

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 receptors are not pattern recognition receptors in innate immunity?
 - (A) Toll-like receptor
 - (B) T cell receptor
 - (C) NOD-like receptor
 - (D) C-type lectin receptor
 - (E) B cell receptor

2. Which one is the strategy to generate gene-modified mice?
 - (A) Chemical reagents
 - (B) PCR
 - (C) Gene trapping
 - (D) Irradiation
 - (E) Gene targeting

3. Which of the following methods can be used for detecting cytokine production by cells?
 - (A) Gene cloning
 - (B) ELISA
 - (C) Quantitative PCR
 - (D) Intracellular staining
 - (E) DNA sequencing

4. Which of the following techniques are applied with monoclonal antibody?
 - (A) ELISPOT
 - (B) Immunoprecipitation
 - (C) Western blot
 - (D) Flow cytometry
 - (E) Southern blotting

5. Which of the following cell types are immune cells?
 - (A) Dendrocyte
 - (B) Cardiomyocyte
 - (C) Adipocyte
 - (D) Neutrophil
 - (E) Mast cell

6. Which of the following organs can initiate mucosal immunity?
 - (A) Gut
 - (B) Spleen
 - (C) Neuron

見背面

- (D) Kidney
(E) Brain
7. Which of the following statements are not true?
(A) The immune system recognizes infection and induces protective responses.
(B) The cells of the immune system derive from precursors in the bone marrow.
(C) The myeloid lineage comprises most of the cells of the adaptive immune system.
(D) Lymphocytes mature in the bone marrow or the thymus and then congregate in lymphoid tissues throughout the body.
(E) Most infectious agents activate the innate immune system and induce an inflammatory response.
8. Which of the following cancer therapy is a kind of immunotherapy?
(A) T cell
(B) Radiation
(C) Surgical
(D) Targeting
(E) Chemical
9. Regarding to antibody which statements are true?
(A) It has one pair of heavy chain and light chain.
(B) It is part of cellular immunity.
(C) It is secreted by plasma cells.
(D) It can block the entry of virus into host cells.
(E) It can be classified into IgM, IgG, IgE, and IgA four isotypes.
10. Which of the following diseases can be controlled by vaccine?
(A) Influenza
(B) Arthritis
(C) Ebola infection
(D) Tuberculosis
(E) Hepatitis
11. Which of the followings *are true* of molecular chaperones?
(A) They assist polypeptide folding by helping the folding process follow the most energetically favorable pathway.
(B) They can isolate proteins from other components of the cells until folding is complete.
(C) They can interact with unfolded polypeptides in a way that changes the final fold of the protein.
(D) They help streamline the protein-folding process by making it a more efficient and reliable process inside the cell.
(E) They are essential for combating invading microorganism

12. Figure 1. shows a signaling pathway that is turned on inappropriately in many human cancers. PTEN and Akt are cancer-critical genes. The key proteins and their positive or negative influences on each other are shown. Which of the followings are true?
- (A) PTEN is a tumor suppressor
 - (B) PTEN is a proto-oncogene
 - (C) Akt is a tumor suppressor
 - (D) Akt is a proto-oncogene
 - (E) It is common that more than one of these pathway components are mutated in a single tumor.

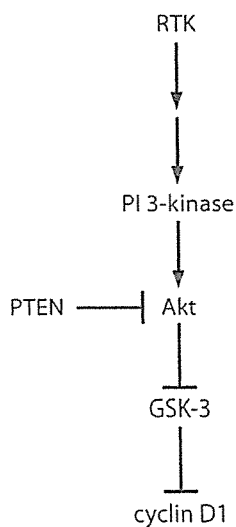


Figure 1

13. Which of the following statements are true ?
- (A) Generally, the total number of nonpolar amino acids has a greater effect on protein structure than the exact order of amino acids in a polypeptide chain.
 - (B) The “polypeptide backbone” refers to all atoms in a polypeptide chain, except for those that form the peptide bonds.
 - (C) The chemical properties of amino acid side chains include charged, uncharged polar, and nonpolar.
 - (D) The relative distribution of polar and nonpolar amino acids in a folded protein is determined largely by hydrophobic interactions, which favor the clustering of nonpolar side chains in the interior.
 - (E) In summary, all proteins are negatively charged molecules.
14. To study how proteins fold, scientists must be able to purify the protein of interest, use solvents to denature the folded protein, and observe the process of refolding at successive time points. Which of the following statements are true?
- (A) The solvents break all covalent interactions.
 - (B) The solvents break all noncovalent interactions.

- (C) Mild detergents do not break all noncovalent interactions within a protein and lead to partial unfolding
- (D) The solvents create a new protein conformation.
- (E) Proteins fold into only one single, correct conformation.
15. Which of the following statements are true ?
- (A) Collagen is a protein that participates in both the cytoskeleton and the extracellular matrix.
- (B) Collagen is not used inside the cell; it is secreted and incorporated into the existing collagen fibers in the extracellular matrix.
- (C) Collagen fibers and elastin fibers serve similar functions.
- (D) Collagen fibers are highly organized, triple-strand coiled-coils that provide strength to hold tissue together.
- (E) Elastin molecules are linked together in a loose network allowing the fibers to stretch without tearing.
16. Although there are many distinct prokaryotic species, most have a small range of shapes, sizes, and growth rates. Which of the following characteristics are not observed in prokaryotes?
- (A) a highly structured cytoplasm
- (B) endoplasmic reticulum
- (C) the ability to divide rapidly
- (D) a cell wall
- (E) chromosomes
17. 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.
18. 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.

19. Which of the following statements are true?
- (A) CO₂ and H₂O are generated during the oxidation of food molecules.
 - (B) Activated carrier molecules store heat energy for the cell to use later.
 - (C) Catabolism is a general term that refers to the processes by which large molecules are synthesized from smaller molecules.
 - (D) The oxidation of sugar is an energetically favorable process.
 - (E) No energy is lost as heat during oxidation of glucose.
20. A successful infection by a pathogen requires that _____. (Select all that apply.)
- (A) the pathogen is able to multiply
 - (B) the host's immune defenses are never compromised
 - (C) the pathogen is transmissible to new hosts
 - (D) a mutualistic association between host and pathogen forms
 - (E) biofilms must form at the site of infection
21. Which of the following properties are important when considering free diffusion of a molecule through a lipid bilayer membrane?
- (A) Charge
 - (B) Size
 - (C) Hydrophobicity
 - (D) The presence of hydrogen bonds
 - (E) The presence of highly reactive oxygen molecule
22. Which of the following statements about microtubules are CORRECT?
- (A) β -tubulin is one of the major components of microtubules-organizing center (MTOC), which generates mitotic spindles
 - (B) Growth and catastrophe (disassembly) of microtubules all occur at the plus end
 - (C) Ciliary microtubules are arranged in a characteristic 9+2 triplet structure
 - (D) Drugs that trigger microtubule disassembly are useful anti-cancer drugs, whereas drugs that generate highly stable microtubules will promote cancer progression
 - (E) Common microtubules-dependent motor proteins are kinesins and dynein, which all use ATP hydrolysis as energy source to promote cargo transport
23. Which of the following statements about endocytosis are CORRECT?
- (A) Endocytosis can proceed in both clathrin-dependent and clathrin-independent manners
 - (B) Conserved amino acid motifs could be found in the cytoplasmic parts of some membrane receptors that recruit endocytic machinery to mediate endocytosis
 - (C) Clathrin remains on the cytosolic surface of early endosomes and will disassemble when the early endosomes mature into recycling endosomes
 - (D) Dynamin, a large GTPase, is required to relieve endocytic vesicles from the plasma membrane
 - (E) AP1 is a core component in receptor-mediated endocytosis

24. Which of the following statements about cell division are CORRECT?
- (A) Symmetric cell division generates two daughter cells with identical fate and will expand cellular diversity in the organ
 - (B) Asymmetric cell division is a stochastic (by chance) event that generates two daughter cells with different sizes
 - (C) Positioning of the mitotic spindle will determine where the cleavage furrow forms, which then divides the mother cell equally or unequally
 - (D) Chromosomes are condensed at metaphase, together with pairing of homologous chromosomes
 - (E) Asymmetric cell division is solely controlled by cell-intrinsic factors
25. Which of the following statements about enzymes are CORRECT?
- (A) The binding of the majority of enzymes with their substrates follow the “induced-fit” model, and only a few display “lock-and-key fit” mode of binding
 - (B) Flippases catalyze the movements of substrates molecules over the same leaflet of the membrane
 - (C) Small GTPases shuttle between GTP-bound (inactive) and GDP-bound (active) states
 - (D) Topoisomerases alter DNA topology, but not sequence, by cutting the DNA to wind or unwind the molecule, and the reseal it
 - (E) The protein kinase A (PKA) holoenzyme consists of two catalytic subunits and two regulatory subunits
26. Which of the following statements about signal transduction are CORRECT?
- (A) Hormone signaling could be downregulated by decreasing surface receptor level by receptor endocytosis
 - (B) Receptor tyrosine kinases usually form homodimers and trans-phosphorylate each other
 - (C) Activation of the G protein-coupled receptors induces the formation of tripartite $G\alpha$ - $G\beta\gamma$ proteins, and the $G\alpha$ - $G\beta\gamma$ complex will further transducer the signals
 - (D) Nuclear hormone receptors contain DNA binding domains and can regulate gene expression upon activation by their ligands
 - (E) cyclic AMP, calcium, diacyl glycerol, inositol-1,4,5-triphosphate and sodium are all common second messengers in cellular signal transduction
27. Which of the following statements about animal development are CORRECT?
- (A) Morphogens are secreted molecules that control cell fates and pattern formation in a concentration-dependent manner
 - (B) Apoptosis is relatively rare during development but becomes more common during aging
 - (C) Expression of the caudalizing (tail-becoming) genes in the rostral (head) part of a developing vertebrate embryo will lead to duplication of caudal structures at the cost of rostral structures
 - (D) The developmental potential of stem cells becomes more and more restricted as the developmental process proceeds

(E) Germ line tissues are first specified when the animals reach reproductive maturity

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

- (A) Mutations in gene A and gene B individually cause different phenotypes, but mutations simultaneously in gene A and gene B cause B phenotypes only. Genetically, mutation in gene A is epistatic to mutation in gene B.
- (B) Mitochondrial genome is inherited from the father
- (C) The chance of recombination between homologous chromosomes is inversely related to the distance between the two loci that will recombine
- (D) Aneuploidy refers to aberrant nuclear chromosome number that is not the integral multiple of the monoploid chromosome number. Examples in human include Down syndrome (trisomy 21)
- (E) Dominant phenotypes can be caused by both gain- and loss-of-function gene mutations

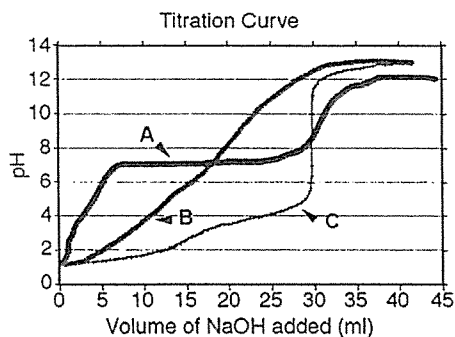
29. Which of the following amino acids carry positive charges?

- (A) Threonine
- (B) Tryptophan
- (C) Lysine
- (D) Glutamate
- (E) Arginine

30. Which of the following processes require the consumption of energy/ATP?

- (A) Pumping of Na ion out of the cells by Na-K-ATPase
- (B) Glucose entry into the intestinal epithelium by glucose transporters
- (C) Synaptic vesicles movements in the axon a neuron
- (D) Concentration of proton (H⁺) into the vacuoles of plant cells
- (E) Ethanol entry into the cell through the plasma membrane

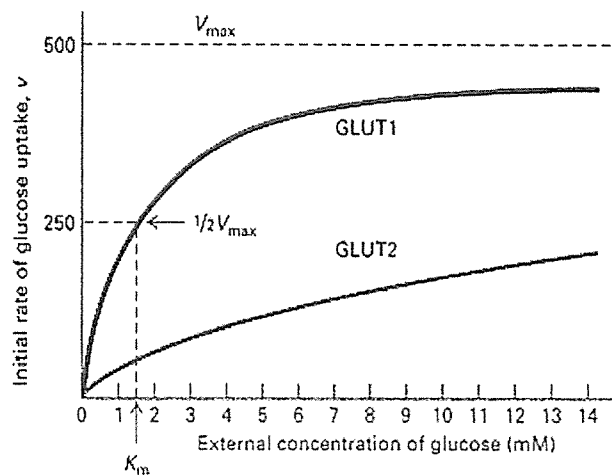
31. You would like to make a pH 7.4 buffer for your cell biological experiments. There are three kinds of chemicals in your laboratory with different titration curve as illustrated below. Which of them is suitable for your buffer preparation?



- (A) A.
- (B) B.
- (C) C.

- (D) A and B.
- (E) A and C.

32. You are measuring two glucose transporters, GLUT1 and GLUT2, for their activity to uptake glucose into the cells. The following diagram is your result which describes the kinetic features of these two transporters with regard to the concentration of its substrate glucose and the initial rate of glucose uptake, V . According to Michaelis-Menton equation, which of the following descriptions for your results are CORRECT?



- (A) The maximum transport rate, V_{max} , depends on the number of transporter in the membrane.
 - (B) V_{max} is achieved when half of the total transporters are working at their maximal rate.
 - (C) K_m is the glucose concentration when V is half of V_{max} and can serve as an indicator of the affinity of the transporter for glucose.
 - (D) GLUT2 has a K_m higher than the K_m of GLUT1
 - (E) GLUT2 has higher affinity for glucose than GLUT1.
33. Aging is characterized by a progressive loss of physiological integrity, leading to impaired function and increased vulnerability to death. Which of following description is the hallmark of aging?
- (A) Telomere lengthening.
 - (B) Loss of proteostasis.
 - (C) Deregulated nutrient sensing.
 - (D) Stem cell replenishment.
 - (E) Mitochondrial dysfunction.
34. Membrane enclosed organelles are thought to evolve in different ways. Which of the following organelle has been thought to evolve from invagination of the plasma membrane?
- (A) Mitochondria,
 - (B) ER,
 - (C) Nuclear Envelope,

- (D) Chloroplasts,
(E) Golgi.
35. Protein glycosylation, the attachment of sugar moieties to proteins, is an enzyme-directed chemical reaction. Those attached glycans serve a variety of structural and functional roles in proteins, and at least 50% of the proteins in cells are glycosylated. Where does glycosylation of protein occur in eukaryotic cells?
(A) ER
(B) Golgi
(C) lysosome
(D) nucleus
(E) cytoplasm
36. 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 response is what ER would initiate when misfolded proteins are accumulated in it?
(A) Decrease chaperones production.
(B) ER expansion to increase its protein folding capacity.
(C) Retro-translocation of misfolded protein into the cytosol.
(D) Misfolded protein degradation by proteasome outside the ER lumen.
(E) Apoptosis.
37. Which of the following descriptions about autophagy are CORRECT?
(A) Autophagy is a self-degradative process and is generally considered as suicidal mechanism of cells.
(B) Autophagy is important for balancing sources of energy at critical times in development and in response to nutrient stress.
(C) Autophagy also plays a housekeeping role in removing misfolded or aggregated proteins.
(D) Autophagy has a key role in preventing diseases such as cancer, neurodegeneration, diabetes, autoimmune diseases and infections.
(E) Autophagy can be either non-selective or selective in the removal of specific organelles, ribosomes and protein aggregates.
38. The existence of water channel had been proposed since 1970 but was eventually identified till 1992 by Peter Agre. Which of the following sentences could support the existing of water channel on the membrane of a cell?
(A) Red blood cells, but not the frog eggs, swell with water.
(B) Mercurials would inhibit water transport in red blood cells.
(C) There is a maximal rate (V_{max}) for water transport of red blood cells.
(D) Water (H_2O) crosses through the red blood cell membrane with almost no resistance, while acid hydronium ion (H_3O^+) does not permeate.

(E) The transport of water does not require ATP hydrolysis.

39. Lysosomes are specialized vesicles which contain digestive enzymes to break down waste materials and damaged cellular organelles. Thus, materials destined for degradation would follow different pathways to the lysosome. Which one of the following pathway would deliver the cargo into lysosome?

(A) Mannose-6 phosphate modification.

(B) Autophagy.

(C) Exocytosis.

(D) Endocytosis.

(E) Phagocytosis.

40. The shape, internal organization and functional polarity of a cell are provided by a three-dimensional filamentous protein network called the cytoskeleton. The cytoskeleton is composed of three major filament systems: microfilaments, microtubules and intermediate filaments. Which of the following descriptions about intermediate filaments are CORRECT?

(A) Intermediate filaments are tissue-specific filaments which mainly provide structural support and barrier functions.

(B) There are no motors that use intermediate filaments as tracks.

(C) Similar to microtubules, intermediate filaments are also polarized fibrous components.

(D) There are five major classes of intermediate filament proteins, with the nuclear lamins being the most ancient and ubiquitous in animal cells.

(E) The neurofilaments are intermediate filaments and important for the structure of axons.

試題隨卷繳回