Biology & Biotechnology: second-round sample tasks

Question 1
Which enzymes are used in laboratories to break down proteins?

1. Kinases
2. Restriction enzymes
3. Proteases
4. Topoisomerases
5. Lyases

Answer: 3
Maximum score: 1

Question 2
Which of the following is most suitable for isolating a group of microbes from a mixture?

1. Gram stain
2. Liquid medium
3. Bacteriophage
4. Ultraviolet
5. Application of selective media

Answer: 5
Maximum score: 3

Question 3
DNA polymerase during replication

1. encodes a repressor protein.
2. can be stopped by an inducer protein.
3. binds to primase and helicase.
4. recognizes the start codon.
5. limits the functioning of enhancers.

Answer: 3
Maximum score: 3

Question 4
Compared to prokaryotic mRNA, eukaryotic mRNA:

1. is shorter in size.
2. is monocistronic.
3. contains a longer poly-A tail.
4. does not contain stop codons.
5. uses a different genetic code to code for amino acids.

Answer: 2
Maximum score: 3

Question 5
Which biosafety level is required when working with opportunistic pathogens?

1. Level 1
2. Level 2
3. Level 3
4. Level 4

5. Level 5

Answer: 2
Maximum score: 1

Question 6
In biotechnological production, enzymes are used to produce

1. nucleotides,
2. sugars,
3. protein hydrolysates,
4. vitamins,
5. maltose molasses.

Answer: 1, 2, 3, 5
Maximum score: 3

Question 7
Plasmid vectors used for protein expression must contain:

1. origin of replication,
2. recombination sites,
3. broad spectrum protease gene,
4. marker genes,
5. promoter.

Answer: 1, 4, 5
Maximum score: 3

Question 8
The polymerase chain reaction involves one molecule of double-stranded DNA, which primers can bind to. How many copies of double-stranded DNA will there be in the reaction mixture after the eighth PCR cycle if the efficiency amplification is 75%?
Answer: 192.
Maximum score: 3

Question 9
Which processes are characteristic of meiosis prophase 2?

1. divergence of monochromatid chromosomes
2. formation of the second fission spindle and destruction of the nuclear membrane
3. conjugation of homologous chromosomes
4. chromatin decompaction
5. cell septum formation

Answer: 2
Maximum score: 3

Question 10
The distance between genes is determined by

1. frequency of inversion.
2. location of histones.
3. number of coupling groups.
4. percentage of crossovers between them.
5. number of non-allelic genes.

Answer: 4
Maximum score: 1

Question 11
Which of the following organelles are non-membranous?

1. lysosomes
2. nuclei
3. ribosomes
4. mitochondria
5. plastids

Answer: 3
Maximum score: 3

Question 12
The primary disturbances in oncogenic transformation are changes in the activity of genes controlling

1. the secretory activity of cells.
2. cell life cycle.
3. cell shape.
4. cell metabolism.
5. inflammation factors.

Answer: 2
Maximum score: 1

Question 13
Which taxon has the strobilus as a reproductive organ?

1. Gymnosperms
2. Angiosperms
3. Microalgae
4. Ferns
5. Brown algae

Answer: 1
Maximum score: 1

Question 14
Which of the following organisms have an open circulatory system?

1. Gastropod
2. Lancelet
3. Fish
4. Fly
5. Snake

Answer: 1, 2, 4
Maximum score: 3

Question 15
Which of the following are cases of syntrophism?

1. soil bacillus and turnip
2. koala and wolf
3. human being and dust mite
4. penguin and polar bear
5. hare and scarab

Answer: 1, 3, 5
Maximum score: 3

Question 16
Hemophilia is an X-linked recessive genetic disorder. What is the likelihood of a female carrier of the hemophilia gene having daughters with hemophilia when the father does not carry the gene for hemophilia? Give your answer as a unit fraction.
Answer: 0
Maximum score: 3

Question 17
RNA viruses include
1. adenoviruses.
2. herpes virus.
3. smallpox virus.
4. poliovirus.
5. bacteriophage T4.

Answer: 4
Maximum score: 1

Question 18
The plant cell wall contains
1. chitin.
2. hemicellulose.
3. starch.
4. murein.
5. lysozyme.

Answer: 2
Maximum score: 1

Question 19
Bacterial infections include
1. syphilis.
2. flu.
3. tobacco mosaic disease.
4. wheat rust.
5. West Nile fever.

Answer: 1
Maximum score: 1

Question 20
The nucleus and mitochondria are similar in that they contain
1. flagella.
2. 40S ribosomes.
3. own genomes.
4. centrioles.
5. the Golgi complex.

Answer: 3
Maximum score: 3

Question 21
Which of the following is observed using only an electron microscope?

1. sperm
2. bacterium
3. sporangium
4. bacteriophage
5. cell nucleus

Answer: 4
Maximum score: 1

Question 22
The characteristic features of the soil bacterium Bacillus cereus are

1. Gram staining,
2. the absence of pili and flagella,
3. spore formation,
4. the inability to grow under aerobic conditions,
5. biofilm formation.

Answer: 1, 3, 5
Maximum score: 3

Question 23
Viral diseases transmitted through the fecal-oral route include

1. hepatitis A,
2. hepatitis C,
3. polio,
4. dysentery,
5. rotavirus infections.

Answer: 1, 3, 5
Maximum score: 3

Question 24
The virus genome contains: adenine 20%, thymine 20%, cytosine 30%, guanine 30%. Choose the correct statement.

1. The virus is likely to contain single-stranded DNA.
2. The virus is likely to contain single-stranded RNA.
3. The virus is likely to contain double-stranded DNA.
4. The virus is likely to contain double-stranded RNA.

Answer: 3
Maximum score: 3

Question 25
Trypsin promotes the breakdown of protein molecules

1. in the oral cavity.
2. in the stomach.
3. in the small intestine.
4. in the large intestine.
5. in the rectum.

Answer: 4
Maximum score: 1

Question 26
Insulin is involved in the regulation of
1. heat production.
2. glucose consumption by tissues.
3. the release of glucose into the blood.
4. the removal of water from the body.
5. the number of red blood cells.

Answer: 2
Maximum score: 1

Question 27
The action potential in a neuron is formed due to
1. the potassium ion concentration gradient.
2. sodium ion concentration gradient.
3. membrane depolarization.
4. magnesium ion concentration gradient.
5. membrane hyperpolarization.

Answer: 3
Maximum score: 3

Question 28
An example of specific immunity is
1. saliva lysozyme destroying bacterial cell walls.
2. antigen provision by antigen-presenting cells.
3. antibody release by lymphocytes.
4. Histamine release by mast cells.
5. immunological suppression.

Answer: 3
Maximum score: 3

Question 29
Who was the first to put forward postulates proving the pathogenicity of the microorganism?
1. Edward Jenner
2. Louis Pasteur
3. Alexander Flemming
4. Robert Koch
5. Ilya Mechnikov

Answer: 4
Maximum score: 1

Question 30
What are the central organs of the immune system of animals?
1. lymph nodes
2. thymus
3. bursa of Fabricius
4. bone marrow
5. appendix

Answer: 2, 3, 4
Maximum score: 3

Question 31
Which proteins and peptides are secreted by the pancreas?

1. trypsin
2. aldosterone
3. ACTH
4. chymotrypsin
5. insulin

Answer: 1, 4, 5
Maximum score: 3

Question 32
Calculate the grams of oxygen that can be potentially bound by 5 liters of blood, given that 1 liter of blood can bind 200 ml of oxygen (atomic mass 16 g/mol). Round your answer to the nearest tenth of a gram.
Answer: 1.4 g
Maximum score: 3

Question 33
What is the rate of the enzymatic reaction at a substrate concentration of 1 Km (Michaelis constant)?

1. 25% max speed
2. 50% max speed
3. 75% maximum speed
4. 80% maximum speed
5. 125% maximum speed

Answer: 2
Maximum score: 3

Question 34
CO_2 molecules are formed during glucose catabolism at the stage of

1. citric acid formation.
2. succinate oxidation to fumarate.
3. glyceraldehyde phosphate oxidation to 1,3-diphosphoglycerate.
4. pyruvate oxidation to acetyl- CoA.
5. NADH oxidation in mitochondria.

Answer: 4
Maximum score: 3

Question 35
Which function does helicase perform during replication?

1. It breaks hydrogen bonds in DNA.
2. It removes unnecessary seed fragments.
3. It maintains a single-stranded DNA state.
4. It synthesizes ribo-oligonucleotides.
5. It joins together the Okazaki fragments.

Answer: 1
Maximum score: 1

Question 36

Which is true of translation?

1. The ribosome moves away from the 3' end of the transcript.
2. Translation requires binding of the leader sequence to elongation factors.
3. AUG is the start codon of translation.
4. UGA is the start codon of translation.
5. The ribosome uses ATP energy to synthesize a peptide bond.

Answer: 3
Maximum score: 1

Question 37
Changes in translation activity in prokaryotes may be related to

1. the enhancer sequence.
2. the ribosome binding site sequence.
3. the insulator sequence.
4. the promoter sequence.
5. upstream activator sequences within the promoter.

Answer: 2
Maximum score: 1

Question 38
Select all correct statements about nitrogenous bases.

1. They form hydrogen bonds with each other within double-stranded nucleic acids.
2. They contain aromatic structures.
3. They are an ester.
4. They have a strong aroma and contain a nitro group.
5. They contain heteroatoms.

Answer: 1, 2, 5
Maximum score: 3

Question 39
Oxidoreductases can be found in the following metabolic processes:

1. pyruvate dehydrogenase complex,
2. electron transport chain in mitochondria,
3. broadcast,
4. glycolysis,
5. urea cycle.

Answer: 1, 2, 4
Maximum score: 3

Question 40
Stearic acid contains 18 carbon atoms. What is the maximum amount of ATP that can be obtained from the decomposition of one molecule of stearic acid in the Krebs cycle, if the substrate of the cycle is acetyl-CoA, and 10 molecules of ATP are obtained for each acetyl residue?
Answer: 90
Maximum score: 3

Question 41
Which is true of the protein hormone insulin?

1. Insulin is industrially obtained from the human pancreas.

2. Insulin is not soluble in water.
3. Insulin is not resistant to proteases.
4. Insulin is unstable to nucleases.
5. Insulin is unstable to the action of limes.

Answer: 3
Maximum score: 3

Question 42
During the fermentation of sugar-containing raw materials using lactobacilli, the main fermentation product is:

1. acetic acid
2. stearic acid
3. propionic acid
4. lactic acid
5. nitric acid

Answer: 4
Maximum score: 1

Question 43
Muscle tissue mainly consists of the following proteins:

1. insulin
2. hemoglobin
3. collagen
4. actin
5. myosin

Answer: 3, 4, 5
Maximum score: 3

Question 44
To stain specific proteins on the cell surface, it is optimal to use

1. silver nitrate.
2. hematoxylin.
3. eosin.
4. labeled antibodies.
5. fluorescein.

Answer: 4
Maximum score: 3

Question 45
The maximum amount of energy per unit mass can be stored in the form of:

1. proteins.
2. lipids.
3. sugars.
4. nucleic acids.
5. Cellulose.

Answer: 2
Maximum score: 1