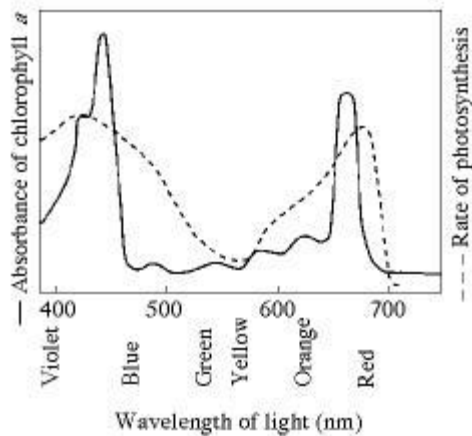


# Saint Louis University 1818 Advanced College Credit

## 2016-2017 BIOL 1240 Principles of Biology I Final Exam Questions

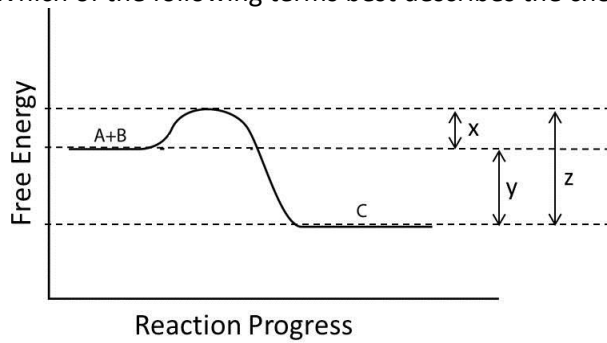
The questions in this document are required to be used in all 1818 BIOL 1240 courses in the 2016-2017 academic year. These questions should only be used on final exams (in December and/or May). These questions should not be available to students in advance of the final exams in any format (i.e., not on other exams, in classwork or homework assignments, or in a study guide). To protect the integrity of the exam questions, the portion of the final exam containing these questions should be retained by the instructor and not given to students.

1. The figure below shows the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis. Why are they different?

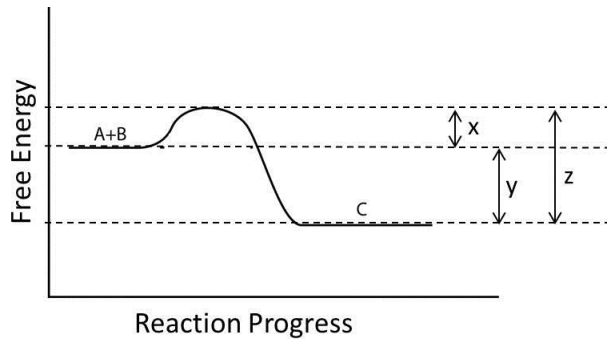


- A) Green and yellow wavelengths inhibit the absorption of red and blue wavelengths.
- B) Bright sunlight destroys photosynthetic products.
- C) Other pigments absorb light in addition to chlorophyll *a*.
- D) Aerobic bacteria take up oxygen, which changes the measurement of the rate of photosynthesis.

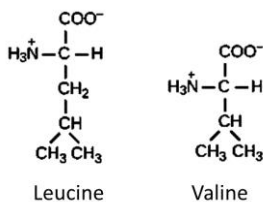
2. Which of the following terms best describes the chemical reaction represented in this graph?



- A) Endergonic reaction  
 B) Anabolic reaction  
 C) Coupled reaction  
 D) Exergonic reaction  
 E) Nonspontaneous reaction
3. Which of the following would be the SAME if this reaction were catalyzed by an enzyme? (The uncatalyzed reaction is depicted in the graph.)

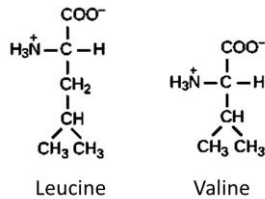


- A) x would be the same  
 B) y would be the same  
 C) z would be the same  
 D) All of these
4. The structures of the amino acids leucine and valine are shown below. The side chains of these two amino acids:



- A) are electrically charged  
 B) are hydrophilic  
 C) are nonpolar  
 D) will not interact with other amino acids

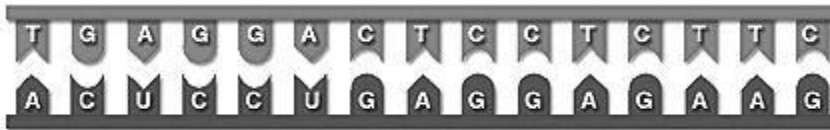
5. If leucine and valine (shown below) were in an integral membrane protein, they would be most likely to be located



- A) in the transmembrane portion of the protein  
B) on the cytoplasmic side of the protein  
C) on the extracellular side of the protein  
D) Either B or C
6. Lipids can carry out all of the following functions in cells EXCEPT:  
A) storage of energy  
B) formation of cell membranes  
C) catalysis of chemical reactions  
D) serving as hormones that aid in intercellular communication
7. Water's special characteristics that allow it to support life are derived from its molecules' ability to:  
A) form hydrogen bonds with each other  
B) repel one another in the presence of salts  
C) break their covalent bonds with very little energy input  
D) form nonpolar associations with each other
8. Alpha helices and beta-pleated sheets are examples of protein:  
A) tertiary structure  
B) primary structure  
C) quaternary structure  
D) secondary structure
9. Which of the following statements a hormone that promotes homeostasis is CORRECT?  
A) Every cell in the body can respond to the hormone.  
B) The hormone will only affect cells in the organ that released it  
C) The response to the hormone brings a variable closer to its normal level.  
D) The response to the hormone feeds back to promote the release of more hormone.
10. Oxytocin stimulates milk letdown (release of milk) when a baby is nursing. The more a baby suckles, the more oxytocin is released. The release of oxytocin from the posterior pituitary gland is controlled by:  
A) negative feedback  
B) antagonistic hormones  
C) positive feedback  
D) pheromones

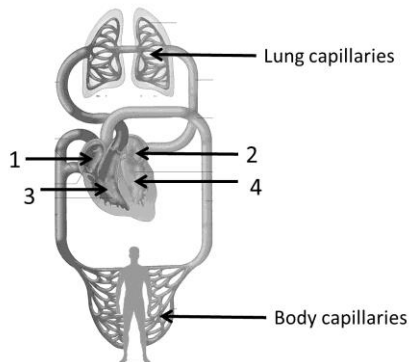
11. Why are action potentials normally conducted in only one direction along an axon?
- A) The nodes of Ranvier can conduct action potentials in only one direction.
  - B) The brief refractory period prevents re-opening of voltage-gated  $\text{Na}^+$  channels.
  - C) The axon hillock has a higher membrane potential than the axon terminals.
  - D) Ions can flow along the axon in only one direction.
12. Which of the following is a **DIRECT** result of depolarization of the presynaptic membrane of an axon terminal?
- A) Voltage-gated  $\text{Ca}^{2+}$  channels in the membrane open.
  - B) Synaptic vesicles fuse with the membrane.
  - C) The postsynaptic cell produces an action potential.
  - D) Ligand-gated channels open, allowing neurotransmitters to enter the synaptic cleft.
  - E) An EPSP or IPSP is generated in the postsynaptic cell.
13. Why do we need to be repeatedly vaccinated for influenza viruses?
- A) Because influenza viruses only attack helper T cells, thereby suppressing the immune system
  - B) Because influenza viruses alter their surface proteins and avoid immune recognition
  - C) Because influenza viruses don't actually generate an immune response; influenza is an inflammatory response
  - D) Because influenza viruses are too small to serve as good antigens
14. Upon a second exposure to an antigen that was encountered previously, the immune system response with \_\_\_\_\_ compared to the response that occurred upon the first exposure to the antigen.
- A) more intensity and over the same time period
  - B) more intensity and over a longer time period
  - C) more intensity and over a shorter time period
  - D) less intensity and over a shorter time period
15. In biological membranes, how are the phospholipids arranged?
- A) In a bilayer, with the fatty acids tails pointing toward each other
  - B) In a bilayer, with the fatty acid tails facing outward
  - C) In a single layer, with the fatty acids facing the interior of the cell
  - D) In a single layer, with the phosphate groups facing the interior of the cell
  - E) In a bilayer, with the phosphate groups in the interior of the membrane

16. A patient has had a serious accident and lost a lot of blood. In an attempt to replenish body fluids, the patient is given a transfusion of a salt solution. A volume of the salt solution equal to the volume of blood lost is transferred directly into one of the patient's veins. In blood, the concentration of NaCl is 9 g/L. The salt solution used for the transfusion contains 18 g/L NaCl. What will be the most probable result of this transfusion?
- It will have no unfavorable effect as long as the salt solution is free of viruses and bacteria.
  - The patient's red blood cells will shrivel up because the blood fluid has become hypertonic compared to the cells.
  - The patient's red blood cells will shrivel up because the blood fluid has become hypotonic compared to the cells.
  - The patient's red blood cells will burst because the blood fluid has become hypertonic compared to the cells.
  - The patient's red blood cells will swell because the blood fluid has become hypotonic compared to the cells.
17. Mitochondria and chloroplasts share some common features. Which of the following is **NOT** true?
- Mitochondria are found in both animal and plant cells.
  - Mitochondria and chloroplasts contain their own circular DNA.
  - Mitochondria and chloroplasts contain their own ribosomes and produce their own proteins.
  - Mitochondria and chloroplasts are both components of the endomembrane system.
  - Mitochondria and chloroplasts may have originated from prokaryotic organisms.
18. In this depiction of transcription, the \_\_\_\_\_ strand is RNA because it \_\_\_\_\_.



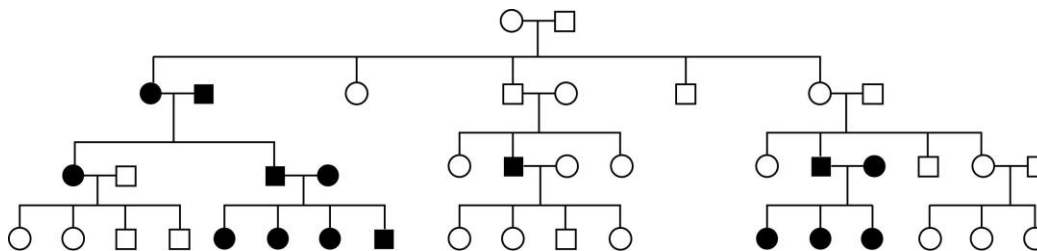
- upper; is single-stranded
  - lower; contains uracil
  - lower; contains thymine
  - upper; has no uracil
19. Which of the following is an advantage of a complete digestive system over a gastrovascular cavity?
- Extracellular digestion is not needed.
  - Specialized regions are possible.
  - Digestive enzymes can be more specific.
  - Extensive branching is possible.
  - Intracellular digestion is easier.

20. The diagram below represents the circulatory system. Beginning with chamber #4, in what order does blood pass through the four chambers in this diagram?



- A) 4, 1, 2, 3  
B) 4, 2, 3, 1  
C) 4, 3, 1, 2  
D) 4, 1, 3, 2
21. After a cell passes the G1 restriction checkpoint during interphase, it will:
- A) move into prophase of mitosis  
B) stop dividing  
C) undergo chromosome duplication  
D) undergo cytokinesis  
E) show a drop in the amount of DNA it contains
22. A homologous pair of chromosomes consists of:
- A) one duplicated chromosome with two chromatids  
B) two chromosomes of the same length and centromere position with similar but not identical genetic information.  
C) two autosomes of different sizes  
D) two nonsister chromatids  
E) synaptonemal complexes
23.  $R$  and  $T$  represent dominant alleles, and  $r$  and  $t$  represent recessive alleles for two genes that are located on different chromosomes. Which of the following crosses would be expected to produce only offspring that exhibit both dominant traits?
- A)  $ttrr \times ttrr$   
B)  $TtRr \times TtRr$   
C)  $TTRr \times TtRR$   
D)  $TtRr \times ttrr$   
E)  $TtRr \times ttRr$

24. In the pedigree below, circles represent females, squares represent males, and shaded figures represent individuals expressing a specific trait. The expression of this trait is most likely due to which of the following?



- A) Sex-linked dominant inheritance  
 B) Sex-linked recessive inheritance  
 C) Autosomal dominant inheritance  
 D) Autosomal recessive inheritance

Use the DNA sequence below and the codon table provided to answer the next two questions.

DNA Sequence: 3'- TAG TTC AAA CCG CGT AAC ATT-5'

Triplet Number                                    1                                    2                                    3                                    4                                    5                                    6                                    7

First position (5' end)	Second position				Third position (3' end)
	U	C	A	G	
U	UUU Phe } F UUC Phe } UUA Leu } L UUG Leu }	UCU Ser } S UCC Ser } UCA Ser } UCG Ser }	UAU Tyr } Y UAC Tyr } UAA Stop UAG Stop	UGU Cys } C UGC Cys } UGA Stop UGG Trp } W	U C A G
C	CUU Leu } L CUC Leu } CUA Leu } CUG Leu }	CCU Pro } P CCC Pro } CCA Pro } CCG Pro }	CAU His } H CAC His } CAA Gln } Q CAG Gln }	CGU Arg } R CGC Arg } CGA Arg } CGG Arg }	U C A G
A	AUU Ile } I AUC Ile } AUA Ile } M AUG Met }	ACU Thr } T ACC Thr } ACA Thr } ACG Thr }	AAU Asn } N AAC Asn } AAA Lys } K AAG Lys }	AGU Ser } S AGC Ser } AGA Arg } R AGG Arg }	U C A G
G	GUU Val } V GUC Val } GUA Val } GUG Val }	GCU Ala } A GCC Ala } GCA Ala } GCG Ala }	GAU Asp } D GAC Asp } GAA Glu } E GAG Glu }	GGU Gly } G GGC Gly } GGA Gly } GGG Gly }	U C A G

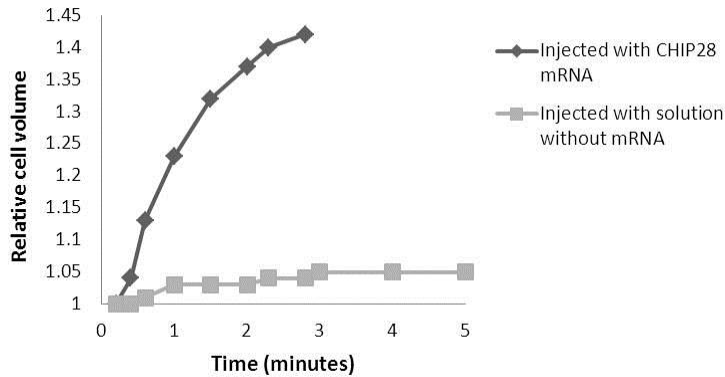
25. The mRNA transcribed from the DNA would read:
- A) 5'-TAGTTCAAACCGCGTAACAAT-3'  
 B) 5'-ATCAAGTTTGGCGCATTGTAA-3'  
 C) 5'-AUCAAGUUUGGCGCAUUGUAA-3'  
 D) 5'-AAUCA AUGCGCCAAACUUGAU-3'  
 E) 5'-AUUGUUACGCGGUUUGAACUA-3'

26. Which of the following modifications of the DNA would produce the greatest change in the primary structure of the polypeptide chain?
- A) Deleting the first T in the second triplet
  - B) Changing the second triplet to read 3'-CTC-5'
  - C) Changing the third triplet to read 3'-AAC-5'
  - D) Changing the fourth triplet to read 3'-CCA-5'
  - E) Deleting the sixth triplet
27. What do the villi of the human intestine and capillaries of a gill have in common?
- A) Both have a large surface area.
  - B) Both have the same thickness.
  - C) Both have the same tissue volume.
  - D) Both have cells with the same metabolic rate.
28. Prokaryotic cells lack membrane-bound organelles found in eukaryotes. However, prokaryotes must perform many of the same functions as eukaryotes. How do prokaryotes perform the function of a nucleus without a "control center of the cell"?
- A) Prokaryotes cannot express genes because they don't have a nucleus.
  - B) Prokaryotes still have DNA, even though it is not enclosed in a nucleus.
  - C) Prokaryotes use free-floating proteins, which do the job of the nucleus.
  - D) Prokaryotes have ribosomes, which perform the function of the nucleus.
  - E) Prokaryotes have a cell wall, so they do not need DNA.
29. A pathogenic bacterium has been engulfed by a phagocytic cell as part of the innate (nonspecific) immune response. Which of the following statements best describes what occurs in the phagocytic cell?
- A) Ribosomes in the phagocytic cell begin to synthesize bacterial proteins.
  - B) The bacterium enters a phagolysosome, where it becomes bound by antibodies produced by the phagocytic cell.
  - C) The bacterium enters a phagolysosome, where its macromolecules are broken down into smaller molecules.
  - D) The bacterium enters a vesicle that fuses with a mitochondrion, where its macromolecules are broken down into smaller molecules.
30. Which of the following are functions of membrane proteins?
- A) Cell-cell adhesion
  - B) Cell signaling or communication
  - C) Cell-surface identity markers
  - D) Synthesis of digestive enzymes
  - E) A, B, and C
31. Which of the following would move across the plasma membrane most rapidly?
- A) an amino acid
  - B)  $K^+$
  - C) starch
  - D) sucrose
  - E) a small lipid



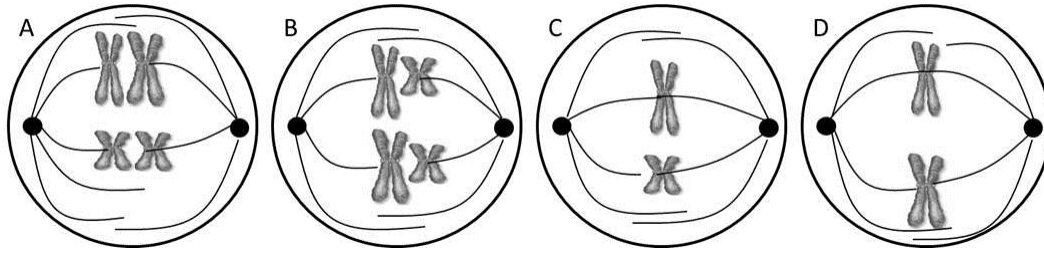
Use the information provided below to answer the next **two** questions.

The graph below is based on data reported by Peter Agre and his colleagues (*Science* 256:385, 1992). In this experiment, mature mRNA derived from a gene called *CHIP28* was injected into frog oocytes (egg cells). After a few minutes, the oocytes were placed in a solution, and changes in cell volume (relative to the starting volume, defined as 1.0) were recorded. The changes in volume were due to the movement of water across the cell membrane. A graph representing the results of this experiment is shown below.



32. What was the dependent variable in this experiment?
- A) Cell volume
  - B) Time
  - C) Injection with *CHIP28* mRNA or solution without mRNA
  - D) Cell type
33. Before the protein encoded by the *CHIP28* mRNA could begin functioning, what process needed to occur in the oocytes?
- A) mRNA splicing
  - B) transcription
  - C) replication
  - D) translation
34. Fruit flies have a diploid number of 8 chromosomes. After completion of a mitotic cell cycle, each daughter cell will contain \_\_\_\_\_ chromosomes. When a fruit fly cell undergoes meiosis, the daughter cells will each contain \_\_\_\_\_ chromosomes after meiosis I and \_\_\_\_\_ chromosomes after meiosis II.
- A) 8; 8; 8
  - B) 8; 8; 4
  - C) 16; 8; 4
  - D) 4; 8; 4
  - E) 8; 4; 4

35. Which of these diagrams correctly represents a cell with a diploid number of 4 at metaphase of mitosis?



- A) A  
 B) B  
 C) C  
 D) D  
 E) None of these
36. What biological theory explains both the unity and diversity of life?  
 A) The theory of evolution by natural selection  
 B) The endosymbiotic theory  
 C) The cell theory  
 D) The central dogma
37. Embryonic stem cells are derived from a:  
 A) blastocyst  
 B) gastrula  
 C) zygote  
 D) gamete
38. Which of the following sequences represents structures in the correct order, **from smallest to largest**?  
 A) gene, chromosome, genome, nucleotide  
 B) nucleotide, gene, genome, chromosome  
 C) gene, nucleotide, genome, chromosome  
 D) nucleotide, chromosome, gene, genome  
 E) nucleotide, gene, chromosome, genome
39. After cellular respiration has occurred, a carbon atom that was originally in a molecule of glucose can be found in a molecule of  
 A) ATP  
 B) CO<sub>2</sub>  
 C) NADH or FADH<sub>2</sub>  
 D) acetyl-CoA

40. A skeletal muscle cell and a brain cell from the same individual contain the same
- A) alleles
  - B) mRNA molecules
  - C) protein molecules
  - D) A and B are correct
  - E) A, B, and C are correct
41. In mitochondria found in liver cells, the surface area of the inner mitochondrial membrane has approximately five times more surface area than the outer mitochondrial membrane. The large surface area of the inner mitochondrial membrane
- A) increases the rate of oxidative phosphorylation
  - B) increases the rate of the citric acid cycle (Krebs cycle)
  - C) decreases the rate of the citric acid cycle (Krebs cycle)
  - D) decreases the rate of oxidative phosphorylation
  - E) has no effect on the rate of oxidative phosphorylation or the Krebs cycle

## Answer Key

1. C  
Learning Objective: 1c; 4h
2. D  
Learning Objective: 1c; 4b
3. B  
Learning Objective: 1c; 4c
4. C  
Learning Objective: 2i
5. A
6. C  
Learning Objective: 2e
7. A  
Learning Objective: 2d
8. D  
Learning Objective: 2e
9. C  
Learning Objective: 3i; 7b
10. C  
Learning Objective: 7b
11. B  
Learning Objective: 7e; 7g
12. A  
Learning Objective: 7f
13. B  
Learning Objective: 10e
14. C  
Learning Objective: 10e
15. A  
Learning Objective: 3e
16. B  
Learning Objective: 3g
17. D  
Learning Objective: 3c; 3f
18. B  
Learning Objective: 2e; 5p
19. B  
Learning Objective: 9i
20. D  
Learning Objective: 9f
21. C  
Learning Objective: 5a
22. B  
Learning Objective: 5d
23. C  
Learning Objective: 5i
24. D

- Learning Objective: 5k  
25. C  
Learning Objective: 5p  
26. A  
Learning Objective: 5r  
27. A  
Learning Objective: 9a  
28. B  
Learning Objective: 3a  
29. C  
Learning Objective: 3c  
30. E  
Learning Objective: 3e  
31. E  
Learning Objective: 3g  
32. A  
Learning Objective: 1c  
33. D  
Learning Objective: 5m  
34. E  
Learning Objective: 5e  
35. E  
Learning Objective: 5c  
36. A  
Learning Objective: 1a  
37. A  
Learning Objective: 8d  
38. E  
Learning Objective: 1a  
39. B  
40. A  
41. A