

Biology, 2014 EC, natural science, entrance exam

Grade 12 · Biology · 2014 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), a mesh of sugar chains cross linked by short chains of amino acids. No other group of organisms builds its wall from this material: plant cell walls are made of cellulose and fungal walls of chitin. So what makes the bacterial wall unique is its chemical composition.

Mechanical support is something every cell wall gives, so option D cannot be the unique feature. Permeability is a property of the cell membrane rather than the wall.

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 is a sulphur oxidizing genus. It gains energy by oxidizing hydrogen sulphide (H_2S) to sulphate, and sulphate is the form of sulphur that plant roots can absorb from the soil.

Desulphovibrio does the opposite job: it reduces sulphate back to hydrogen sulphide. *Klebsiella* and *Azotobacter* are nitrogen fixing bacteria, so they work on 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 caused by *Salmonella* bacteria taken in with contaminated food, especially undercooked meat, poultry and eggs. The bacteria multiply in the gut and cause diarrhoea, stomach cramps and fever. The textbook lists salmonellosis among the diseases spread by eating contaminated food.

The other options fail for a different reason each: candidiasis is a fungal infection, while tuberculosis and pneumonia spread mainly through droplets in the air, not through food.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.7 Modes of disease transmission and ways of prevention, Table 2.8 (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 integrate with the hostcell'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 virus does not make new virus particles straight away. Its DNA joins the host cell's own DNA and is copied quietly every time the host cell divides. This integrated state is the key feature of lysogeny, so option B is correct.

Option A is wrong because this integration is a genetic change in the host. Option C is wrong because the two cycles follow different paths: the lytic cycle builds new viruses at once and bursts the cell, while the lysogenic cycle hides first. Option D is wrong because release in the lytic cycle destroys the host cell.

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 ribosomes and no metabolism of its own, so it cannot grow or reproduce outside a cell. It must enter a living cell and use that cell's machinery to copy itself. For this reason viruses are described as complete (obligate) parasites of living cells.

Option A is tempting, but not every viral infection causes disease, so "completely pathogenic" is too strong. Parasitism is the term that applies to all viruses without exception.

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

6. Assume you wanted to demonstrate compatibility of blood groups. (1)
- 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 you can conclude that the unknown blood sample was,

- A. blood group AB
- B. ✓ **blood group O**
- C. blood group A
- D. blood group B

Answer: B

Agglutination (clumping) happens when red blood cells carrying an antigen meet the antibody against that antigen. The tube containing group O blood has both anti A and anti B antibodies, so any sample with A or B antigens would clump at least there.

The unknown sample clumped nowhere. That means its red cells carry neither A nor B antigen, which is exactly the description of group O, the universal donor.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2.1 Blood donation.

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

(1)

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

Answer: C

Syphilis, chancroid and gonorrhea are sexually transmitted infections. The sores and inflammation they cause break the skin and mucous membranes of the genitals, which opens an easy entry point for HIV during sex. So each of those three raises the chance of catching HIV.

Tuberculosis is different: it is spread through the air and is not sexually transmitted, so it does not raise the chance of catching HIV. Instead, TB is a disease that often attacks people who already live with HIV because their immune system is weakened.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.2.6 The major sexually transmitted infections (STIs) in Ethiopia (page 212).

8. 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 uses mild heat, for example 61.5 degrees Celsius for 30 minutes or 71 degrees Celsius for 15 seconds. This is hot enough to kill most disease causing microbes in milk without spoiling its taste and nutrients.

It is not sterilization. Bacterial spores and some heat resistant bacteria survive the mild temperature, and these survivors slowly multiply and spoil the food. That is why pasteurized food keeps for days or weeks, not for years.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.9 Controlling microorganisms (page 108).

9. 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 species 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*. Both names are printed in italics (or underlined when handwritten).

Option B fails because the species name is never capitalized. Option D fails because both names are in Latin or latinized form, not English. Neither name is abbreviated, so option A is also wrong.

Textbook: Biology Grade 9, Unit 2 Characteristics and classification of organisms, section 2.4 Linnaean system of nomenclature.

10. 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 cross the alveolar wall by diffusion, and each gas follows its own concentration gradient. Air in the alveoli holds more oxygen than the blood arriving from the body, so oxygen diffuses into the blood. That same blood holds more carbon dioxide than alveolar air, so carbon dioxide diffuses out.

The two gases move in opposite directions simply because their gradients point in opposite directions. Options C and D actually describe faults: thin capillary walls and the large alveolar surface are what make the exchange fast.

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

11. Identify the correct statement about the effect of exercise on breathing rate. (1)
- A. The vital capacity of the lungs decreases 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 trains the diaphragm and the muscles between the ribs, so a fit person breathes more deeply and moves air more efficiently. That is what option D says (read "getting fit" as a misprint of "getting fir").

The others state the opposite of what happens. Vital capacity does not fall during exercise (A). Tidal volume, the air moved per breath, is larger during exercise than at rest, not smaller (B). Fast and deep breathing comes from needing more oxygen, not less (C).

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

12. 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

Match each function to its component. Red blood cells carry oxygen because they are packed with haemoglobin. White blood cells defend the body against disease-causing microbes. Platelets stick together at a wound and start blood clotting.

Reading the functions in the order given (oxygen transport, fighting disease, clotting), the matching order is red blood cells, white blood cells, platelets, which is option C.

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

13. 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. pulmonary vein
D. ✓ **valves.**

Answer: D

The valves between the atria and the ventricles (the bicuspid and tricuspid valves) work as one way doors. When the ventricles contract, healthy valves snap shut so blood can only leave through the arteries. If a valve is damaged and cannot close fully, some blood leaks backwards 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.

14. 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 actually does its work: oxygen and nutrients pass out to the cells, and carbon dioxide and other wastes pass in. Their structure fits this job. A wall only one cell thick gives materials a very short distance to cross, and the huge number of tiny vessels gives an enormous total surface for exchange.

Transporting blood over distance is the job of arteries and veins; returning blood to the heart is the job of veins.

Capillaries exist for exchange.

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

15. During image formation, light is refracted twice before it is focused on the retina. This phenomenon happens at the (1)
- A. Aqueous humor and lens
B. iris and lens
C. lens and vitreous humour
D. ✓ **cornea and lens**

Answer: D

Light entering the eye is bent (refracted) twice on its way to the retina. The first and strongest bending happens at the curved cornea. The second happens at the lens, which fine tunes the focus by changing its shape so the image lands exactly on the retina.

The iris cannot be part of the answer: it is a muscular ring that widens or narrows the pupil to control how much light enters, but it does not bend the light. The humours fill the eye and have little refracting role compared with the cornea and lens.

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

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

(1)

Student 1. Blindfolded two students, one of them tightly holding the nose while the other without holding the nose and testing the food

Student 2. Blindfolded one student and the other left with open eyes, both holding their nose tightly while testing the food

Student 3. None of the participants blindfolded and only one eye, both holding their nose tightly while testing the food

Student 4. None of the participants blindfolded and both of them taste the food without holding the nose.

Which student designed the most appropriate experiment?

A. Student 1

B. Student 4

C. Student 2

D. ✓ Student 3

Answer: D

What we call flavour is really two senses working together: taste receptors on the tongue and smell receptors in the nose. Sight adds a third influence, because seeing the food creates expectations. To find the actual taste of a food, the experiment must block smell (hold the nose tightly) and remove visual clues, keeping every other condition the same for the people being compared.

Judged by that rule, the setting where the tasters hold their noses while other conditions are kept equal isolates the tongue's own taste best. Student 4's design is clearly the weakest, because with eyes open and noses free nothing is controlled at all.

Textbook: Biology Grade 12, Unit 5 Human body system, section 5.2.2 The Tongue (page 279).

17. 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 eye's focusing power is too strong for the length of the eyeball, or the eyeball is too long. Either way, light from distant objects is converged too soon and the image forms in front of the retina, so distant objects look blurred.

A concave lens fixes this because it spreads (diverges) the rays a little before they enter the eye, pushing the focus back onto the retina. A weak lens (options A and C) would cause the opposite problem, long sightedness, where the image would focus behind the retina.

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

18. 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

The thyroid gland sets the speed of the body's metabolism. When it is overactive (hyperthyroidism) the body burns fuel too fast, so the patient loses weight even while eating normally, produces extra heat and sweats, and often becomes nervous and irritable. This trio of symptoms points straight at the thyroid.

A pancreas problem such as diabetes shows itself mainly through thirst, frequent urination and high blood sugar, and the gonads control reproduction, so neither matches this picture as well.

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

19. 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. They release their hormones into the blood, and the blood carries those hormones past every cell in the body. Only cells that carry the matching receptor recognise the hormone and respond, so receptors are what give a hormone its specific target.

Exocrine glands work differently: they pour their secretions through ducts directly onto the place of action, like sweat onto the skin or digestive enzymes into the gut. Since the secretion is delivered to its site, no receptor addressing is needed. Option A has the two gland types swapped, which is why it is wrong.

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

20. 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. It cannot cause the disease, but the immune system still treats it as an invader: it makes antibodies and, more importantly, memory cells. If the real pathogen arrives later, those memory cells recognise it and destroy it before illness develops.

So a vaccine works by triggering the immune system. It does not kill pathogens by itself the way a drug does, and it has nothing to do with healing wounds.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.5 The immune system.

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 their genetic information as DNA. That makes cold sore the only disease on the list caused by a DNA virus.

All the others come from RNA viruses: AIDS is caused by HIV, a retrovirus with an RNA genome; swine flu is caused by an influenza virus (RNA); and corona viruses, including the one behind COVID 19, are RNA viruses.

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 waterbodies. What is the best strategy to overcome these problems? (1)
- A. Decomposition
 - B. Succession
 - C. Fossilization
 - D. ✓ **Recycling**

Answer: D

Recycling answers both halves of the problem at once. Turning used materials into new products means fewer fresh raw materials have to be taken from nature, which slows resource depletion. At the same time, material that is recycled never becomes waste dumped into rivers and lakes.

Decomposition, succession and fossilization are natural processes, not strategies people can apply to manage waste; fossilization in particular takes millions of years.

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 lives in nodules on the roots of legumes such as beans and peas. Using the enzyme nitrogenase, it converts nitrogen gas from the air into ammonia that the plant can use. Converting atmospheric nitrogen into a usable compound is exactly what nitrogen fixation means, and the Grade 10 textbook lists *Rhizobium* under this stage.

The other stages use different bacteria: nitrification is done by *Nitrosomonas* and *Nitrobacter*, while denitrification returns nitrogen gas to the air.

Textbook: Biology Grade 10, Unit 6 Ecological Interactions, section on the nitrogen cycle (page 167).

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

Recovery through succession depends on the pioneer species. Hardy colonizers such as lichens, mosses and grasses settle on the bare or damaged ground first, and as they live and die they build up soil and organic matter. By improving the conditions they make it possible for larger plants and animals to move in, stage after stage, until a stable climax community forms.

Option C fails because lichens and mosses are the pioneer stage, not the climax; a climax community is the mature community, such as a forest. Options B and D reverse the order: complex organisms come late, and pioneers are usually simple plants and lichens rather than animals.

Textbook: Biology Grade 9, Unit 6 Ecology, section 6.1.6 Ecological succession.

25. What are the common plants of the boreal forest?

(1)

- A. Deciduous trees
B. Mosses
C. ✓ **Conifers**
D. Epiphytes

Answer: C

The boreal forest, also called taiga, is the cold northern biome, and its typical plants are conifers: cone bearing trees such as spruce, pine and fir. Their needle shaped leaves with a waxy coat survive the long freezing winters and shed snow easily, which is why conifers dominate this biome.

Mosses do grow on the boreal forest floor but they do not define the biome. Deciduous broadleaf trees are the mark of temperate forests, and epiphytes belong to tropical rainforests.

Textbook: Biology Grade 9, Unit 6 Ecology, section 6.1.5 Biomes.

26. Which one of the following may NOT be regulated by a plant hormone?

(1)

- A. ✓ Seed dispersal B. Cell elongation
C. Cell division D. Fruit ripening

Answer: A

Plant hormones control processes happening inside the plant. Auxin drives cell elongation, cytokinins stimulate cell division, and ethylene ripens fruit, so options B, C and D are all hormone regulated.

Seed dispersal is different. Once the seed is ready, it is carried away by outside agents such as wind, water or animals. That movement is a physical process outside the plant's body, so no hormone regulates it.

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 of auxin by the main shoot

Answer: B

The growing tip of the main shoot produces auxin, and this auxin keeps the lateral (side) buds dormant. Biologists call this apical dominance. While the tip is present and auxin flows down the stem, the plant grows tall with few branches.

When the tip is removed, for example by pruning, the auxin supply drops and its inhibitory effect on the side buds disappears. The lateral buds then sprout into branches and the plant becomes bushy. Option D describes the opposite situation: more auxin from the main shoot would keep the side buds suppressed and the plant unbranched.

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. Fighting global warming
 - C. fighting soil erosion
 - D. ✓ **biodiversity conservation**

Answer: D

All three actions protect living things and the places they live: guarding individual species keeps them from extinction, cutting pollution keeps their habitats healthy, and slowing deforestation saves the habitats themselves. Together they preserve the variety of life, and the collective name for that work is biodiversity conservation.

Some of these actions also help against global warming or soil erosion, but those are side benefits of single actions, not the umbrella that covers all three.

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. Noug
 - B. Enset
 - C. Zigba
 - D. ✓ **Mango**

Answer: D

An endemic plant is one that occurs naturally only in a particular region. Noug (*Guizotia abyssinica*), enset (*Ensete ventricosum*) and zigba (*Podocarpus falcatus*) all belong to Ethiopia's own flora; the Grade 9 textbook presents noug among the crops for which Ethiopia is the primary centre of diversity.

Mango (*Mangifera indica*) originated in southern Asia and was introduced to Ethiopia, so it is the one that is not endemic.

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

Mago National Park, in the hot lowlands of the lower Omo valley, is the park known for large savanna game: elephants, lions, cheetahs, giraffes and buffalo all live there. That matches the animal list in the question exactly.

The other parks have different signature wildlife. Awash National Park is dry acacia savanna known for beisa oryx, kudu and gazelles, and it has no elephants or giraffes. Bale Mountains National Park is home to the mountain nyala and the Ethiopian wolf, and the Simien Mountains hold the walia ibex and gelada baboon.

