. Suppose two moles of glucose is burned aerobically. How many moles of ATP can be produced by substrate level phosphorylation in Krebs cycle? (1)

A. ✓ **4**
B. 6
C. 10
D. 8

> **Answer:** A
> Each turn of the Krebs cycle makes one ATP (as GTP) by substrate level phosphorylation. One glucose gives two pyruvate molecules, so the cycle turns twice per glucose and yields 2 ATP.
> For two moles of glucose: 2 times 2 equals 4 moles of ATP. Be careful not to add the ATP made in glycolysis or by the electron transport chain; the question asks only about the Krebs cycle.
> **Textbook:** Biology Grade 12, Unit 3 Energy transformation, section 3.4 Cellular respiration (page 136).

16. During alcoholic fermentation, CO_2 is released when (1)

A. acetaldehyde is reduced
B. pyruvate is oxidized
C. ✓ **pyruvate is decarboxylated**
D. ethanol is oxidized

> **Answer:** C
> Alcoholic fermentation has two steps after glycolysis. First, pyruvate loses a carbon atom as CO_2; removing a carbon in this way is called decarboxylation, and this is the step that releases the gas. Second, the acetaldehyde left behind is reduced to ethanol.
> Option A is the ethanol forming step, and no CO_2 is made there. So the CO_2 escapes when pyruvate is decarboxylated, option C.
> **Textbook:** Biology Grade 12, Unit 3 Energy transformation, section 3.4 Cellular respiration (page 136).

17. During anaerobic respiration, reduced NAD is required to (1)

A. split pyruvate to CO_(2) and acetaldeyde.
B. ✓ **reduce pyruvate to lactate.**
C. convert lactate into pyruvate.
D. reduce pyruvate to acetyl CO_(2)

> **Answer:** B
> Glycolysis can keep running only if the NADH it makes is turned back into NAD+. In muscle cells working without enough oxygen, the hydrogen carried by reduced NAD is used to reduce pyruvate to lactate. This frees the NAD+ so more glucose can be broken down.
> Option A does not need reduced NAD: splitting pyruvate into CO_2 and acetaldehyde is a decarboxylation. Converting lactate back to pyruvate, option C, is an oxidation that produces reduced NAD instead of using it.
> **Textbook:** Biology Grade 12, Unit 3 Energy transformation, section 3.4 Cellular respiration (page 136).

18. Why do we get tired and fatigued during exercise such as long distance running? It is due to (1)

A. accumulation of CO.
B. ✓ **accumulation of lactic acid**
C. high rate of aerobic respiration.
D. shortage of glucose.

> **Answer:** B
> During hard exercise the muscles need more oxygen than the blood can deliver. The muscle cells then switch to anaerobic respiration and turn glucose into lactic acid. As lactic acid builds up in the muscles, it causes the tired, aching feeling of fatigue and can lead to cramps.
> A shortage of glucose is not the direct cause, and aerobic respiration by itself does not make muscles tired. The culprit is the lactic acid from the anaerobic pathway.
> **Textbook:** Biology Grade 12, Unit 3 Energy transformation, section 3.4 Cellular respiration (page 136).

19. If one base in the six triplets of the gene coding for one of the four Polypeptides in the haemoglobin molecule alters the triplet from GAG To GTG, which one of the following biological terms best describes The above phenomenon? (1)

A. ✓ **Mutation**
B. Cloning
C. Translation
D. Transcription

> **Answer:** A
> The DNA base sequence changed: one base in a triplet was replaced, turning GAG into GTG. Any change in the base sequence of the genetic material is called a mutation. This particular substitution, in the gene for one haemoglobin chain, is the famous mutation behind sickle cell anaemia.
>
> Transcription and translation are the normal steps of making a protein from a gene, and cloning means copying DNA or organisms. None of them means a change in the sequence.
>
> **Textbook:** Biology Grade 12, Unit 4 Evolution, section 4.1.6 Mutation (page 208).

20. Which one of the following is the basic characteristic of mutation? It is (1)

A. ✓ **spontaneous**
B. planned
C. regular
D. expected

> **Answer:** A
> A mutation is a sudden, random change in the genetic material. It arises spontaneously: no cell plans it, no one can predict when or where it will appear, and it follows no regular schedule.
>
> That is why "planned", "regular" and "expected" are all wrong. Each one describes the opposite of how mutations happen.
>
> **Textbook:** Biology Grade 12, Unit 4 Evolution, section 4.1.6 Mutation (page 208).

21. The theory that suggests "life can evolve autonomously from non-living objects" is known as (1)

A. cosmozoan theory
B. ✓ **spontaneous generation theory**
C. biochemical theory
D. eternity theory

> **Answer:** B
> The idea that living things can arise by themselves from non-living matter is the theory of spontaneous generation. People once believed, for example, that maggots formed on their own from rotting meat.
>
> The cosmozoan theory says life reached Earth from space, and the biochemical theory says life formed step by step through chemical evolution in the early oceans. Those describe different origins, so B is the answer.
>
> **Textbook:** Biology Grade 12, Unit 4 Evolution, section 4.1.2 Theories of evolution (page 171).

22. Which one of the following is true about neo-Darwinian theory? (1)

A. There is a natural variation in features and variation which are heritable
B. All species tend to produce more offspring than can possibly survive
C. ✓ **It takes into genetic and animal behavior to understand evolution**
D. Development of new feature is important for survival

> **Answer:** C
> Neo-Darwinian theory is the updated version of Darwin's theory. It keeps natural selection but adds the science Darwin did not have: genetics, which explains where variation comes from and how it is inherited, together with studies of animal behavior. That is what option C describes.
>
> Options A and B are parts of Darwin's original theory, so they do not set the newer theory apart.
>
> **Textbook:** Biology Grade 12, Unit 4 Evolution, section 4.1.2 Theories of evolution (page 171).

23. Which one of the following statements describes the evolutionary Theory of Lamarck? (1)

A. Acquired characteristics cannot be inherited

B. ✓ **Structures commonly used become more develoed**

C. Origin of species happens only through natural selection

D. Species started complex and gradually become simple

Answer: B

Lamarck's theory rests on two ideas. First, use and disuse: a body part that is used often becomes bigger and stronger, while an unused part shrinks away. Second, these acquired changes are passed on to the offspring. Option B states the use and disuse idea, so it describes Lamarck's theory.

Option A says the opposite of what Lamarck believed. Option C is Darwin's natural selection. Option D reverses Lamarck's view, since he pictured life moving from simple forms toward more complex ones.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.2 Theories of evolution (page 171).

24. The behavior which trainers look, if modified, could lead to the Desired behavior and reward such a behavior is (1)

A. innate

B. instinct

C. reflex

D. ✓ **operant**

Answer: D

In operant conditioning, a trainer watches for a behavior that is close to the wanted one, rewards it, and shapes it step by step into the desired behavior. The animal learns because its own action brings the reward. That is exactly what the question describes, so the behavior is operant.

Innate behavior, instinct and reflex are inborn. They appear without training and cannot be shaped by rewards in this way.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.5.1 Types of animal behavior.

25. Which one of the following examples of behavior describes when a animal stops responding to stimulus or cue after a period of repeated exposure? (1)

A. Imprinting

B. Reflex

C. ✓ **Habituation**

D. Conditioning

Answer: C

Habituation is a simple form of learning in which an animal stops responding to a stimulus, or cue, after meeting it repeatedly with no effect. Birds that stop fearing a scarecrow show habituation. The question repeats this definition almost word for word, so the answer is habituation.

Conditioning is different: the animal learns to link a stimulus with a reward, a punishment or another stimulus. Imprinting is early attachment to a parent figure, and a reflex is not learned at all.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.5.1 Types of animal behavior.

26. police man trained a dog on how to find explosive materials through Sniffing; on another instant the same police man observed a week old Puppy following him to the roadside. Which one of the following is Correct about the behaviors of the animal in the observation? (1)

A. The first case is genetically encoded and he second is adaptive

B. Both of the cases indicate natural behavior of the animals

C. ✓ **Both of the cases indicate learned behavior of the animals**

D. The first cases develop through trial and the second genetically Coded.

> **Answer:** C
> Both behaviors were gained through experience, so both are learned. Teaching the dog to find explosives by rewarding correct sniffing is operant conditioning. The young puppy following the policeman is imprinting, in which a very young animal attaches to and follows a figure it meets early in life. Conditioning and imprinting are both forms of learned behavior, so C is correct.
>
> Options A, B and D each call at least one of the two behaviors inborn, which is not the case here.
>
> **Textbook:** Biology Grade 11, Unit 2 Animals, section 2.5.1 Types of animal behavior.

27. Which one of the following behavior is a courtship behavior? (1)

A. ✓ **Touch**

B. Scent marking

C. Ritual fighting

D. Defending a den

> **Answer:** A
> Courtship is the behavior that comes before mating, when animals attract and accept a partner. Courtship signals include visual displays, sounds, chemicals and touch. Among the options, touch is the one used as a courtship signal.
>
> Scent marking and defending a den are territorial behaviors, and ritual fighting is competition between rivals, usually between males. None of these is a signal between mates.
>
> **Textbook:** Biology Grade 11, Unit 2 Animals, section 2.5.2 Patterns of behavior.

28. The Ethiopian wolf (Canis simensis) lives and hunt in packs. During patrolling their habitat, both male and female wolves of the group maintain their area with urine containing pheromone. This pattern of behavior best exemplifies (1)

A. courtship behavior

B. ✓ **territorial behavior**

C. operant behavior

D. learned behavior

> **Answer:** B
> The wolves mark the borders of their home area with pheromone in their urine so that other animals stay away. Claiming and defending an area in this way is territorial behavior. The Grade 11 book gives the same example: dogs and lions mark their territory with pheromones in urine.
>
> Courtship is about attracting a mate, and operant behavior is learned through reward. Neither fits scent marking of an area.
>
> **Textbook:** Biology Grade 11, Unit 2 Animals, section 2.5.2 Patterns of behavior.

29. The terrestrial biome characterized by cold temperature, dry Precipitation frozen soil and inhabited by migration birds is (1)

A. boreal forests
B. deserts
C. tropical montane forests
D. ✓ **tundra**

Answer: D
The tundra is the cold biome of the far north. Precipitation is low, winters are very cold, and a soil layer called permafrost stays frozen all year. Plants are mostly mosses, grasses and lichens, and many birds fly to the tundra only for summer nesting. This matches every clue in the question, including the migrating birds.

Boreal forests are also cold but are covered by conifer trees. Deserts are defined by dryness rather than frozen soil, and tropical montane forests are warm and wet.

Textbook: Biology Grade 9, Unit 6 Ecology, section 6.1.5 Biomes (page 148).

30. Which one of the following explains biodiversity? (1)

A. ✓ **The variability among living organisms, within species, and of Ecosystem.**
B. The large number of human races in the world
C. The similarity and differences of organisms which live in different Ecosystems
D. Large number of organisms in the ecosystem

Answer: A
Biodiversity means the variety of life at every level: the variety of genes within a species, the variety of species, and the variety of ecosystems. Option A covers all of these levels, so it is the best definition.

Option D only counts how many organisms live in an ecosystem, which measures abundance, not variety. Option B is about humans only, and option C talks about comparing organisms instead of defining diversity itself.

Textbook: Biology Grade 11, Unit 6 Population and natural resources, section 6.5.6 Loss of biodiversity.

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