

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. Which of the following statements about cellular energy are CORRECT?
 - (A) Electron transport chain complexes are functionally coupled to inter-membrane potential in the mitochondria
 - (B) Glycolysis produces more energy than aerobic respiration
 - (C) Flipping of phospholipid molecules between leaflets of the membrane bilayers occurs spontaneously and does not require energy
 - (D) Increased sympathetic nerve activity promotes fat burning and heat production
 - (E) H^+ ions diffuse passively to accumulate in the acidic lysosomes
2. Which of the following techniques can be used to edit gene?
 - (A) RT-PCR
 - (B) Gel shift
 - (C) CRISPR/Cas9
 - (D) Electrophoresis
 - (E) ELISA
3. Which of the following antibodies are isotype of antibody?
 - (A) IgH
 - (B) IgD
 - (C) IgB
 - (D) IgE
 - (E) IgA
4. Which of the following techniques need to use monoclonal antibody?
 - (A) ELISpot
 - (B) Flow cytometry
 - (C) PCR
 - (D) Immunoprecipitation
 - (E) Southern blot
5. Which of the following techniques can be used to detect gene?
 - (A) HPLC
 - (B) Gel filtration
 - (C) PCR
 - (D) Western blot
 - (E) Southern blot
6. Which of the following cell types are not immune cells?
 - (A) Adipocyte
 - (B) B cell
 - (C) Macrophage
 - (D) Neuron cell
 - (E) NK cell

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7. Which of the following materials are not pathogens?
- (A) Ant
 - (B) Snake
 - (C) Parasite
 - (D) Beetle
 - (E) Fungus
8. Which of the following organs are not in mucosal system?
- (A) Gut
 - (B) Liver
 - (C) Lung
 - (D) Brain
 - (E) Kidney
9. Which of the following responses are not immune responses?
- (A) Killing cancer cells
 - (B) Mitosis
 - (C) Secretion of inflammatory cytokine
 - (D) Production of antibody
 - (E) Nutrition transport
10. Which of the following strategies can be used to control cancer?
- (A) CAR-T
 - (B) Immune checkpoint blockade
 - (C) Radiation therapy
 - (D) Dendritic cell vaccine
 - (E) Chemical therapy
11. Which of the following experimental approaches are used to determine protein-protein interactions?
- (A) Affinity chromatography
 - (B) Flow cytometry
 - (C) Immunoprecipitation
 - (D) RNA interference (RNAi)
 - (E) Yeast two-hybrid.
12. Which of the following proteins are membrane-bound electron carriers of mitochondria?
- (A) Cytochromes
 - (B) Flavoproteins
 - (C) Glycophorin A
 - (D) Iron-sulfur proteins
 - (E) Ubiquinone
13. Which of the following molecules can function as extracellular messengers?
- (A) Amino acids and amino acid derivatives
 - (B) Eicosanoids
 - (C) Gases (NO and CO)
 - (D) Polypeptides and proteins
 - (E) Steroids.

14. Which of the following enzymes are involved in the generation of microRNA (miRNA)?
- (A) Helicase
 - (B) Dicer
 - (C) Dmcl
 - (D) Drosha
 - (E) RAG.
15. Which of the following experimental approaches are used to study the function of cytoplasmic organelles?
- (A) Autoradiography
 - (B) Biochemical analysis of subcellular fractions
 - (C) Use of cell-free systems
 - (D) Use of genetic mutants
 - (E) Use of the green fluorescent protein.
16. What are the inhibitory checkpoint molecules which are targets for cancer immunotherapy?
- (A) CD28
 - (B) CTLA-4
 - (C) ICOS
 - (D) OX40
 - (E) PD-1.
17. What are the types of ion channels?
- (A) Diffusion-gated channels
 - (B) Ligand-gated channels
 - (C) Mechano-gated channels
 - (D) pH-gated channels
 - (E) Voltage-gated channels.
18. What are the types of chromosomal aberrations that cause human disorders?
- (A) Deletions
 - (B) Duplications
 - (C) Inversions
 - (D) Recombinations
 - (E) Translocations.
19. Which are the genes of HIV?
- (A) *gag*
 - (B) *pol*
 - (C) *maf*
 - (D) *rev*
 - (E) *tat*.
20. Which are the oncogenes?
- (A) *MYC*
 - (B) *RAS*
 - (C) *TP53*
 - (D) *PTEN*
 - (E) *RB*.

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21. Which of the following statements about a lipid bilayer membrane are CORRECT?
- (A) Lipid molecules in the membrane are amphipathic
 - (B) Phospholipids can diffuse in the same leaflet and flip freely to the other leaflet of membrane
 - (C) Cholesterol will increase membrane fluidity and facilitates planar diffusion of proteins
 - (D) Gangliosides are glycolipids and their structures are often complex
 - (E) Lipid bilayers are permeable to small gas molecules and ions
22. Which of the following statements about cytoskeletons are CORRECT?
- (A) Stress fibers are composed of microtubules
 - (B) γ -tubulin is a major component of the microtubule organizing center (MTOC)
 - (C) Arp2/3 complexes promote the formation of branched actin polymers
 - (D) F-actin is the major cytoskeleton in filopodia, finger-like membrane protrusions of the cell.
 - (E) Kinesins and dynein are motor proteins that use ATP hydrolysis as energy source to move along actin tracks
23. Which of the following statements about endocytosis and intracellular trafficking are CORRECT?
- (A) Receptor-mediated endocytosis requires clathrins to coat the endocytic pits
 - (B) Receptors that could be endocytosed have conserved gene sequences that encodes peptide motifs at the N-terminus to mediate endocytosis
 - (C) cis-Golgi receives vesicles from the endoplasmic reticulum, and trans-Golgi buds off vesicles for membrane secretion or other trafficking routes
 - (D) Rab small GTPases are important regulators of membrane trafficking
 - (E) Endocytosis can both terminate signaling and facilitate signaling
24. Which of the following statements about mitosis and stem cells are CORRECT?
- (A) Most tissues contain various numbers of stem cells as a source of cell renewal, except for the nervous system, which contains no stem cells. Thus adult neurons cannot be replaced by newly generated neurons
 - (B) iPSCs (induced pluripotent stem cells) are produced by reprogramming of differentiated postmitotic cells
 - (C) Symmetric cell division increases cell diversity, and asymmetric cell division expands cell number.
 - (D) Differentiated cell nuclei could be reprogrammed after transferred to an enucleated oocyte
 - (E) Positioning of mitotic spindle, which determines the plane of cell division, could be regulated by extrinsic factors
25. Which of the following statements about imprinted (印痕) memory are CORRECT?
- (A) Imprinted memory can be formed at any stage of life
 - (B) Imprinted memory is easily reversible
 - (C) Imprinted memory can be formed by visual or olfactory stimuli
 - (D) Imprinted memory is specific to avian (bird) or mammalian species, and lower vertebrates or invertebrates do not form such memory
 - (E) Imprinted memory is specific for the type of sensory stimuli and does not cross-react with other sensory modalities
26. Which of the following statements about ion channels are CORRECT?
- (A) Nicotinic acetylcholine receptors are sodium channels
 - (B) The transmembrane domains of ion channel proteins face the lipid bilayer with hydrophobic amino acids and form the channel passage with hydrophilic, polar or charged residues
 - (C) Ion channels are only expressed in neurons
 - (D) Ion channels could be formed by different protein subunits

(E) Ion channels could be gated by membrane potential, photon, ligands but not mechanical force

27. Which of the following statements about animal development are CORRECT?

- (A) Neurons and skin tissues are largely derived from the mesoderm
- (B) Colinearity of Hox genes refers to the arrangement of Hox gene expression tissues in the same order of Hox genes on the chromosome
- (C) Developmental cell fates could be specified by different concentration of morphogenic cues
- (D) Apoptosis is a rare event in development and it is not regulated genetically
- (E) Germ line tissues are segregated from the somatic tissues from very early phase of development

28. Which of the following statements about genetics are CORRECT?

- (A) Mutations in gene X and gene Y individually cause different phenotypes, but mutations simultaneously in gene X and gene Y express only Y phenotypes only. Genetically, gene Y acts downstream of gene X.
- (B) Mitochondrial genome has variable copy number
- (C) cM (centi-Morgan) is a unit of absolute distance between two genes on the same chromosome that is determined by the chance of recombination between these two genes
- (D) Mendelian law of genetic segregation applies to both linked and unlinked traits/mutations
- (E) Conditional mutant alleles are often missense mutations

29. Which of the following amino acids can be targets of kinases?

- (A) Threonine
- (B) Alanine
- (C) Tyrosine
- (D) Glutamate
- (E) Serine

30. Which of the following descriptions about cellular organization are CORRECT?

- (A) Primary cilia are motile structures that promote cellular movements
- (B) Smooth endoplasmic reticulum (sER) is the primary site for lipid synthesis
- (C) Dendrites and axons have distinct microtubule organization
- (D) Chloroplasts, mitochondria and peroxisomes are double-membrane organelles
- (E) Permeability of the nuclear envelope is regulated by the nuclear pore complexes (NPC)

31. Endoplasmic Reticulum (ER) not only serves as an entry site for secretory pathway, it is also an important quality control for protein post-translational modification, folding and assembly. Which of the following events belongs to unfolded protein response (UPR) in cells?

- (A) Decrease of chaperones production,
- (B) Attenuation of general protein translation,
- (C) Stimulating ER-associated degradation process,
- (D) ER expansion,
- (E) Apoptosis.

32. Which of the following is an important model organism for the study of developmental biology?

- (A) *Escherichia coli*
- (B) *Saccharomyces cerevisiae*
- (C) *Caenorhabditis elegans*
- (D) *Drosophila melanogaster*
- (E) *Mus musculus*

33. The human microbiota, the microorganisms that reside in and on a single human being, consists of:

- (A) Bacteria,
- (B) Archaea,
- (C) Fungi,
- (D) Protists,
- (E) Viruses.

34. Which of the following is a function of RNA ?

- (A) As transient carriers of genetic information,
- (B) As a carrier of amino acids to the site of protein synthesis,
- (C) is the genetic information carriers in some viruses,
- (D) Catalytic roles in CRISPR-Cas9 genome-editing system,
- (E) Catalytic roles in RNA splicing.

35. Which of the following is correct regarding telomere?

- (A) Telomere is bound by specific proteins that protect the end of linear chromosomes from attack by exonucleases,
- (B) Telomerase utilizes reverse transcriptase activity to prevent shortening of chromosomes,
- (C) Every time somatic cells replicate, telomerase extends the ends of the chromosomes,
- (D) Specialized telomere-binding proteins prevent loss of DNA during replication,
- (E) *Drosophila* species maintain telomere lengths by the regulated insertion of retrotransposons into telomeres.

36. Polyglutamine (polyQ) diseases:

- (A) Result from template slippage during replication,
- (B) Occur when CAG repeats increase above the disease threshold,
- (C) Are caused by expanded cytosine-adenine-guanine repeats,
- (D) Are a group of neurodegenerative disorders,
- (E) Are recessive inheritance.

37. Which of the following is true of chemotherapeutic agents?

- (A) Create broken chromosomes or stalled replication forks
- (B) The cytotoxic effect of these DNA damaging agents requires the cell to be actively dividing,
- (C) Inhibit angiogenesis,
- (D) Are antimicrotubule agents
- (E) Are proteasome inhibitors.

38. The minimal requirement of DNA sequences for a long linear DNA molecule to function as a chromosome are:

- (A) Replication origin
- (B) Telomeres
- (C) Open reading frame
- (D) Centromere
- (E) Nucleosome

39. Which of the following is NOT affected by the presence of epigenetic marks?

- (A) Development,
- (B) Imprinting,
- (C) X-chromosome inactivation,

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- (D) Maturation of RNA,
- (E) Unique gene expression patterns in different cells.

40. Which of the following organelles are likely to have evolved as a result of prokaryotic plasma membrane invagination?

- (A) Endoplasmic reticulum,
- (B) Golgi apparatus,
- (C) Mitochondria,
- (D) Nucleus,
- (E) Lysosome.

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