

Please choose the most appropriate terms/phrases/statements that complete or answer the questions.
Attention: More than one of the choices provided may be correct.

(2.5 points for each question)

1. Eukaryotic cells are bigger and more elaborate than prokaryotic cells. Which of the following statements are true?
 - (A) By definition, all eukaryotic cells have a nucleus.
 - (B) Endoplasmic reticulum which generates the chemical energy is essential for all eukaryotic cells.
 - (C) In contrast, the chloroplast is a type of organelle found only in the cells of plants and algae, and performs photosynthesis.
 - (D) The function of cytoskeleton is to maintain cell shape and structure.
 - (E) The ribosomes are required for DNA synthesis.
2. Which of the following descriptions are correct for DNA?
 - (A) It is mainly found as a long, double-stranded molecule.
 - (B) It contains the sugar ribose.
 - (C) It normally contains the bases thymine, cytosine, adenine, and guanine.
 - (D) It can normally adopt distinctive folded shapes.
 - (E) It can be used as the template for protein synthesis.
3. Which of the following descriptions are correct for messenger RNAs (mRNAs)?
 - (A) They contain codons.
 - (B) They contain anticodons.
 - (C) They are (covalently) attached to amino acids.
 - (D) They carry genetic information and are exported from the nucleus
 - (E) They are at the core of a complex that carries out protein synthesis.
4. Which of the following descriptions are correct for a cell? All cells ...
 - (A) have membrane transport proteins.
 - (B) have the membrane-enclosed DNA.
 - (C) replicate their genome by DNA polymerization.
 - (D) transcribe their genetic information by RNA polymerization.
 - (E) synthesize proteins on the ribosome.
5. Which of the following descriptions are NOT true for a virus? A virus...
 - (A) is a type of cell.
 - (B) has genetic material made of proteins.
 - (C) can only infect a single host species.
 - (D) can act as a vector for gene transfer.
 - (E) cannot persist in its host for more than one cell generation.
6. Which of the following would you NOT expect to find in a bacterial cell?
 - (A) Swimming using flagella
 - (B) Having a cell wall around the plasma membrane
 - (C) ATP production in mitochondria
 - (D) Protein production on the ribosome
 - (E) Sexual exchange of DNA with other bacteria
7. Indicate which of the following structure or molecule can be found in both animal and plant cells?

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- (A) Mitochondria
(B) Nucleus
(C) Plasma membrane
(D) Chloroplast
(E) Golgi apparatus
8. Indicate which of the following structure or molecule can be found in a bacterial cell?
(A) Mitochondria
(B) Nucleus
(C) Plasma membrane
(D) Chloroplast
(E) Golgi apparatus
9. It is a model organism used to study various eukaryotic cell and developmental processes such as cell division and cell death. Its hermaphrodite (雌雄同體) adult is composed of exactly 959 somatic (non-germ) cells, the lineage of each of which has been worked out with great precision. It is approximately 1 mm long. Which of the following is correct for this organism?
(A) *Histoplasma capsullatum*.
(B) *Yersinia pestis*.
(C) *Caenorhabditis elegans*.
(D) *Candida albicans*.
(E) *Drosophila melanogaster*.
10. Adenosine 5'-triphosphate, or ATP, is the principal molecule for storing and transferring energy in cells. The pieces of toast you had for breakfast are broken down to generate ATP. Which of the following statements are true?
(A) The stage which digests starch to glucose generates the most ATP.
(B) There are 2 net ATP generated from glycolysis.
(C) There are 2 net ATP is generated from the citric acid cycle.
(D) The stage which involves oxidative phosphorylation generates the most ATP.
(E) Oxidative phosphorylation produces about 28 ATP molecules.
11. Which of the following cell types are not immune cells?
(A) Adipocyte
(B) B cell
(C) Macrophage
(D) T cell
(E) Neuron cell
12. Which one is not the class of pathogen?
(A) Spider
(B) Snake
(C) Virus
(D) Beetle
(E) Fungus
13. Which of the following organs are not in mucosal system?
(A) Gut
(B) Liver

- (C) Nose
 - (D) Spleen
 - (E) Kidney
14. Which of the following responses are not immune responses?
- (A) Mitosis
 - (B) Killing cancer cells
 - (C) Nutrition transport
 - (D) Production of antibody
 - (E) Secretion of inflammatory cytokine
15. Which one is the isotype of antibody?
- (A) IgD
 - (B) IgH
 - (C) IgB
 - (D) IgE
 - (E) IgA
16. Which of the following techniques can be used to edit gene?
- (A) RT-PCR
 - (B) ELISA
 - (C) CRISPR/Cas9
 - (D) Electrophoresis
 - (E) Gel shift
17. Which of the following techniques can be used to detect gene?
- (A) HPLC
 - (B) PCR
 - (C) Gel filtration
 - (D) Western blot
 - (E) Southern blot
18. Which of the following techniques need to use monoclonal antibody?
- (A) Northern blot
 - (B) Flow cytometry
 - (C) PCR
 - (D) ELISpot
 - (E) Southern blot
19. Which of the following models are always used in studying biology in vivo?
- (A) Human
 - (B) Monkey
 - (C) Mouse
 - (D) Zebra fish
 - (E) Fruit fly
20. Which of the following strategies can be used to control cancer?
- (A) CAR-T
 - (B) Immune checkpoint blockade

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- (C) Radiation therapy
(D) Dendritic cell vaccine
(E) Chemical therapy
21. Which of the following statements about protein degradation are correct?
(A) happens randomly.
(B) frequently makes use of proteasomes.
(C) can regulate cellular processes by removing enzymes and regulatory proteins that are no longer needed.
(D) Lysosomes are the only place to degrade cellular proteins.
(E) Ubiquitin marks protein for degradation.
22. Which of the following mutations would be most likely to interfere with the proper insertion of a protein in the plasma membrane?
(A) amino acid mutation from L \rightarrow V within a transmembrane domain.
(B) amino acid mutation from L \rightarrow K within a cytoplasmic domain.
(C) amino acid mutation from M \rightarrow K within a transmembrane domain.
(D) amino acid mutation from I \rightarrow A within a cytoplasmic domain.
(E) amino acid mutation from W \rightarrow R within a transmembrane domain.
23. Which of the following statements about receptor-mediated endocytosis is correct?
(A) Receptor-mediated endocytosis is a dynamic process.
(B) Receptor-mediated endocytosis requires a clathrin coat.
(C) Receptor-mediated endocytosis is used to internalize all outside molecules into the cell.
(D) Receptor-mediated endocytosis can be used to downregulate transmembrane signal transduction.
(E) Receptor-mediated endocytosis indirectly increases membrane fluidity by helping to transport cholesterol into the cell.
24. A mutation in an integrin protein would likely affect which of the following:
(A) the failure to mediate Ca²⁺ binding.
(B) fibronectin binding.
(C) defects in attachment of the cell to the extracellular matrix.
(D) communication between the nucleus and cytoskeleton.
(E) an interruption in signal transduction.
25. Which of the following statements are true?
(A) A transcription factor is the part of the promoter sequence closest to the start of transcription.
(B) As in prokaryotes, the regulatory regions for eukaryotic genes are always right next to the genes they control.
(C) Response elements are enhancers of transcription activated by transcription factors.
(D) RNA transcribed from the coding strand instead of the template strand is called antisense RNA.
(E) Polyadenylation of eukaryotic mRNA occurs at the 5' end.
26. During which cellular process do ribonucleic acid molecules involve?
(A) formation of the nucleolus.
(B) nucleosome formation.
(C) centriole assembly.
(D) DNA replication.
(E) ribosome assembly.

27. Telomerase

- (A) induces apoptosis.
- (B) contains reverse transcriptase.
- (C) contains RNA molecules.
- (D) is inactivated by Bcl-2.
- (E) is active in all normal adult cells.

28. You have identified an enzyme that appears to be involved in the addition of palmityl group (a fatty acid) to certain proteins. Knowing that palmitoylated proteins are usually targeted to the plasma membrane, in which organelles might this enzyme be expressed?

- (A) nucleus.
- (B) ribosomes.
- (C) endoplasmic reticulum.
- (D) Golgi apparatus.
- (E) mitochondria.

29. During which cellular process do all three forms of RNA associate?

- (A) ribosome assembly.
- (B) chromatin formation.
- (C) formation of the nucleolus.
- (D) protein synthesis.
- (E) DNA replication.

30. The functions of the cytoskeleton include all of the following except

- (A) providing the cell shape.
- (B) protein translation.
- (C) chromosome segregation during division.
- (D) providing movement of molecules in the cell.
- (E) ribosome assembly.

31. Which of following bonds are involved in protein-protein interaction?

- (A) Ionic bond
- (B) Van der Waals
- (C) H-bond
- (D) Salt bridge
- (E) Zn^{+2} -mediated coordinated bond

32. Which of the following macromolecules have catalyst function in the biological system?

- (A) RNA
- (B) Protein
- (C) Lipid
- (D) Carbohydrate.
- (E) Fatty acid

33. Which of the following mechanisms regulate the level of protein expression?

- (A) Gene transcription
- (B) proteolysis
- (C) Allosteric regulation
- (D) Protein Folding

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(E) post-translational modification

34. Which of the following biomolecules have reducing function?

- (A) Glutathione
- (B) NAD^+
- (C) NADP^+
- (D) FADH_2
- (E) Vit C

35. IPTG-induction of β -galactosidase activity is due to

- (A) stimulation of Lac repressor function
- (B) IPTG binding to the *lac* operon and inducing transcription.
- (C) IPTG binding to the *lacI* gene product and inhibiting its activity.
- (D) Lac repressor loses the DNA binding activity
- (E) IPTG stimulates enzymatic function of β -galactosidase

36. Eukaryotes are different from prokaryotes in having

- (A) cell membrane
- (B) mitochondria
- (C) cell wall
- (D) nuclear membrane
- (E) Endoplasmic reticulum

37. Which of the biomolecules provide energy during translation.

- (A) ATP
- (B) TTP
- (C) GTP
- (D) CTP
- (E) UTP

38. Six restriction enzymes shown below are indicated with specific recognition sequence. Which of them would generate DNA fragments with average size of 256 bp when used to completely digest an *E. coli* genomic DNA sample

- (A) Not I : GCGGCCGC
- (B) Hind III : AAGCTT
- (C) Hpa II : CCGG
- (D) Hpa I : GTTAAC
- (E) AluI: AGCT

39. Choose biomolecules in the followings, which function are inhibited by CO

- (A) NADH-Q reductase (complex I)
- (B) CoenzymeQ (complex II)
- (C) QH_2 -cytochrome c reductase (complex III)
- (D) Cytochrome C oxidase
- (E) Hemaglobulin

40. Which of the following enzymes are responsible for transcription in eukaryotes?

- (A) RNA polymerase I
- (B) RNA polymerase II

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- (C) RNA polymerase III
- (D) DNA polymerase δ
- (E) DNA polymerase α

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