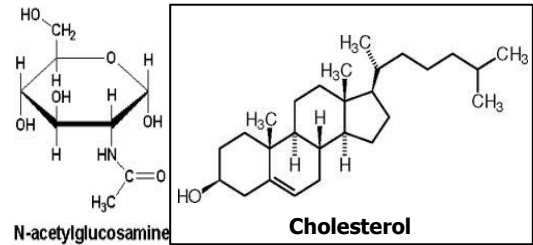


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I. Choose the correct answer (choose only one answer, multiple answers will cancel the question; 2 points each)

1. The membrane permeability to different molecules can be determined from their permeability coefficient (P) values, thus, when compared to N-acetylglucosamine, cholesterol would be expected to have:

- a. Greater membrane permeability than N-acetylglucosamine since it has a greater (P) value.
- b. Lesser membrane permeability than N-acetylglucosamine since it has a higher (P) value.
- c. Greater membrane permeability than N-acetylglucosamine since it has a smaller (P) value.
- d. Lesser membrane permeability than N-acetylglucosamine since it has a smaller (P) value.
- e. None of the above, where membrane is equally permeable to both molecules.



2. Channel proteins, such as porin, act to transfer substances across the biological membranes where:

- a. Polar substances are transferred from lower molar concentration to higher molar concentration.
- b. Polar substances are transferred from higher molar concentration to lower molar concentration.
- c. Non-polar substances are transferred from lower molar concentration to higher molar concentration.
- d. Non-polar substances are transferred from higher molar concentration to lower molar concentration.
- e. None of the above, porin – like proteins are using energy – dependent mechanisms.

3. A tRNA that has an anticodon of (5' – ACU – 3') would be needed to translate the following codon in the gene:

- a. 5' – AGU – 3'
- b. 5' – UGA – 3'
- c. 5' – AGT – 3'
- d. 5' – TGA – 3'
- e. 5' – ACT – 3'

4. Degeneracy of the genetic code means:

- a. A single codon will only incorporate one amino acid.
- b. An amino acid can only be incorporated by a single codon.
- c. More than one amino acid can be incorporated by a specific codon.
- d. A specific amino acid can be represented by more than one codon.
- e. None of the above, the genetic code is not degenerate.

5. The translation frame (-3) of the following sequence (starting with the amino-terminal end) is represented by the following amino acid sequence (use the attached table of the genetic code to identify the required translation frame):

5' – GGCTCCGCGGCCGCCTTCTATAACTTTAAGAAGGAGCCCTTAACCTGAGTTAACGACAAG – 3'

- a. **GSAAAFYNFKKEPLT*VNDK**
- b. **CR*LRLRAPS*SYRRRPRS**
- c. **LSLTQVKGSFLKL*KAAAE**
- d. **APRPPSITLRRSP*PELTT**
- e. **LVVNSG*GLLLKVIEGGRGA**

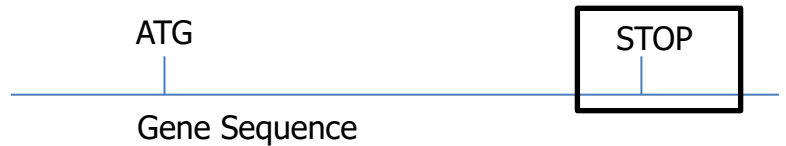
The genetic code

First position (5' end)	Second Position				Third position (3' end)
	U	C	A	G	
U	Phe Phe F Leu Leu L	Ser Ser S Ser Ser	Tyr Tyr Y Stop * Stop *	Cys Cys C Stop * Trp W	U C A G
C	Leu Leu L Leu Leu	Pro Pro P Pro Pro	His His H Gln Gln Q	Arg Arg R Arg Arg	U C A G
A	Ile Ile I Ile Met M	Thr Thr T Thr Thr	Asn Asn N Lys Lys K	Ser Ser S Arg Arg R	U C A G
G	Val Val V Val Val	Ala Ala A Ala Ala	Asp Asp D Glu Glu E	Gly Gly G Gly Gly	U C A G

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6. If you know that the above sequence, represented by a boxed area in the diagrammatic representation, represents part of a cDNA sequence of a gene. Which translation frame would represent the coding sequence of the gene?

- a. **GSAAAFYNFKKEPLT*VNDK**
- b. **CR*LRLRAPS*SYRRRPRS**
- c. **LSLTQVKGSFLKL*KAAAE**
- d. **APRPPSITLRRSP*PELTT**
- e. **LVVNSG*GLLLKVIEGGRGA**



7. Virus – mediated gene delivery utilizes the ability of the viral vector to inject and replicate its DNA inside the host cell. This process of virus – mediated transfer of cellular genetic material from one bacterial cell to another is called:
- a. Transfection
 - b. Transformation
 - c. Induction
 - d. Transposition
 - e. Transduction
8. In the classical model of transcriptional control, a repressor protein binds to:
- a. An enhancer
 - b. A “CAAT” site
 - c. A ribosomal – binding site
 - d. An operator
 - e. A “TATA” box
9. Plants and some bacteria are different than animals in that they:
- a. Form a polysaccharide from glucose
 - b. Use CO₂ to increase their biomass
 - c. Produce NADH via reduction reactions
 - d. Synthesize Glutamate and aspartate via transamination reaction
 - e. Oxidize glucose through glycolytic pathway to make energy
10. At the completion of S phase of cell cycle of a mammalian cell, all the following are correct EXCEPT:
- a. Histone content in the cell is almost doubled than its amount in G1 phase
 - b. Nascent strand of the replicated DNA base-pairs with a complementary parent strand
 - c. Each replicated chromosome has 4 telomeres
 - d. Sister chromatids separate from one another
 - e. The nucleus contains DNA equivalent to the amount of a tetraploid cell
11. When crossing two animals with genotypes *AaBb* X *AaBb*, Mendel’s principle of independent assortment predicts the ratio of the four possible phenotypes (AB, Ab, aB, ab) of the offspring will be (respectively):
- a. 1:1:1:1
 - b. 3:2:2:1
 - c. 4:2:1:1
 - d. 9:3:3:1
 - e. 6:4:4:2

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12. Bile

- a. Is an important enzyme that digests fats
- b. Is made by gall bladder
- c. Is the cause of the yellowish color of skin observed in people who lack digestion of β -carotene
- d. Emulsifies fats
- e. All of the above

13. Passive immunity is required during the time of epidemics and it can be elicited by:

- a. An allergen
- b. Native and / or recombinant bacterial / viral protein(s)
- c. Monoclonal antibodies
- d. $CD4^+$ cells
- e. Inflammatory cytokines

14. Chemoreceptors are involved in:

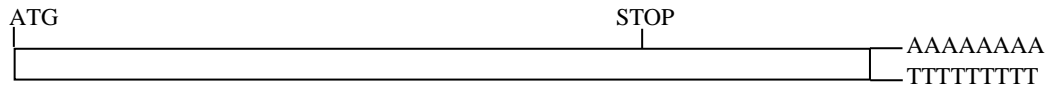
- a. Vision
- b. Hearing
- c. Tasting
- d. Smelling
- e. Answer (a) and (B)
- f. Answer (c) and (d)

15. If alleles R and s are present on one chromosome of an individual and alleles r and S are present on the homologous chromosome, what gametes will be produced? Assume that chromosomal crossover will not occur.

- a. RS, Rs, rS, rs
- b. RS, rs
- c. Rs, rS
- d. R, S, r, s
- e. RS, Rr, Ss, rs

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- II. State True (T) or False (F), and explain your answer **(2 points each)**
- a. In PCR reaction to amplify the gene shown in the diagram, the primers used to amplify the gene should be the poly dA and a second primer starting with TAC. ()



- b. The origin of replication contains a special sequence that marks the ends of the chromosomes so that they would not be recognized as broken DNA by the repair systems. ()
- c. The open reading frame of a gene sequence is a particular translation frame that starts with cysteine and ends with the poly- adenylation tail. ()
- d. The effect of substrate concentration on enzyme activity is linear, where increasing subs. conc. increases enzyme activity. ()
- e. A person who is on a dietary regime should stop eating fatty food as this would increase body fats. ()

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- III. A **phosphate buffer system**, pH 5.9, consists of 90 ml of 0.1 M sodium phosphate monobasic (NaH_2PO_3) and 10 ml of 0.1 M sodium phosphate dibasic (Na_2HPO_3), which act as the acid and its conjugate base in the buffer system, respectively. Use the Henderson Hasselbalch equation to calculate the pK value of the phosphate and then use the calculated pK to estimate the new pH value of the buffer system after the addition of 10 ml of 0.1 M solution of sodium hydroxide. **(10 points)**

Henderson Hasselbalch Equation:

$$\text{pH} = \text{pk} + \log \frac{\text{Conc.of base}}{\text{Conc.of Acid}}$$