

4. Which part of the digestive system is responsible for producing enzymes that digest carbohydrates, proteins, and fats? (1)
- A. Stomach
B. Small intestine
C. ✓ **Pancreas**
D. Liver

Answer: C

Pancreatic juice is the one secretion that carries all three enzyme classes at once: amylase for starch, trypsin and other proteases for protein, and lipase for fat. It empties into the duodenum through the pancreatic duct. The small intestine tempts because its lining does make enzymes such as maltase and peptidases, but those finish the job on small molecules rather than supply the full set.

5. Which structure separates the thoracic cavity from the abdominal cavity and plays a key role in breathing? (1)
- A. Larynx
B. ✓ **Diaphragm**
C. Trachea
D. Bronchi

Answer: B

The diaphragm is a dome of muscle stretched across the base of the chest, and it forms the floor of the thoracic cavity above the abdomen. When it contracts it flattens, the chest volume rises, the pressure inside falls below atmospheric pressure and air flows in. The trachea tempts because it is central to breathing too, but it is the tube that carries air, not the partition between the two cavities.

6. What is the main product of anaerobic respiration in muscle cells during vigorous exercise? (1)
- A. ✓ **Lactic acid**
B. Ethanol
C. Oxygen
D. Carbon dioxide

Answer: A

When exercise outruns the oxygen supply, muscle cells keep making ATP by glycolysis alone. The pyruvate that piles up is reduced to lactic acid, and that step regenerates the NAD^+ glycolysis needs to keep going. The acid builds up and contributes to muscle fatigue. Ethanol is the wrong choice because alcoholic fermentation belongs to yeast and some plant tissue, not to animal muscle.

7. Which of the following best describes the process of fermentation in yeast cells? (1)
- A. Yeast cells use oxygen to break down glucose and produce ATP, water, and carbon dioxide.
B. ✓ **Yeast cells break down glucose without oxygen, producing ethanol and carbon dioxide.**
C. Yeast cells produce ATP by converting lactic acid into energy.
D. Yeast cells use lactic acid as the main energy source in the absence of oxygen.

Answer: B

Yeast is a facultative anaerobe. With no oxygen it breaks glucose down to pyruvate by glycolysis, then converts the pyruvate to ethanol and carbon dioxide, gaining only 2 ATP per glucose. That reaction is what raises bread dough and makes alcoholic drinks. Option A describes ordinary aerobic respiration, which yeast also performs, but only when oxygen is present.

8. Which of the following statements about red blood cells is true? (1)
- A. Red blood cells have a nucleus and live for about 10–20 days.
 - B. ✓ **Red blood cells are shaped as biconcave discs, which gives them a large surface area for oxygen exchange.**
 - C. Red blood cells are responsible for fighting infections in the body.
 - D. Red blood cells are made in the liver and transport carbon dioxide around the body.

Answer: B

A mature red blood cell is a biconcave disc, dented on both faces. That shape gives a large surface area for the volume inside and keeps every haemoglobin molecule close to the surface, so oxygen loads and unloads fast. It also lets the cell bend through narrow capillaries. Option A fails twice over: the mature cell has pushed out its nucleus, and it survives about 120 days, not 10 to 20.

9. In the ABO blood group system, which blood type can receive blood from any of the four ABO blood types? (1)
- A. Type A
 - B. Type B
 - C. ✓ **Type AB**
 - D. Type O

Answer: C

A person with type AB carries both the A and the B antigen on their red cells, so their plasma makes neither anti-A nor anti-B antibodies. Blood of any ABO type can be given without the donor cells being attacked, which is why AB is called the universal recipient. Type O tempts because it is the famous one, but O is the universal donor: it has no antigens to give, while its plasma holds both antibodies.

10. Which of the following is NOT a characteristic of bacteria? (1)
- A. Bacteria are single-celled organisms.
 - B. ✓ **Bacterial cells contain a nucleus to store genetic material.**
 - C. Bacteria can have structures like flagella to help them move.
 - D. Some bacteria are useful for processes like fermentation and decay.

Answer: B

Bacteria are prokaryotes. Their single circular chromosome sits free in the cytoplasm in a region called the nucleoid, with no membrane around it. Statement B claims they have a nucleus, so it is the false one and therefore the answer to a NOT question. Option C is true and is often picked by mistake, because many bacteria really do swim using flagella.

11. What is the main purpose of using UHT (Ultra High Temperature) treatment for food? (1)
- A. To make the food taste better
 - B. To keep the food warm for longer
 - C. ✓ **To sterilize the food by killing all micro-organisms**
 - D. To preserve the food by freezing

Answer: C

UHT means the liquid is heated to roughly 135°C for a few seconds and then sealed. That short, very hot treatment destroys micro-organisms and their heat resistant spores, so sealed UHT milk keeps for months without a fridge. Freezing tempts as an answer because it also preserves food, but it slows microbes rather than killing them, and it is a different method entirely.

12. Which of the following is the most common way people get infected with tapeworms? (1)
- A. By drinking contaminated water
 - B. ✓ **By eating undercooked or raw meat containing young tapeworms**
 - C. By coming into contact with contaminated soil
 - D. Through insect bites

Answer: B

The larval stage of the tapeworm forms cysts in the muscle of cattle and pigs. If that meat is eaten raw or undercooked, the cyst survives, attaches to the wall of the small intestine and grows into an adult worm. Thorough cooking kills the larvae. Contaminated water is not an empty option, since swallowing tapeworm eggs causes its own disease, but the usual route to an intestinal tapeworm is the meat.

13. Which of the following is the most effective way to prevent the spread of gonorrhea? (1)
- A. Getting vaccinated for gonorrhea
 - B. ✓ **Using a male or female condom during sexual activity**
 - C. Avoiding alcohol consumption
 - D. Avoiding all contact with infected individuals

Answer: B

Gonorrhoea is passed on when infected fluids touch the mucous membranes of a partner. A condom is a physical barrier that stops that contact, and it is the method within a person's own control. Option A tempts because vaccination prevents many infections, but there is no licensed vaccine against gonorrhoea, so it cannot be the best answer.

14. What is the primary reason why chancroid is particularly concerning in regions with high HIV/AIDS rates? (1)
- A. It causes severe pain and tissue damage
 - B. It can lead to permanent infertility
 - C. ✓ **The sores caused by chancroid increase the likelihood of contracting HIV**
 - D. It has no effective treatment

Answer: C

Chancroid produces open, soft sores on the genitals. Broken skin removes the body's barrier and brings immune cells that HIV infects right to the surface, so a person with those sores catches HIV far more easily and passes it on more easily. Option A is a true statement about chancroid, but pain and tissue damage on their own do not explain why the disease matters so much where HIV is common.

15. What is the primary role of neurotransmitters at a synapse? (1)
- A. To produce electrical impulses
 - B. ✓ **To cross the synapse and start an electrical impulse in the next neuron**
 - C. To insulate the axon for faster impulse transmission
 - D. To repair damaged neurons

Answer: B

A synapse is a gap, so the electrical impulse cannot jump it. The arriving impulse makes the first neuron release neurotransmitter into the cleft, the molecules diffuse across, bind receptors on the next neuron and depolarise its membrane, starting a new impulse. Option C describes myelin, which is a fatty sheath around the axon and has nothing to do with crossing the gap.

16. What is a conditioned reflex action? (1)
- A. A reflex action that is innate and present at birth
 - B. ✓ **A reflex action that is learned through experience**
 - C. A reflex action that occurs only in response to physical injury
 - D. A reflex action that is triggered by emotional stimuli

Answer: B

A conditioned reflex is built by learning. An animal that meets a neutral stimulus over and over alongside the natural one begins to respond to the neutral stimulus by itself, as in Pavlov's dogs salivating at a bell. It is not present at birth and it fades if the pairing stops. Option A describes a simple or innate reflex, such as the knee jerk, which is the opposite case.

17. Which of the following conditions can be corrected using concave (diverging) lenses? (1)
- A. Long sight
 - B. ✓ **Short sight**
 - C. Astigmatism
 - D. Presbyopia

Answer: B

In short sight the eyeball is too long or the lens too strong, so parallel rays from a distant object come to a focus in front of the retina. A concave lens diverges the rays before they enter the eye, moving the focus back onto the retina. Long sight tempts as an answer, but that fault focuses light behind the retina and needs a convex converging lens instead.

18. Which of the following is a function of the epidermis layer of the skin? (1)
- A. Temperature regulation
 - B. ✓ **Protection against UV light**
 - C. Containing blood vessels and sweat glands
 - D. Storing fat for insulation

Answer: B

The epidermis is the outer layer of the skin, and the melanin its cells make absorbs ultraviolet light before it can reach and damage the DNA of the dividing cells below. Option C is the one that catches people out, because blood vessels and sweat glands are real skin structures, but they lie deeper, in the dermis, and it is the dermis that carries out temperature regulation.

19. Which of the following is a primary function of insulin in the body? (1)
- A. To increase blood sugar levels
 - B. To regulate the heart rate
 - C. ✓ **To lower blood sugar levels by helping glucose enter cells**
 - D. To speed up the breathing rate

Answer: C

Insulin is released by the beta cells of the pancreas when blood glucose rises after a meal. It makes muscle and fat cells take glucose in and pushes the liver to store it as glycogen, so the blood level falls back to normal. Option A is the job of glucagon, insulin's partner hormone, which works in the opposite direction when blood sugar drops.

20. Which of the following contraceptive methods is considered to be 99% effective at preventing pregnancy and does not require daily action from the user? (1)
- A. The combined oral contraceptive pill
 - B. Male condoms
 - C. ✓ **Hormonal implants**
 - D. Diaphragm

Answer: C

A hormonal implant is a small rod placed under the skin of the arm that releases progestogen steadily for three to five years. Because nothing depends on the user remembering anything, its real world failure rate stays under 1 in 100 women a year. The pill tempts because it reaches a similar figure when taken perfectly, but it needs a tablet every day, which the question rules out.

21. What is the primary function of sweating in homoiotherms? (1)
- A. To increase body temperature B. To release excess carbon dioxide
C. ✓ **To cool the body down by evaporation** D. To conserve water and ions

Answer: C

Sweat glands push water onto the skin surface, and turning that water into vapour takes latent heat out of the skin. The blood flowing underneath is cooled and carries the lower temperature back to the core. This is why sweating works poorly in very humid air, where evaporation is slow. Option D reverses the truth, because sweating loses water and ions rather than conserving them.

22. Which physiological response helps conserve heat when the core body temperature drops? (1)
- A. Sweating B. Vasodilation
C. ✓ **Vasoconstriction** D. Panting

Answer: C

When the core cools, the arterioles supplying the skin narrow. Less warm blood reaches the surface, so less heat is radiated away and the core is protected. Vasodilation is the tempting opposite: it widens those vessels, floods the skin with blood and increases heat loss, which is what the body does when it is too hot.

23. Which of the following structures in a leaf is primarily responsible for controlling gas exchange and water loss? (1)
- A. Palisade mesophyll B. ✓ **Stomata**
C. Xylem D. Phloem

Answer: B

Stomata are pores in the leaf epidermis, each one bounded by a pair of guard cells. Carbon dioxide enters and oxygen and water vapour leave through them, and the guard cells change shape to widen or close the pore. Xylem tempts because it is deeply involved with water, but it delivers water to the leaf rather than controlling what escapes.

24. Which of the following is NOT a requirement for photosynthesis? (1)
- A. Water B. Carbon dioxide
C. Chlorophyll D. ✓ **Nitrogen**

Answer: D

Photosynthesis needs carbon dioxide, water, light and chlorophyll. Nitrogen appears nowhere in the reaction itself: the plant takes up nitrate to build proteins, chlorophyll and DNA, so it matters for growth but not as a raw material for the reaction. Chlorophyll is the tempting choice for students who think of it as part of the leaf rather than a requirement, but without it the light energy is never absorbed and nothing happens.

25. What is the main purpose of boiling a leaf in water during the starch test for photosynthesis? (1)
- A. To remove the starch
B. To soften the leaf
C. ✓ **To kill the leaf and stop biochemical processes**
D. To add iodine solution to the leaf

Answer: C

The leaf is dropped into boiling water first to kill the cells and stop every enzyme, which freezes the starch pattern exactly as it was at the moment of the test. It also breaks down the cell walls a little so that alcohol can pull out the chlorophyll and iodine can soak in afterwards. Option B is not wrong about what happens, but softening is a side effect. Removing starch would defeat the whole experiment.

26. Which of the following is responsible for the movement of water from the roots to the leaves in plants? (1)

- A. Active transport
- B. ✓ **Transpiration**
- C. Photosynthesis
- D. Respiration

Answer: B

Water evaporates from the mesophyll cells into the air spaces and out of the stomata. That loss lowers the water potential at the top of the plant and pulls on the water column in the xylem, which holds together because water molecules stick to one another. The pull reaches all the way down to the roots. Active transport tempts, but it moves mineral ions into the root hair cells and does not lift the bulk water column.

27. What is the role of guard cells in the process of transpiration? (1)

- A. They absorb water from the soil.
- B. ✓ **They open and close the stomata to regulate water loss.**
- C. They transport sugars through the plant.
- D. They produce chloroplasts for photosynthesis.

Answer: B

Guard cells sit in pairs around each stoma. When they take in water and become turgid, their unevenly thickened walls bow apart and the pore opens; when they lose water and go flaccid, the pore closes and water loss drops. So the plant can trade gas exchange against water saving. Option A describes root hair cells, which are the ones that absorb water from the soil.

28. What is the primary function of auxins (IAA) in plants? (1)

- A. Inhibit cell division
- B. Stimulate root growth
- C. ✓ **Stimulate cell elongation and shoot growth**
- D. Promote fruit ripening

Answer: C

Auxin, mainly indole acetic acid, is made at the shoot tip and moves down. It loosens the cell wall so that cells take in water and stretch, and that elongation is what makes a shoot grow longer and bend towards light. Option B is the trap, because the same concentration that stretches shoot cells actually holds root elongation back. Ripening is controlled by ethylene, not auxin.

29. In which response do roots grow towards water? (1)

- A. Geotropism
- B. ✓ **Hydrotropism**
- C. Phototropism
- D. Thermotropism

Answer: B

Hydro means water, and tropism means a growth response whose direction is set by the stimulus. Roots growing towards a damp patch of soil are showing hydrotropism. Geotropism is the tempting answer because roots also grow downwards, but that response is a reply to gravity, and it can be overridden when the water lies to one side.

30. How does auxin (IAA) affect the growth of shoots and roots in response to gravity? (1)
- A. Auxin promotes growth in both shoots and roots
 - B. ✓ **Auxin promotes growth in shoots and inhibits growth in roots**
 - C. Auxin inhibits growth in both shoots and roots
 - D. Auxin inhibits growth in shoots and promotes growth in roots

Answer: B

Roots and shoots read the same auxin signal in opposite ways. A concentration that makes shoot cells elongate is high enough to inhibit root cells. Lay a seedling on its side and auxin gathers on the lower face: the shoot's lower side stretches so the shoot curves up, while the root's lower side is held back so the root curves down. Option A cannot be right, because if auxin promoted both, the root would bend upward with the shoot.

31. What is the primary role of enzymes in biochemical reactions? (1)
- A. To increase the temperature of reactions
 - B. To create products from substrates
 - C. ✓ **To lower the activation energy and speed up reaction**
 - D. To increase the activation energy needed for reaction

Answer: C

An enzyme is a biological catalyst. It holds the substrate in its active site in a way that makes the reaction easier to start, which lowers the activation energy and lets the reaction run fast at body temperature. The enzyme itself comes out unchanged. Option B is the tempting one, but the products would form in any case: the enzyme changes the speed, not the chemistry.

32. Which of the following statements about enzyme specificity is true? (1)
- A. Enzymes are specific only for a single bond type and not for a substrate.
 - B. ✓ **Enzyme specificity refers to the ability of an enzyme to act only on a particular substrate.**
 - C. Enzymes can act on any type of substrate without preference.
 - D. Enzyme specificity refers to the size of the enzyme, not its function.

Answer: B

Specificity means an enzyme works on one substrate or one closely related family, because the shape and charge of the active site fit that molecule and no other. Sucrase splits sucrose and leaves maltose alone. Option C says the opposite of this, and an enzyme that accepted any substrate would make controlled metabolism impossible.

33. What causes the denaturation of an enzyme? (1)
- A. Low temperature and acidic pH
 - B. ✓ **High heat, extreme pH, heavy metals, or solvents**
 - C. Low concentration of substrate
 - D. An increase in enzyme concentration

Answer: B

An enzyme works because its polypeptide chain is folded into a precise shape. Strong heat, extreme pH, heavy metal ions and organic solvents break the weak bonds holding that fold, the active site loses its shape and the substrate no longer fits. The change is usually permanent. Low temperature tempts, but cold only slows the molecules down, and activity returns when the enzyme is warmed again.

34. Which of the following is a characteristic of an enzyme's active site? (1)
- A. It is where the enzyme binds to its cofactor.
 - B. ✓ **It is the region where the enzyme binds to its substrate.**
 - C. It binds to non-protein molecules like vitamins.
 - D. It is only responsible for enzyme activation.

Answer: B

The active site is the small pocket on the enzyme surface whose shape matches the substrate. The substrate binds there, the reaction happens there and the products leave from there. Option A is the near miss: some enzymes really do need a cofactor, and it may bind at or near the site, but what defines an active site is that it holds the substrate.

35. What is the primary function of oxidoreductase enzymes? (1)
- A. Catalyze the transfer of functional groups.
 - B. Catalyze the breakdown of starch.
 - C. ✓ **Catalyze oxidation-reduction reactions by transferring electrons.**
 - D. Catalyze the joining of two molecules using ATP.

Answer: C

Oxidoreductases move electrons, usually as hydrogen atoms, from one molecule to another, so one reactant is oxidised while the other is reduced. The dehydrogenases of respiration that load hydrogen onto NAD^+ belong to this class. Option A describes transferases, a different class that moves functional groups such as phosphate rather than electrons.

36. Which factor does NOT affect enzyme activity? (1)
- A. Temperature
 - B. pH
 - C. Enzyme concentration
 - D. ✓ **The color of the enzyme**

Answer: D

Colour is not a chemical variable in catalysis. Rate depends on temperature, pH, substrate concentration, enzyme concentration and any inhibitor present. Enzyme concentration is the tempting distractor, because it is easy to think the enzyme is unchanged by the reaction and therefore does not matter, but more enzyme means more active sites and a faster rate while substrate is plentiful.

37. What happens when an enzyme is exposed to extreme pH or temperature? (1)
- A. The enzyme becomes more efficient.
 - B. ✓ **The enzyme becomes denatured and loses its function.**
 - C. The enzyme speeds up the reaction rate.
 - D. The enzyme increases its affinity for the substrate.

Answer: B

Extreme pH or high temperature breaks the hydrogen and ionic bonds that hold the enzyme's three dimensional fold. The active site distorts, the substrate no longer fits, and the enzyme is denatured and inactive. Option A is the opposite: warming does raise the rate, but only up to the optimum, and past it the curve falls away sharply as denaturation sets in.

38. Which of the following is an example of a cofactor required by some enzymes for activity? (1)
- A. Substrate
 - B. ✓ **Vitamin B complex (Coenzyme)**
 - C. Product
 - D. Inhibitor

Answer: B

Many enzymes cannot work with protein alone. The B group vitamins are converted into coenzymes such as NAD from niacin and FAD from riboflavin, and these carry hydrogen or chemical groups between reactions. Option A tempts because the substrate is always present in the reaction, but the substrate is the molecule being changed, not a helper the enzyme needs to function.

39. What is the main difference between the structure of DNA and RNA?

(1)

- A. DNA has a single strand, while RNA has a double strand
- B. DNA contains uracil, while RNA contains thymine
- C. ✓ **DNA contains deoxyribose, while RNA contains ribose**
- D. DNA contains ribose, while RNA contains deoxyribose

Answer: C

The name gives the answer. DNA is built on deoxyribose, which lacks the hydroxyl group on carbon 2 that ribose carries in RNA. That missing oxygen makes DNA chemically steadier, which suits a molecule that must store information for a lifetime. Option B is the swapped version of a real difference: DNA carries thymine and RNA carries uracil, not the other way round.

40. What is the function of RNA in cells?

(1)

- A. RNA is responsible for storing genetic information
- B. ✓ **RNA facilitates the translation of DNA into proteins**
- C. RNA stores energy for the cell
- D. RNA is responsible for DNA replication

Answer: B

RNA carries the genetic message out and turns it into protein. Messenger RNA copies the gene, transfer RNA brings the matching amino acids and ribosomal RNA builds the ribosome where the chain is assembled. Option A is the tempting one because RNA does hold a sequence, but in cells the long term store of genetic information is DNA.

41. What is the primary function of meiosis in organisms?

(1)

- A. To produce genetically identical daughter cells for growth and repair
- B. ✓ **To produce gametes (sex cells) with half the number of chromosomes**
- C. To replicate DNA for cellular repair
- D. To divide somatic cells for tissue regeneration

Answer: B

Meiosis is the division that makes gametes. One diploid cell divides twice while the DNA is copied only once, so four cells are produced, each with half the chromosome number. Fertilisation then restores the full set. Option A describes mitosis, which keeps the chromosome number the same and serves growth and repair.

42. What happens during the S phase of the cell cycle?

(1)

- A. The cell grows and accumulates nutrients
- B. ✓ **DNA is replicated to form sister chromatids**
- C. The nuclear envelope dissolves, and chromosomes condense
- D. The cytoplasm divides into two separate cells

Answer: B

S stands for synthesis. During this part of interphase each DNA molecule is copied, so every chromosome ends up as two identical sister chromatids joined at the centromere. Nothing visible happens to the chromosomes yet, because they stay uncoiled. Option A describes G1, the growth phase that comes before S.

43. In a monohybrid cross, when two heterozygous individuals ($Tt \times Tt$) are crossed, what is the expected phenotypic ratio of the offspring? (1)
- A. 1:1
B. ✓ 3:1
C. 2:1
D. 1:2:1

Answer: B

Cross $Tt \times Tt$ and the Punnett square gives $1 TT : 2 Tt : 1 tt$. The first three all carry at least one dominant allele and look the same, while only tt shows the recessive character, so the phenotypic ratio is 3 : 1. Option D is the trap: 1 : 2 : 1 is the correct genotypic ratio for the same cross, and the question asked about phenotype.

44. Which of the following statements best describes Mendel's Law of Independent Assortment? (1)
- A. Alleles for a single trait separate during meiosis
B. ✓ **Alleles for different traits separate independently of each other during meiosis**
C. Dominant traits will always be expressed in offspring
D. Recessive traits will always be expressed when two recessive alleles are inherited

Answer: B

The law of independent assortment says that when gametes form, the alleles of one gene separate without regard to the alleles of another gene, provided the two genes sit on different chromosomes. That is why a dihybrid cross gives new combinations of characters. Option A is the tempting one, but it states the law of segregation, which concerns a single pair of alleles.

45. What is the genetic composition that determines an individual to be male in humans? (1)
- A. XX
B. ✓ XY
C. X
D. YY

Answer: B

Humans have 22 pairs of autosomes plus one pair of sex chromosomes. An XY combination is male, because the Y chromosome carries the SRY gene that switches the embryonic gonad into a testis. XX is the female combination, which is why it is the common wrong answer here.

46. Which of the following is an example of non-Mendelian inheritance? (1)
- A. Complete dominance
B. ✓ **Incomplete dominance**
C. Gene segregation
D. Independent assortment

Answer: B

In incomplete dominance neither allele masks the other, so the heterozygote shows a blend, as when a red flower crossed with a white one gives pink. Mendel's model predicts that the heterozygote should look exactly like the dominant parent, so this pattern falls outside it. Option A is the trap: complete dominance is the textbook Mendelian case, not an exception to it.

47. What is one of the main uses of biotechnology in food production? (1)
- A. ✓ **Genetic engineering of crops**
B. Creating synthetic chemicals
C. Developing biological weapons
D. Reducing biodiversity loss

Answer: A

Genetic engineering of crops is the main use of biotechnology in food production. Genes are added to give pest resistance, tolerance of drought or salt, longer shelf life or better nutrient content, as in vitamin A enriched rice. Option B tempts because industry does make chemicals, but making synthetic chemicals is an industrial chemical process and does not involve living systems.

48. Which of the following is a key feature of forensic biotechnology?

(1)

- A. The use of genetic engineering to improve crops
- B. ✓ **Analysis of DNA and other biological evidence at crime scenes**
- C. The development of new biofuels
- D. Engineering microorganisms for industrial use

Answer: B

Forensic biotechnology means reading biological evidence left at a crime scene. Small samples of blood, hair, semen or saliva are amplified and profiled by DNA fingerprinting, and the pattern is compared with samples from suspects or relatives. It clears the innocent as often as it convicts. Option A describes agricultural biotechnology, which uses similar laboratory tools for a completely different purpose.

49. What is the main role of biotechnology in medicine?

(1)

- A. Increasing the cost of drug production
- B. ✓ **Providing effective diagnostics, prevention, and treatment**
- C. Reducing the need for medical research
- D. Limiting the development of new disease

Answer: B

Biotechnology serves medicine in three ways: diagnosis through test kits and DNA probes, prevention through vaccines made from cloned antigens, and treatment through products such as human insulin and monoclonal antibodies grown in engineered cells. Option A is the reverse of what happens, because growing insulin in bacteria made it far cheaper than extracting it from animal pancreases.

50. Which of the following is an example of a biotechnological process used for wastewater treatment?

(1)

- A. PCR amplification
- B. ✓ **Bio-trickling filters**
- C. Genetic engineering of plants
- D. DNA sequencing

Answer: B

A bio-trickling filter is a bed of stones or plastic media coated with a film of bacteria and other microbes. Wastewater trickles over the bed, air passes through, and the biofilm oxidises the dissolved organic matter so that cleaner water leaves at the bottom. Option A is the tempting one because PCR is famous biotechnology, but it copies DNA in a laboratory tube and treats no water.

51. According to the World Health Organization (WHO), health is defined as:

(1)

- A. The absence of disease
- B. ✓ **A state of complete physical, mental and social well-being**
- C. The ability to grow and reproduce
- D. The ability to exercise regularly

Answer: B

The World Health Organization defines health as a state of complete physical, mental and social well being, and not merely the absence of disease or infirmity. The point of the definition is that a person can be free of infection and still be unhealthy through poor nutrition, stress or isolation. Option A is exactly the half of the sentence that the WHO wrote in order to reject it.

52. What is the primary role of biology in nature conservation? (1)
- A. To reduce pollution
 - B. ✓ **To manage renewable and non-renewable resources properly**
 - C. To increase the demand for natural resources
 - D. To exploit natural resources for immediate use

Answer: B

Conservation biology studies how populations, habitats and whole ecosystems work, and uses that knowledge to plan how renewable resources such as forests, soil and fish may be used at a rate they can sustain, and how non-renewable ones may be spared. Option A is part of caring for the environment, but reducing pollution is one tool. Sound management of the resources themselves is the wider role.

53. Which of the following is an example of a non-renewable resource? (1)
- A. Cattle
 - B. Trees
 - C. ✓ **Coal**
 - D. Water

Answer: C

Coal formed from plant material buried and compressed for many millions of years. We burn it far faster than any new coal can form, so once a seam is worked out it is gone in human terms, which is what non-renewable means. Trees are the tempting answer because forests are being lost, but a tree can be replanted and regrown within a lifetime, so timber is a renewable resource that is being badly managed.

54. Which of the following activities does not contribute to the appreciation of nature? (1)
- A. Planting a tree
 - B. Reducing pollution
 - C. Hugging a tree
 - D. ✓ **Urbanization and excessive development**

Answer: D

The question asks which activity does not show appreciation of nature. Urbanisation and unchecked development clear habitats, seal the soil under concrete and pollute rivers, so it works against nature rather than valuing it. Hugging a tree is the odd looking option that many pick, but it is a harmless gesture of care and it damages nothing.

55. What does food security ensure? (1)
- A. That food is produced only for wealthy individuals
 - B. ✓ **That everyone has physical, social, and economic access to nutritious food**
 - C. That food prices are high to prevent overconsumption
 - D. That food production remains the same each year

Answer: B

Food security means that all people, at all times, have physical, social and economic access to enough safe and nutritious food for an active healthy life. All four parts matter: the food must exist, be reachable, be affordable and be worth eating. Option D is the trap, because steady production alone does not feed people who cannot afford or reach the food.

56. Which of the following is a renewable resource in Ethiopia? (1)
- A. Gold
 - B. Coal
 - C. ✓ **Coffee**
 - D. Oil

Answer: C

Coffee is grown from living plants that flower and fruit again season after season, so with good soil and care the supply renews itself. That is what makes it renewable. Gold tempts because Ethiopia exports it as well, but gold is a mineral formed over geological time, and every gram mined is a gram that will not be replaced.

57. Which of the following is NOT a main group of microorganisms? (1)
- A. Bacteria
 - B. Fungi
 - C. ✓ **Mammals**
 - D. Viruses

Answer: C

Micro-organisms are organisms too small to see without a microscope, and the main groups are bacteria, fungi, protozoa, algae and viruses. Mammals are large multicellular animals visible to the naked eye, so they are the odd one out. Viruses are the tempting choice, because they are not cells and some argue they are not fully alive, but the syllabus still counts them among the micro-organisms.

58. What is the key difference between prokaryotic and eukaryotic cells? (1)
- A. Eukaryotic cells have no nucleus, while prokaryotic cells have a nucleus.
 - B. Eukaryotic cells are unicellular, while prokaryotic cells are multicellular.
 - C. ✓ **Prokaryotic cells have no membrane-enclosed nucleus, while eukaryotic cells do.**
 - D. Eukaryotic cells lack cell membranes, while prokaryotic cells have them.

Answer: C

In a prokaryotic cell the DNA lies free in the cytoplasm in the nucleoid, with no membrane around it, and there are no mitochondria or other membrane bound organelles either. A eukaryotic cell keeps its DNA inside a true nucleus. Option B is the trap: plenty of eukaryotes are single celled, including yeast and Amoeba, so cell number does not separate the two groups.

59. Which shape do cocci bacteria have? (1)
- A. Spiral-shaped
 - B. Rod-shaped
 - C. ✓ **Spherical**
 - D. Oval-shaped

Answer: C

Bacteria are named by shape, and coccus comes from the Greek word for a berry, so cocci are spherical. They may sit in pairs, chains or clusters, as in Streptococcus and Staphylococcus. Rod shaped is the tempting answer, but rods are called bacilli, and the spirals are spirilla.

60. Which of the following best describes the habitat of Archaea? (1)
- A. Archaea are only found in warm, tropical climates.
 - B. ✓ **Archaea inhabit extreme environments such as hot springs, saline lakes, and deep-sea vents.**
 - C. Archaea only live in the human gut.
 - D. Archaea thrive in forested areas with abundant rainfall.

Answer: B

Archaea are best known as extremophiles. Different groups live in boiling hot springs, in salt lakes far saltier than the sea, in acidic waters and around deep sea vents, and their membranes and enzymes are built to hold together in those conditions. Option C is a near miss, because methane producing archaea really do live in the human gut, but the word only makes the statement false.

61. What is the primary difference between fungi and plants? (1)
- A. Fungi can photosynthesize, while plants cannot.
 - B. Fungi do not have cell walls, while plants do.
 - C. ✓ **Fungi have chitin in their cell walls, while plants have cellulose.**
 - D. Fungi are always unicellular, while plants are always multicellular.

Answer: C

Both fungi and plants have cell walls, but they are made of different material: chitin in fungi and cellulose in plants. Fungi also have no chlorophyll and feed by absorbing digested organic matter. Option D is the tempting one, because yeasts are unicellular, but mushrooms and moulds are multicellular fungi, so the word always breaks the statement.

62. Which of the following is an example of how fungi benefit humans? (1)
- A. Fungi can cause diseases in humans.
 - B. ✓ **Fungi help in the fermentation process to produce traditional beverages like Tej and Tella.**
 - C. Fungi only serve as food for other organisms.
 - D. Fungi are used to produce energy in power plants.

Answer: B

Yeasts are fungi, and their fermentation of sugars is what turns honey into Tej and grain into Tella, as well as raising injera and bread dough. The alcohol and carbon dioxide come from the same anaerobic pathway. Option A is a true statement, since fungi do cause ringworm and thrush, but the question asked for a benefit to humans, not a harm.

63. Which of the following diseases is caused by the protozoan Plasmodium? (1)
- A. Giardiasis
 - B. ✓ **Malaria**
 - C. Toxoplasmosis
 - D. Amoebiasis

Answer: B

Malaria is caused by protozoa of the genus Plasmodium, carried from person to person by the female Anopheles mosquito. The parasite multiplies first in liver cells and then inside red blood cells, and the bursting of those cells causes the cycles of fever. Amoebiasis tempts because it is also a protozoan disease, but its cause is Entamoeba histolytica.

64. What is the primary mode of transmission for Leishmania parasites? (1)
- A. Contaminated water
 - B. Mosquito bites
 - C. ✓ **Sand fly bites**
 - D. Direct human-to-human contact

Answer: C

Leishmania parasites are passed on by the bite of an infected female phlebotomine sand fly, a small insect that breeds in cracks in walls and soil and bites mainly at dusk and night. Control therefore targets sand flies rather than mosquitoes. Option B is the standard mix-up, because mosquitoes carry malaria and several viruses, but they do not carry Leishmania.

65. Which of the following protozoan diseases affects the liver and causes diarrhea in humans? (1)
- A. Malaria
 - B. Toxoplasmosis
 - C. ✓ **Amoebiasis**
 - D. African trypanosomiasis

Answer: C

Amoebiasis is caused by Entamoeba histolytica, swallowed as cysts in food or water contaminated with faeces. The parasite invades the wall of the large intestine and causes diarrhoea with blood and mucus, and it can travel in the blood to the liver and form an abscess there. Malaria is the tempting option because it too has a liver stage, but its usual signs are fever and chills rather than diarrhoea.

66. What is the outer protein shell of a virus called? (1)
- A. Envelope
 - B. Genome
 - C. ✓ **Capsid**
 - D. Peplomer

Answer: C

The capsid is the coat of protein subunits that surrounds and protects the viral nucleic acid, and its proteins also help the virus attach to the right host cell. Option A is the near miss: some viruses do carry an outer envelope, but that layer is lipid taken from the host cell membrane, and it lies outside the capsid rather than being the protein shell itself.

67. Which of the following types of viruses contain RNA as their genetic material? (1)
- A. Papovavirus
 - B. Parvovirus
 - C. ✓ **Retroviruses**
 - D. Herpesvirus

Answer: C

Retroviruses, HIV among them, carry their genes as RNA together with the enzyme reverse transcriptase, which copies that RNA into DNA once inside the host cell. The DNA copy is then inserted into the host chromosome. Papovaviruses, parvoviruses and herpesviruses all carry DNA instead, so retroviruses are the only RNA group in the list.

68. In which of the following structures do DNA viruses primarily replicate? (1)
- A. Cytoplasm
 - B. ✓ **Nucleus**
 - C. Ribosomes
 - D. Mitochondria

Answer: B

A DNA virus needs the host's DNA copying and transcribing machinery, and that machinery is in the nucleus. So its genome is delivered there, replicated by host polymerases and transcribed into messenger RNA that leaves for the ribosomes. The cytoplasm is the tempting answer because most RNA viruses do replicate there, and because a few large DNA viruses such as poxviruses are exceptions.

69. Which of the following is NOT a stage in the viral replication cycle? (1)
- A. Attachment of the virus to a host cell
 - B. Replication of the viral genome
 - C. ✓ **Fusion of the viral particle with a host's DNA**
 - D. Release of new virus particles

Answer: C

The viral cycle runs as attachment, entry, replication of the genome, assembly of new particles and release. Nothing in it joins a whole virus particle to the host DNA. Some viruses do insert their genome, as retroviruses and lysogenic phages do, but what is inserted is bare nucleic acid, not the intact virion, so option C is the stage that does not exist. Option B is a genuine stage, which is why it is a common wrong pick.

70. What role do microorganisms play in agriculture? (1)
- A. ✓ **They help in the decomposition of organic matter and formation of humus**
 - B. They prevent the nitrogen cycle from occurring
 - C. They convert phosphorus to a form that plants cannot use
 - D. They eliminate all plant pests

Answer: A

Soil bacteria and fungi break dead plant and animal material down into humus, and as they do so they release nitrogen, phosphorus and other nutrients back into the soil in forms that roots can absorb. Nitrogen fixing bacteria add to this by turning atmospheric nitrogen into nitrate. Option B is the reverse of the truth, because microbes drive the nitrogen cycle rather than blocking it.

71. What is the main benefit of using anaerobic bacteria in sewage treatment? (1)
- A. They produce oxygen for the process
 - B. ✓ **They reduce the volume of sludge and produce methane gas, which can be used as an energy source**
 - C. They increase the oxygen consumption of the water
 - D. They prevent bacteria from spoiling the water

Answer: B

Anaerobic bacteria digest the solids in sewage sludge without oxygen. The volume of sludge that has to be disposed of falls sharply, and the methane rich biogas given off can be burned to run the treatment plant or to cook. Option A cannot be right by definition, because organisms working without oxygen do not produce it, and adding oxygen would kill them.

72. Which of the following is an example of disease transmission via droplet infection? (1)

- A. Cholera
- B. Malaria
- C. ✓ **Pneumonia**
- D. Salmonella

Answer: C

Droplet infection means the pathogen travels in the fine spray thrown out when an infected person coughs, sneezes or talks, and is breathed in by someone nearby. Pneumonia spreads that way. Cholera is the tempting choice because it also spreads quickly through a community, but it travels in water and food contaminated with faeces, which calls for clean water rather than distance and ventilation.

73. Which of the following is an example of a disaccharide? (1)

- A. Glucose
- B. ✓ **Maltose**
- C. Starch
- D. Cellulose

Answer: B

A disaccharide is two monosaccharide units joined by a glycosidic bond. Maltose is two glucose units, and it is what amylase produces when it cuts starch. Starch is the trap, because it is also built from glucose, but it contains hundreds of units and is therefore a polysaccharide. Glucose on its own is a monosaccharide.

74. What is the main difference between alpha-D-glucose and beta-D-glucose? (1)

- A. The number of carbon atoms
- B. ✓ **The position of the hydroxyl group on carbon 1**
- C. The type of glycosidic bond formed
- D. The size of the glucose molecule

Answer: B

Both forms have the same formula, $C_6H_{12}O_6$, and the same ring. They differ only in where the hydroxyl group on carbon 1 points: below the ring in the alpha form and above it in the beta form. That small difference is why starch, built from alpha glucose, is digestible while cellulose, built from beta glucose, is not. Option C confuses cause with effect, because the bond that forms is a consequence of which form joins.

75. Which of the following is a polysaccharide that is a storage form of glucose in animals? (1)

- A. Starch
- B. ✓ **Glycogen**
- C. Cellulose
- D. Chitin

Answer: B

Glycogen is the animal storage polysaccharide, held in the liver and in muscle. It is a highly branched chain of glucose, and the many branch ends let enzymes release glucose quickly when blood sugar falls. Starch is the tempting answer because it is the same idea and also a glucose polymer, but starch is what plants store.

76. What type of reaction results in the formation of disaccharides from monosaccharides? (1)

- A. Hydrolysis
- B. ✓ **Condensation**
- C. Oxidation
- D. Reduction

Answer: B

Two monosaccharides join when the hydroxyl group of one reacts with the hydroxyl group of the other. A molecule of water is removed and a glycosidic bond forms, which is what condensation means. Hydrolysis is the reverse reaction: it adds water to split the bond again, and it is what happens during digestion.

77. Which of the following lipids are made up of fatty acids, glycerol or other alcohol, and phosphoric acid? (1)

- A. Triglycerides
B. Waxes
C. ✓ **Phospholipids**
D. Sterol

Answer: C

A phospholipid is built from glycerol carrying two fatty acid chains and one phosphate group, and the phosphate end is what makes the molecule partly water loving. That split personality is why phospholipids form the bilayer of every cell membrane. A triglyceride is the tempting answer because it shares the glycerol backbone, but it carries three fatty acids and no phosphate at all.

78. What is the main reason lipids are insoluble in water? (1)

- A. They contain a large number of oxygen atoms.
B. They are polar molecules.
C. ✓ **They are hydrophobic in nature.**
D. They have a high molecular weight.

Answer: C

Lipids are made mostly of long hydrocarbon chains in which the electrons are shared evenly, so the molecule has no charged regions. Water molecules are polar and hold on to one another by hydrogen bonds, and they exclude anything that cannot join in. This is what hydrophobic means. Option B fails on its own terms, because a polar molecule would dissolve well.

79. Which type of lipid is an ester of fatty acids and long-chain alcohols? (1)

- A. Triglycerides
C. Phospholipids
- B. ✓ **Waxes**
D. Steroids

Answer: B

A wax is an ester made from a fatty acid and a long chain alcohol, which makes it solid and strongly water repellent at ordinary temperatures. Plants use it as a cuticle on leaves and bees build combs from it. A triglyceride melts because it is also an ester of fatty acids, but its alcohol is glycerol, a short molecule with three carbons.

80. What is the primary function of glycolipids in the cell membrane? (1)

- A. To store energy
- B. To provide insulation
- C. ✓ **To maintain the stability of the membrane and facilitate cellular recognition**
- D. To act as an energy source

Answer: C

Glycolipids sit in the outer half of the membrane with their sugar chains facing outwards. Those sugar groups act as identity markers that other cells and antibodies read, and they also help hold the membrane layer stable. Option A is the tempting one because lipids do store energy in general, but that is the work of triglycerides in fat tissue, not of the sugar bearing lipids in the membrane.

81. What is the primary function of the Calvin cycle in photosynthesis? (1)
- A. To split water molecules
 - B. To convert light energy into chemical energy
 - C. ✓ **To fix carbon and produce glucose**
 - D. To generate oxygen gas

Answer: C

The Calvin cycle is the carbon fixing stage. Rubisco attaches carbon dioxide to the five carbon sugar RuBP, and the ATP and NADPH made in the light reactions are then spent reducing the product to triose phosphate, from which glucose and starch are built. Option B tempts because it is a fair description of photosynthesis as a whole, but converting light energy into chemical energy is what the light dependent stage does.

82. Which pigment is most responsible for the absorption of light energy in photosynthesis? (1)
- A. Carotenoids
 - B. Phycobilins
 - C. ✓ **Chlorophyll a**
 - D. Chlorophyll b

Answer: C

Chlorophyll a sits at the reaction centre of both photosystems, and it is the pigment that actually loses the excited electron into the electron transport chain. The other pigments are accessory: they absorb wavelengths chlorophyll a misses and pass the energy on to it. Chlorophyll b is the tempting answer for that reason, but it hands its energy over rather than releasing an electron itself.

83. Where does the light-dependent reaction of photosynthesis take place? (1)
- A. In the stroma of the chloroplast
 - B. In the cytoplasm
 - C. ✓ **In the thylakoid membranes of the chloroplast**
 - D. In the mitochondria

Answer: C

The light dependent reactions need the photosystems, the electron carriers and ATP synthase, and all of these are embedded in the thylakoid membranes stacked inside the chloroplast. Pumping protons into the thylakoid space builds the gradient that drives ATP synthesis. The stroma is the trap: it is inside the same chloroplast, but it is the fluid where the Calvin cycle runs.

84. What is the role of NADPH in the light-dependent reactions of photosynthesis? (1)
- A. To produce ATP
 - B. ✓ **To provide reducing power for the Calvin cycle**
 - C. To absorb light energy
 - D. To split water molecules

Answer: B

NADPH is the reduced carrier made when the electrons that left photosystem I are loaded onto NADP^+ . It carries that reducing power into the stroma, where it is used to reduce the fixed carbon into sugar. Option A is a near miss because ATP is made in the light reactions too, but supplying ATP is the job of photophosphorylation, not of NADPH.

85. Which of the following occurs during the light-independent reactions (Calvin cycle)? (1)
- A. Water is split to release oxygen
 - B. Light energy is converted into chemical energy
 - C. ✓ **Carbon dioxide is fixed into an organic molecule**
 - D. ATP is converted into NADP+

Answer: C

The light independent stage begins when rubisco joins carbon dioxide to RuBP, giving two molecules of a three carbon acid. That is carbon fixation, and it needs no light directly, only the ATP and NADPH the light stage supplied. Option A is the tempting one, but splitting water to release oxygen is photolysis, which happens in the light dependent stage.

86. Which of the following plants uses the C4 pathway for carbon fixation? (1)
- A. Peanuts
 - B. Cacti
 - C. ✓ **Sugarcane**
 - D. Soybeans

Answer: C

Sugarcane is a C4 plant, along with maize and sorghum. It first fixes carbon dioxide in the mesophyll into a four carbon acid, then pumps that acid into the bundle sheath cells where it releases the carbon dioxide again around rubisco. Cacti tempt because they are the famous desert plants, but they use the CAM pathway, which separates the two steps by night and day rather than by cell type.

87. What is the primary reason that C4 and CAM plants are more efficient in hot, dry climates? (1)
- A. They have larger stomata
 - B. ✓ **They reduce photorespiration by increasing CO2 concentration in their cells**
 - C. They do not require light for photosynthesis
 - D. They only perform photosynthesis at night

Answer: B

C4 and CAM plants both concentrate carbon dioxide at the site where rubisco works. With plenty of carbon dioxide around it, rubisco binds far less oxygen, so photorespiration is suppressed and the plant can keep its stomata narrow and save water in the heat. Option D is the trap: CAM plants do open their stomata at night, but the light reactions still need daylight, so photosynthesis is not carried out entirely at night.

88. What does photorespiration involve in C3 plants? (1)
- A. ✓ **The enzyme rubisco adds O2 instead of CO2 to RuBP, wasting energy**
 - B. The plant fixes CO2 twice in one cycle
 - C. The plant produces excess sugars that are stored for later use
 - D. The plant converts light energy directly into ATP without CO2 fixation

Answer: A

Rubisco can bind oxygen as well as carbon dioxide. When oxygen is added to RuBP instead, the plant gets a two carbon compound that has to be salvaged in a pathway that releases carbon dioxide and consumes ATP, so carbon and energy are lost for nothing. It grows worse in hot dry weather when stomata close and oxygen builds up inside the leaf. Option B describes no real process.

89. Which of the following is a direct consequence of photosynthesis for life on Earth? (1)

- A. ✓ **It contributes to the oxygen balance in the atmosphere**
- B. It releases carbon dioxide into the atmosphere
- C. It consumes all atmospheric carbon
- D. It destroys fossil fuels

Answer: A

The light dependent stage splits water and releases oxygen as a by-product, and that oxygen is the source of almost all the oxygen in the air we breathe. Photosynthesis also removes carbon dioxide, so it keeps the balance of the two gases. Option B states the reverse, and describes respiration and burning instead.

90. Where does glycolysis occur in a eukaryotic cell? (1)

- A. Mitochondria
- B. ✓ **Cytosol**
- C. Nucleus
- D. Ribosomes

Answer: B

Glycolysis takes place in the cytosol, the fluid part of the cytoplasm outside any organelle. It needs no oxygen and no membrane, which is why every cell can do it and why anaerobic organisms rely on it. The mitochondrion is the tempting answer, but the link reaction, the Krebs cycle and the electron transport chain are the stages that happen there, after glycolysis has already produced pyruvate.

91. What is the main role of ATP in cellular metabolism? (1)

- A. To store energy in chemical bonds
- B. To transport oxygen in the cell
- C. ✓ **To store and transfer energy for biochemical reactions**
- D. To break down glucose

Answer: C

ATP holds energy in the bond to its outermost phosphate, and when that phosphate is removed the energy released drives muscle contraction, active transport and synthesis. The ADP produced is then recharged in respiration, so the molecule cycles all day. Option A is only half the answer: it names the storing but leaves out the transfer, and it is the transfer to reactions that makes ATP the cell's energy currency.

92. Which of the following is a product of the Krebs cycle? (1)

- A. Oxygen
- B. ✓ **NADH, FADH₂, ATP, and CO₂**
- C. Pyruvate
- D. Glucose

Answer: B

Each turn of the Krebs cycle in the mitochondrial matrix strips hydrogen from the intermediates onto carriers, giving 3 NADH and 1 FADH₂, makes 1 ATP through GTP by substrate level phosphorylation, and releases 2 molecules of CO₂. Pyruvate is the tempting option, but pyruvate comes out of glycolysis and is the input that feeds the cycle, not a product of it.

93. What occurs during the pyruvate oxidation (link reaction)?

(1)

- A. Glucose is broken into two pyruvate molecules
- B. ✓ **Pyruvate is converted into acetyl CoA**
- C. Oxygen is consumed to form water
- D. ATP is synthesized directly

Answer: B

The link reaction happens in the mitochondrial matrix after pyruvate is carried in. Pyruvate loses one carbon as carbon dioxide, the remaining two carbon fragment is oxidised with the hydrogen going to NAD^+ , and the fragment is attached to coenzyme A to make acetyl CoA, which enters the Krebs cycle. Option A describes glycolysis, the stage that comes before this one.

94. What is the final electron acceptor in the electron transport chain (ETC)?

(1)

- A. NADH
- B. ✓ **Oxygen**
- C. FADH₂
- D. Glucose

Answer: B

Electrons passed down the carriers of the inner mitochondrial membrane end up on oxygen, which takes them together with protons from the matrix to form water. This is why oxygen is described as the final electron acceptor: if it is missing the carriers stay reduced, the chain stops and no more ATP is made this way. NADH tempts, but NADH is the donor that brings electrons in at the start of the chain.

95. Which part of the mitochondria is involved in oxidative phosphorylation?

(1)

- A. Outer membrane
- B. ✓ **Inner membrane**
- C. Matrix
- D. Cristae

Answer: B

Oxidative phosphorylation needs the electron transport chain and ATP synthase, and both are built into the inner mitochondrial membrane. That membrane is also the barrier across which protons are pumped to build the gradient that turns ATP synthase. Cristae are the tempting answer and are not physically wrong, since cristae are the folds of this same inner membrane, but the inner membrane is the structure itself and covers the whole surface, folded or not.

96. What is the main purpose of a respirometer?

(1)

- A. To measure the volume of carbon dioxide produced during respiration
- B. To measure the temperature change during aerobic respiration
- C. ✓ **To measure the volume of oxygen consumed during aerobic respiration**
- D. To measure the amount of glucose used in the respiration process

Answer: C

In a respirometer the organism sits in a sealed tube with soda lime or potassium hydroxide, which absorbs all the carbon dioxide given off. The only gas change left is the oxygen taken in, so the pressure inside falls and the coloured fluid in the manometer moves. The distance it moves gives the volume of oxygen consumed. Option A is the trap, because that setup deliberately removes the carbon dioxide so that it cannot be measured.

97. What happens during fermentation in the absence of oxygen?

(1)

- A. Oxygen is consumed to produce ATP
- B. ✓ **Pyruvate is converted to lactate or ethanol to regenerate NAD⁺**
- C. The electron transport chain produces ATP
- D. Glucose is completely oxidized to carbon dioxide and water

Answer: B

Glycolysis stops as soon as the cell runs out of NAD^+ to accept hydrogen. Fermentation solves that by handing the hydrogen from NADH to pyruvate, making lactate in animals or ethanol and carbon dioxide in yeast, and freeing NAD^+ to be used again. The yield stays at the 2 ATP of glycolysis. Option D is wrong because complete oxidation to carbon dioxide and water needs oxygen.

98. Which type of fermentation occurs in muscle cells when oxygen is scarce?

(1)

- | | |
|--------------------------------------|------------------------|
| A. Alcohol fermentation | B. Aerobic respiration |
| C. ✓ Lactic acid fermentation | D. Glycolysis |

Answer: C

Muscle cells have no way to make ethanol, so when oxygen runs short they reduce pyruvate to lactic acid instead, which regenerates NAD^+ and keeps glycolysis producing ATP. The lactate is later carried to the liver and converted back once oxygen is available. Alcohol fermentation is the tempting parallel, but that pathway belongs to yeast and some plant tissue, not to animals.

— END OF MARKING KEY —

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