

Biology, 2015 EC, natural science, entrance exam

Grade 12 · Biology · 2015 E.C.

MARKING KEY — CONFIDENTIAL**Time allowed:** 120 minutes**Questions:** 30**Total marks:** 30

1. Bacterial cell wall is unique due to its (1)
- A. ✓ **Chemical composition** B. Freely permeability
C. Selective permeability D. Mechanical support

Answer: A

The wall of a bacterial cell is built from peptidoglycan (also called murein). No other group of organisms uses this material, so the chemical composition makes the bacterial wall unique. Plant cell walls are made of cellulose and fungal walls of chitin.

Permeability and mechanical support are jobs that cell walls do in many organisms, so they are not unique to bacteria.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.1.1 Structure of Bacterial Cell (page 47).

2. Which genus of bacteria oxidize hydrogen sulphide to sulphate and make sulphate ions available to be taken by plant roots from the soil? (1)
- A. Klebsiella B. Desulphovibrio
C. Azotobacter D. ✓ **Thiobacillus**

Answer: D

Thiobacillus (written as Thiobacillus in the paper) is the sulphur bacterium that oxidizes hydrogen sulphide to sulphate. Plants cannot use hydrogen sulphide, but their roots absorb sulphate from the soil to build proteins.

Desulphovibrio does the opposite: it reduces sulphate back to hydrogen sulphide. Azotobacter and Klebsiella work in the nitrogen cycle, not the sulphur cycle.

3. Which one of the following diseases is caused by food poisoning bacteria ? (1)
- A. Candidiasis B. ✓ **Salmonellosis**
C. Tuberculosis D. Pneumonia

Answer: B

Salmonellosis is food poisoning. It comes from eating food or water contaminated with Salmonella bacteria, and it causes diarrhoea, fever and stomach cramps.

Candidiasis is caused by a fungus, not a bacterium. Tuberculosis and pneumonia are spread mainly through the air, not through food.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.7 Modes of disease transmission and ways of prevention (page 95).

4. Which one of the following is correct concerning the reproductive cycles of viruses? (1)
- A. Both lytic and lysogenic life cycles release new viruses without the genetic alteration of the host cell
 - B. ✓ **in lysogenic life cycle the DNA of the virus integrates with the host cell's DNA.**
 - C. Both lytic and lysogenic life cycles undergo the same life cycle but ending with different results
 - D. In lytic life cycle, viruses are released without killing the host cell.

Answer: B

In the lysogenic cycle the viral DNA joins the DNA of the host cell. It stays there quietly and is copied each time the cell divides, so option B is correct.

The other options fail: in the lytic cycle new viruses burst out and kill the host cell, so D is false. The two cycles follow different paths, so C is false. And because lysogeny inserts viral DNA into the host genome, the host cell is genetically altered, so A is false.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.5 Viruses (page 78).

5. Unlike free living cells, viruses are completely (1)
- A. pathogenic to a living cell
 - B. mutual to a living cell
 - C. ✓ **parasitic to a living cell**
 - D. harmful to a living cell

Answer: C

A virus has no cytoplasm, no ribosomes and no energy system of its own. It can only reproduce by entering a living cell and using that cell's machinery. For this reason viruses are called obligate parasites.

Not every virus harms its host all the time, so "pathogenic" and "harmful" are too strong as general descriptions, and viruses give nothing back to the cell, so they are not mutual partners.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.5.1 Characteristics of virus (page 79).

6. Why are vaccines important? Because they help to (1)
- A. ✓ **trigger the immune system**
 - B. kill pathogens
 - C. prevent functional diseases
 - D. heal wounds

Answer: A

A vaccine contains a weakened or killed pathogen, or a harmless piece of one. When it enters the body it triggers the immune system to make antibodies and memory cells. If the real pathogen arrives later, the body recognizes it and fights it off quickly.

The vaccine itself does not kill pathogens; that is the work of the immune system it wakes up. It also cannot prevent functional diseases such as diabetes, and it has nothing to do with healing wounds.

7. Assume you wanted to demonstrate compatibility of blood groups. You took four test tubes labelled O, A, B, and AB based on the blood group that each test tube contains. Then you added unknown blood sample in to each tube and no agglutination was observed in each test tube. From this you can conclude that the unknown blood sample was. (1)
- A. blood group B.
 - B. ✓ **blood group O**
 - C. blood group A.
 - D. blood group AB.

Answer: B

Agglutination (clumping) happens when antibodies in the plasma meet red blood cells that carry the matching antigen. The unknown blood clumped in none of the four tubes, so its red cells carry no A antigen and no B antigen.

Blood with neither antigen is group O, the universal donor. If the sample had been group A, for example, it would have clumped in the tubes holding anti A antibodies (the group B and group O tubes).

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2 The circulatory and lymphatic system.

8. Which one of the following diseases the likelihood of contraction HIV?

(1)

- A. Syphilis
B. Chancroid
C. ✓ **Tuberculosis**
D. Gonorrhoea

Answer: C

Tuberculosis stands apart from the other three options. Syphilis, chancroid and gonorrhoea are sexually transmitted infections; the sores and inflammation they cause make it easier for HIV to pass between partners.

Tuberculosis is not sexually transmitted. Its link with HIV runs the other way: once HIV weakens the immune system, TB becomes the most common opportunistic disease, so people living with HIV develop active TB far more often than others.

Note: some words are missing from the printed question, but on either reading tuberculosis is the expected choice.

9. Even though pasteurization is a technique used to heat milk, beer and other foods, it cannot preserve food unspoiled for years because it.

(1)

- A. Cannot kill pathogenic micro organisms
- B. Reduces the nutritional of the food
- C. is conducted in containers that are not properly sealed.
- D. ✓ **uses mild temperature that kills most but not all bacteria**

Answer: D

Pasteurization heats food gently, usually to about 63 to 72 degrees Celsius for a short time. This mild heat kills most harmful bacteria without spoiling the taste of the milk or drink.

Because the temperature never reaches boiling, some bacteria and their tough spores survive. These survivors slowly multiply, so pasteurized food still spoils and cannot stay safe for years.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.9 Controlling microorganisms (page 106).

10. Which one of the following statements is correct about the binomial nomenclature?

(1)

- A. The genus name is written in full while the species name is abbreviated
- B. Both genus and species names are capitalized and italicized when printed.
- C. ✓ **The first letter of genus name is capitalized while the species name is written in small letters.**
- D. The genus name is written in English while the species name is written in Latin.

Answer: C

In binomial nomenclature every organism gets two names: the genus name first, then the species name. The genus name starts with a capital letter and the species name is written entirely in small letters, as in *Homo sapiens*.

Option B fails because the species name is never capitalized. Both names come from Latin, and both are italicized in print or underlined when handwritten.

Textbook: Biology Grade 9, Unit 2 Characteristics and Classification of Organisms (page 25).

11. During gas exchange between the alveoli and blood capillaries, oxygen is absorbed by the blood while carbon dioxide is removed. This opposite direction of gas exchange occurs due to (1)
- A. ✓ **Difference in the concentration gradient of oxygen and carbon dioxide.**
 - B. Difference in the molecular size of oxygen and carbon dioxide.
 - C. Thicker layer of the capillaries.
 - D. The small surface area of the alveoli.

Answer: A

Gases move by diffusion, always from where their concentration is high to where it is low. Air in the alveoli is rich in oxygen, so oxygen diffuses into the blood. Blood arriving at the lungs is rich in carbon dioxide, so carbon dioxide diffuses out into the alveoli.

Each gas follows its own concentration gradient, and the two gradients run in opposite directions. Thin capillary walls and the large alveolar surface help diffusion; they do not decide its direction.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.3 The breathing system.

12. Identify the correct statement about the effect of exercise on breathing rate. (1)
- A. The vital capacity of the lungs decrease during heavy exercise.
 - B. The tidal volume of air at rest is greater than the tidal volume of air during exercise.
 - C. Fast and deep breathing are the result of demanding less oxygen.
 - D. ✓ **Exercise and getting fit makes the lungs efficient.**

Answer: D

Regular exercise strengthens the diaphragm and the muscles between the ribs. A fit person can move more air with each breath, so the lungs work more efficiently. (The option's word "fir" is a misprint of "fit".)

The other options are false. Vital capacity does not fall during exercise. Tidal volume during exercise is larger than at rest, not smaller. And fast, deep breathing happens because the body demands more oxygen, not less.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.3 The breathing system.

13. The following is a list of functions of the components of blood. (1)
- 1. Transport of oxygen
 - 2. Fight against diseases
 - 3. Cause blood clotting

Which one of the following is a correct order of blood components responsible for the above functions respectively?

- A. White blood cells, platelets, red blood cells
- B. Platelets, white blood cells, red blood cells
- C. ✓ **Red blood cells, white blood cells, platelets**
- D. Red blood cells, platelets, white blood cells

Answer: C

Red blood cells carry oxygen; their haemoglobin binds oxygen in the lungs and releases it in the tissues. White blood cells defend the body against disease. Platelets start the clotting process when a vessel is cut.

Matching the three functions in the order given, the correct sequence is red blood cells, white blood cells, platelets.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2 The circulatory and lymphatic system.

14. What is the cause of the back flow of blood in to the atria from the ventricles? It could be damage of the (1)
- A. aorta. B. pulmonary artery.
C. puimonaryvein D. ✓ **valves**

Answer: D

The bicuspid and tricuspid valves sit between the atria and the ventricles. When the ventricles contract, these valves snap shut so blood is pushed forward into the arteries, never backward. If a valve is damaged and cannot close fully, blood leaks back into the atria.

The aorta, pulmonary artery and pulmonary vein are vessels that carry blood to or from the heart; none of them guards the opening between an atrium and a ventricle.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2 The circulatory and lymphatic system.

15. The capillaries are blood vessels that have thin wall and large surface area since their function is (1)
- A. transport of oxygenated blood B. ✓ **exchange of substances**
C. to return blood to the heart D. transport of de oxygenated blood.

Answer: B

Capillaries are where the blood does its real work: oxygen, nutrients, carbon dioxide and wastes cross between the blood and the body cells. Their wall is only one cell thick, which keeps the diffusion distance short, and their enormous total surface area lets exchange happen quickly.

Returning blood to the heart is the job of veins, and carrying oxygenated blood away from the heart is the job of arteries, so those options do not fit capillary structure.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2 The circulatory and lymphatic system.

16. During image formation, light is refracted twice before it is focused on the retina. This phenomenon happens at the (1)
- A. aqueous humour and lens B. iris and lens
C. lens and vitrous humour D. ✓ **Come a and lens**

Answer: D

Light entering the eye bends first at the cornea, which does most of the refraction. It bends a second time at the lens, which fine tunes the focus so a sharp image lands on the retina. (The option's "Come a" is a misprint of "cornea".)

The humours are watery and jelly filled spaces that mainly keep the eye's shape, and the iris only controls how much light enters; none of these focuses the image.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.4 The Eye (page 281).

17. Three students designed the following experimental settings to understand the actual taste of a food.

(1)

#Student 1: Blind folded two students, one of them tightly holding the nose While the other without holding the nose and tasting the food.

#Student 2: Blind folded one student and the other left with open eyes, both holding their nose tightly while tasting the food

#Student 3: None of the participants blind folded and only one eyes, both holding her nose tightly while tasting the food

#Student 4: None of the participants blind folded and both of them taste the food without holding the nose.

Which student designed the most appropriate experiment?

A. Student 1

B. Student 2

C. Student 4

D. ✓ **Student 3**

Answer: D

What we call flavour is really taste from the tongue mixed with smell from the nose. To find the actual taste of a food, the smell must be blocked, so the tasters should pinch their noses shut.

In Student 3's design both tasters are treated the same way and both hold their noses, so whatever they report comes from the tongue alone. Student 4 blocks nothing. Student 1 leaves one taster's nose open, and Student 2 blindfolds only one taster, which adds a needless difference between the two.

Textbook: Biology Grade 12, Unit 5 Human Body System, sections 5.2.2 The Tongue and 5.2.3 The Nose (pages 278 to 280).

18. Short sightedness corrected by a concave lens because the problem arises due to a

(1)

A. weak eye lens that converges light slightly

B. powerful eye lens that diverges light

C. weak eye lens that diverges light.

D. ✓ **strong eye lens that converges light too soon**

Answer: D

In short sightedness (myopia) the eyeball is too long or the eye lens is too strong. The lens converges light too soon, so the image forms in front of the retina and distant objects look blurred.

A concave lens spreads the light rays slightly before they enter the eye. The eye's strong lens then brings them to a focus exactly on the retina.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.4 The Eye (page 281).

19. A patient exhibited symptoms of weight loss, sweating and irritability and the doctor suspected an endocrine malfunction that can be related to the

(1)

A. pancreas

B. adrenal gland

C. ✓ **thyroid glands**

D. gonads

Answer: C

Weight loss, sweating and irritability together point to an overactive thyroid gland. Too much thyroxine speeds up the whole metabolism: the body burns food fast, produces extra heat and the person feels restless, often with a rapid heartbeat.

A pancreas problem would mainly disturb blood sugar, the adrenal glands are tied to stress responses and salt balance, and the gonads control reproduction, so none of them matches this set of symptoms as well.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.6 The endocrine system (page 295).

20. Secretions of endocrine glands require receptors on cell membrane to be picked by their targets while exocrine secretions do not. This is because (1)
- A. exocrine glands secrete hormone directly to the blood stream.
 - B. ✓ **endocrine glands are ductless.**
 - C. exocrine glands are controlled by the nervous system.
 - D. endocrine glands produce protein - based hormones.

Answer: B

Endocrine glands are ductless. Their hormones are released into the blood, which carries them past every cell in the body. Only target cells that carry the matching receptor can pick the hormone out and respond, which is why receptors are needed.

Exocrine glands, such as salivary or sweat glands, pour their secretions through ducts straight onto the place where they act, so no receptor is required.

Option A states the reverse of the truth: secreting directly into the bloodstream is what endocrine glands do, not exocrine glands.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.6 The endocrine system (page 295).

21. Which of the following diseases is caused by a DNA virus? (1)
- A. ✓ **Cold sore**
 - B. Aids
 - C. Swine flu
 - D. Corona

Answer: A

Cold sores are caused by the herpes simplex virus, and herpes viruses carry DNA as their genetic material. So cold sore is the disease caused by a DNA virus.

The other three do not fit. HIV, the virus behind AIDS, is an RNA retrovirus. Swine flu is caused by an influenza virus and corona by a coronavirus, and both of these carry RNA.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.5.3 Classification of Viruses (page 84).

22. Currently, natural resource are being depleted at increasing rate and waste materials are accumulated and discharged freely in to water bodies. What is the best strategy to overcome these problems? (1)
- A. Decomposition
 - B. Succession
 - C. Fossilization
 - D. ✓ **Recycling**

Answer: D

Recycling collects used materials such as paper, metal and plastic and turns them back into raw materials. This slows down the depletion of natural resources and keeps waste out of rivers and lakes, so it attacks both problems in the question at once.

Decomposition, succession and fossilization are natural processes; they are not strategies people can apply to manage resources and waste.

Textbook: Biology Grade 11, Unit 6 Population and Natural Resources, section 6.5.8 Resource depletion (page 278).

23. Which stage of the nitrogen cycle needs the role of Rhizobium? (1)
- A. Decomposition
 - B. Denitrification
 - C. ✓ **Nitrogen fixation**
 - D. Nitrification

Answer: C

Rhizobium is the bacterium that lives in the root nodules of legumes such as beans and peas. It takes nitrogen gas from the air and converts it into ammonia the plant can use. This step is nitrogen fixation.

Nitrification is done by other bacteria such as Nitrosomonas and Nitrobacter, denitrification by denitrifying bacteria, and decomposition by fungi and saprotrophic bacteria.

Textbook: Biology Grade 10, Unit 6 Ecological Interactions, section 6.2.3 Nitrogen cycle.

24. A key aspect in the process of recovery of an ecosystem through succession is that. (1)
- A. ✓ **pioneer species always make the environment better.**
 - B. higher organisms colonize the environment first.
 - C. a climax community of lichens and mosses is established at the end.
 - D. pioneer species always tend to be lower animals.

Answer: A

Succession recovers an ecosystem step by step. Pioneer species such as lichens and mosses settle first on bare ground. As they live and die they break rock, build soil and add humus, making the place better for the species that follow. This improvement of the environment is the key to the whole process.

The other options reverse the order of events: complex organisms arrive late, not first, and lichens and mosses are the starting community, not the climax at the end.

25. What are the common plants of the boreal forest? (1)
- A. Deciduous trees
 - B. ✓ **Conifers**
 - C. Mosses
 - D. Epiphytes

Answer: B

The boreal forest, also called the taiga, is the cold northern biome that stretches across Canada, Scandinavia and Russia. Its typical plants are conifers such as pine, spruce and fir, whose needle shaped leaves survive long freezing winters.

Deciduous trees belong to temperate forests, epiphytes to tropical rainforests, and mosses are most typical of the tundra floor.

26. Which one of the following may NOT be regulated by a plant hormone? (1)
- A. ✓ **Seed dispersal**
 - B. Cell division
 - C. Cell elongation
 - D. Fruit ripening

Answer: A

Seed dispersal is carried out by outside agents: wind, water and animals move seeds away from the parent plant. No plant hormone controls it.

The other three are classic hormone jobs: cytokinins drive cell division, auxins drive cell elongation, and ethylene ripens fruit.

Textbook: Biology Grade 10, Unit 2 Plants, sections 2.6 Seed Dispersal and Germination and 2.9 Response in plants.

27. Bushing of a plant results from (1)
- A. cancellation of the positive effect of apical dominance.
 - B. ✓ **removal of the inhibitory effect of auxin.**
 - C. decreased production of auxin by side shoot.
 - D. increased production of auxin by the main shoot.

Answer: B

The tip of the main shoot produces auxin, and this auxin holds the side buds back. Biologists call the effect apical dominance. When the tip is cut off or damaged, the auxin supply stops, the inhibition is lifted, and the side buds grow out. The plant becomes bushy.

Option D describes the opposite situation: extra auxin from the main shoot would suppress the side buds even more strongly. Option A misnames apical dominance as a positive effect when its action on side buds is inhibitory.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.9 Response in plants.

28. Actions such as protection of individual species, reduction of pollution, and reduction of deforestation can collectively be taken as methods of (1)
- A. agricultural expansion
B. ✓ **biodiversity conservation**
C. Fighting global warming
D. fighting soil erosion

Answer: B

Protecting individual species, cutting pollution and slowing deforestation all defend the variety of living things and their habitats. Taken together they are methods of biodiversity conservation.

Some of these actions also help against global warming or soil erosion, but only biodiversity conservation covers all three at once, and agricultural expansion works against them.

Textbook: Biology Grade 11, Unit 6 Population and Natural Resources, section 6.5.6 Loss of Biodiversity (page 274).

29. Which one of the following plants is NOT endemic to Ethiopia? (1)
- A. ✓ **Mango**
B. Zigba
C. Noug
D. Enset

Answer: A

Mango originally comes from southern Asia and is now grown across the tropics, so it is not endemic to Ethiopia.

Noug (*Guizotia abyssinica*), enset or false banana (*Ensete ventricosum*) and zigba (*Podocarpus*) are native Ethiopian plants, and noug and enset in particular are treated as plants of Ethiopian origin in the curriculum.

Textbook: Biology Grade 9, Unit 2 Characteristics and Classification of Organisms, section 2.5 Common Ethiopian animals and plants.

30. Which one of the following national parks is characterized by the presence of wildlife such as elephant, lion, cheetah and giraffe? (1)
- A. Bale mountains national park
B. Awash national park
C. ✓ **Mago national park**
D. Simien mountains national park

Answer: C

Elephant, lion, cheetah and giraffe are animals of hot lowland savanna. In Ethiopia that combination is found in Mago National Park, in the lower Omo valley of the south west, which is famous for its large savanna game.

Bale Mountains and Simien Mountains are highland parks, home to the Ethiopian wolf, mountain nyala, walia ibex and gelada. Awash National Park holds dry plains animals such as oryx and kudu, but it has no giraffes or elephants.

Textbook: Biology Grade 11, Unit 6 Population and Natural Resources, section 6.3 Conservation of natural resources in Ethiopia (page 256).

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