



LSM 1301 - CA1 (Quiz Compilation)

| Cell and molecular biology

Chemistry of Life

Question 1	1 / 1 pts
Which of the following statements about prions and prion-associated diseases is NOT true?	
<input type="radio"/> Prions are stable and cannot be denatured by heat.	
	<input checked="" type="radio"/> Normal prion and disease-associated prion are the same in its secondary structure.
<input type="radio"/> Prions are proteins only.	
<input type="radio"/> Normal prion and disease-associated prion are the same in its primary structure.	
<input type="radio"/> Prions are present in a healthy person.	

- normal prion and disease-associated prion are different in its secondary structure due to the way they fold
 - normal - alpha helical
 - diseased - beta sheet
- disease-associated prion induces normal prion to transform

Question 2	1 / 1 pts
The function of each protein is closely related to its structure. What is the term used for a change in a protein's three-dimensional shape or conformation due to disruption of hydrogen bonds, disulfide bridges, or ionic bonds, leading to loss of the protein function?	
	<input checked="" type="radio"/> Denaturation
<input type="radio"/> Isomerization	
<input type="radio"/> Hydrolysis	
<input type="radio"/> Dehydration	
<input type="radio"/> Mutation	

- denaturation - disrupt bonds that hold the tertiary structure together, changing the protein's shape
- hydrolysis - destroys the whole polypeptide chain

Question 3

0 / 1 pts

If an animal needed to store energy for long-term use, but not be encumbered with the weight of extra tissue, which is the best molecule for storage?

☐ Complex cellulose.

☐ Fructose and glucose in the form of honey.

☐ Glycogen.

☒ High-calorie fat in adipose tissue.

☐ Starch.

- glycogen - question says don't want extra weight, so this option correct
- adipose tissue - fat can store more energy than glycogen

Question 4

0 / 1 pts

What would be the molecular formula for a molecule made by linking three glucose molecules together by dehydration reactions?

☐ C₁₈H₂₈O₁₄

☒ C₁₈H₃₆O₁₈

☐ C₁₈H₃₀O₁₅

☐ C₁₈H₃₄O₁₇

☐ C₁₈H₃₂O₁₆

- chem formula of glucose - C₆H₁₂O₆
- 3 glucose molecules joined together - 3 x C₆H₁₂O₆ - 2H₂O (H and OH lost from forming 2 bonds) → G-G-G

Question 5

1 / 1 pts

A quick scan of any health magazine would leave most people with the impression that cholesterol is always for you. However, cholesterol is actually crucial to life:

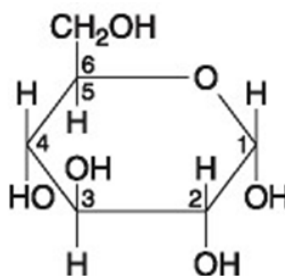
- ☐ As a source for producing vitamin D.
- ☐ As a keeper of fluidity in cell membrane at low temperature.
- ☐ As a material for synthesis of sex hormone.
- ☐ As a component of cell membrane.
- ☒ All of the above.

- cholesterol
- keeper of fluidity in cell membrane at low temp - sit in between phospholipids in the lipid bilayer to prevent them from clumping together at low temp
 - high temp - decreases fluidity by pulling the phospholipids together

Question 6

1 / 1 pts

If two molecules shown in the figure were covalently joined together, carbon 1 of one molecule to carbon 4 of the other, the resulted single molecule would be _____



- ☐ Fructose.
- ☐ Lactose.
- ☒ Maltose.
- ☐ Galactose.
- ☐ Sucrose.

- maltose = glucose + glucose

- fructose - isomer of glucose (same chemical formula but lined up differently)
- lactose = galactose + glucose
- galactose = isomer of glucose
- sucrose = glucose + fructose

Question 7	0 / 1 pts
<p>Which of the following functional groups acts as a base, readily enters dehydration synthesis reactions, and is found in the building-block molecules of proteins?</p>	
<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> phosphate </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> sulfhydryl </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> amino </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> methyl </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> carboxyl </div>	

- base → positively charged
- acid - negatively charged
- amino - positively charged (base)
- carboxyl and phosphate - negatively charged (acidic)

Question 8	1 / 1 pts
<p>Positron emission tomography (PET) is a scanning technique that tracks the uptake of sugar throughout healthy and abnormal tissues of the entire body. Which of the following parts of human body should absorb the least sugar among the others?</p>	
<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Heart. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Brain. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Cancer tumor. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Kidney. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> Bone. </div>	

- bone → structural material, don't have a lot of metabolic activities → use less sugar

	Question 9	0 / 1 pts
	<p>Fats are broken down by pancreatic lipase with the help of bile. Select all the TRUE statements about fat hydrolysis.</p> <p>I. Bile emulsifies larger fat compounds into smaller fat droplets to enhance surface area to volume ratio for lipase to work on.</p> <p>II. Pancreatic lipase breaks down triglyceride into free fatty acids and monoglycerides.</p> <p>III. Absorption of free fatty acids and monoglycerides takes place in the large intestine.</p> <p>IV. Monoglycerides are the main source of fat storage in our body.</p>	
<div style="background-color: red; color: white; padding: 2px 5px; font-weight: bold;">red</div> <div style="background-color: #ccc; padding: 2px 5px; font-weight: bold; margin-top: 5px;">over</div>	<div style="border: 2px solid red; padding: 5px; margin-bottom: 5px;"> <input checked="" type="radio"/> I only. </div> <div> <input type="radio"/> I and II. </div> <div> <input type="radio"/> II only. </div> <div> <input type="radio"/> III and IV. </div> <div> <input type="radio"/> IV only. </div>	

- bile salt emulsifies fat → increase surface area so lipase can work on them more efficiently
- pancreatic lipase breaks down the ester bond between glycerol and fatty acids
- triglyceride are the main source of fat storage

	Question 10	1 / 1 pts
	<p>Which of the following is NOT an amphipathic molecule?</p>	
<div style="background-color: green; color: white; padding: 2px 5px; font-weight: bold;">over</div>	<div> <input type="radio"/> Detergent. </div> <div> <input type="radio"/> Phospholipid. </div> <div> <input checked="" type="radio"/> Triglyceride. </div> <div> <input type="radio"/> Protein alpha-helix with periodic arrangement of side-chains so that one side of the helix is hydrophilic and the opposite side is hydrophobic. </div> <div> <input type="radio"/> Cholesterol. </div>	

- amphipathic - both hydrophilic and hydrophobic

- triglyceride - hydrophobic

Cell Structure and Function

Question 1		0 / 1 pts
Which of the following statement is TRUE ?		
	<input type="radio"/> Mitochondria drain out the energy of cells.	
red	<input checked="" type="radio"/> The Golgi apparatus is a specialized set of nucleotides arranged in stacks.	
	<input type="radio"/> Prokaryotic cells never contain plasmids.	
wer	<input type="radio"/> Lysosomes have an acidic interior, and harbor many hydrolytic enzymes.	
	<input type="radio"/> Genetic material (DNA) is found surrounding the nucleus.	

- lysosomes - stomach of cells, has a lot of enzymes to break down stuff
- no nucleotide in golgi apparutus
- bacteria (prokaryotic) has plasmid
- DNA in nucleus

Question 2		1 / 1 pts
One property that distinguishes cells in domain Bacteria from those in domain Eukarya is the presence of _____?		
	<input type="radio"/> DNA	
	<input type="radio"/> cytoplasmic membrane	
green	<input checked="" type="radio"/> nuclear envelope	
	<input type="radio"/> cell wall	
	<input type="radio"/> ribosome	

- presence of membrane-bound organelles
- cytoplasmic membrane - cell membrane, exists in all cells including bacteria (prokaryotic) cells

Question 3	0 / 1 pts
<p>Which of the following molecules will diffuse most quickly across a lipid bilayer membrane?</p>	
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">swer</div>	<input type="radio"/> O ₂
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> Na ⁺
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> H ₂ PO ₄
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input checked="" type="radio"/> glucose
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> H ₂ O

- smaller and not charged → easier to diffuse across cell membrane

Question 4	1 / 1 pts
<p>Which of the following is/are found in both prokaryotic and eukaryotic cells?</p> <p>I. Ribosomes II. Mitochondria III. Nuclear membrane IV. Plasma membrane V. Golgi apparatus</p>	
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">swer</div>	<input type="radio"/> I, II, IV and V only
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> I, II, III and IV only
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> I only
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input checked="" type="radio"/> I and IV only
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> IV only

- prokaryotes dont have membrane-bound organells

Question 5	1 / 1 pts
<p>Proteins manufactured in the endoplasmic reticulum may be chemically altered and sorted in the _____.</p>	
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">swer</div>	<input type="radio"/> mitochondrion
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> cytosol
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> nucleus
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input checked="" type="radio"/> Golgi apparatus
<div style="background-color: #ccc; padding: 2px 5px; font-size: 0.8em;">ered</div>	<input type="radio"/> lysosome

- after synthesis in rough ER, transported to golgi apparatus for modification (folding)
- cytosol - fluid component of cytoplasm
 - cytoplasm - includes everything in the cell except for the nucleus

Question 6	1 / 1 pts
<p>A plant cell was grown in a test tube containing radioactive nucleotide thymine. Later examination of the cell showed the radioactivity to be concentrated in the_____.</p>	
<div style="display: flex; flex-direction: column; gap: 10px;"> <div><input type="radio"/> rough endoplasmic reticulum</div> <div><input type="radio"/> smooth endoplasmic reticulum</div> <div><input type="radio"/> central vacuole</div> <div><input type="radio"/> lysosome</div> <div><input checked="" type="radio"/> nucleus</div> </div>	

- nucleotide found in nucleus
- rough ER - protein synthesis and modification
- smooth ER - lipid and steroid synthesis

Question 7	1 / 1 pts
<p>Macrophages are one type of white blood cells that help defend human body by engulfing and destroying bacteria and viruses. Which organelle plays a crucial role in destroying these "invaders"?</p>	
<div style="display: flex; flex-direction: column; gap: 10px;"> <div><input checked="" type="radio"/> Lysosome</div> <div><input type="radio"/> Food vacuole</div> <div><input type="radio"/> Rough ER</div> <div><input type="radio"/> Golgi apparatus</div> <div><input type="radio"/> Smooth ER</div> </div>	

- lysosomes - carry acidic enzymes - invaders fed into them to destroy them

Question 8

0 / 1 pts

Which of the following statement(s) is/are **TRUE** for active transport but **FALSE** for facilitated diffusion across membrane?

- There is conformational change in the membrane transporter.
- Solutes transport against their concentration gradient.
- Solutes transport following their concentration gradient.
- ATP hydrolysis is needed to provide energy.
- ATP hydrolysis is not needed.

☐ I, III and IV only

☐ I, II and V only

☐ II and IV only

☐ III and V only

☒ I, II and IV only

- conformational change needed for both active transport and facilitated diffusion
- active transport - against concentration gradient
- diffusion - follows concentration gradient
- ATP (energy) needed for active transport to work but not facilitated diffusion

Question 9

0 / 1 pts

Which of the following statement(s) is/are **TRUE** for **BOTH** mitochondria and chloroplasts?

- Found in both animal and plant cells.
- Sites for energy conversion.
- Contains both outer and inner membrane.
- Found in both prokaryotic and eukaryotic cells.
- Contains enzymes.

☐ II, III and V.

☐ II, III, IV and V.

☐ I, II and III.

☐ II, III and IV.

☒ II and III.

- chloroplast only found in plant cells
- mitochondria and chloroplast - membrane-bound organelles, cant be found in prokaryotic cells

- both contains enzymes (for activation energy) to carry out the energy conversion process

Question 10	0 / 1 pts
<p>Which of the following process is considered as endocytosis?</p> <p>I. Macrophage engulfing an invading bacterium II. Antibody producing cells secreting antibodies III. Plasma membrane dimples inward and bud off into cytosol as vesicles carrying liquid IV. Bacteria secreting toxin into culture medium V. Virus infecting an immune cell</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>II, III and V</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 2px solid red; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input checked="" type="radio"/> </div> <div>I and III</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>II and IV</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>I, III and V</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>III and V</div> </div>	

- endocytosis - something entered the cell
- exocytosis - something exited the cell

Energy of Life

Question 1	1 / 1 pts
<p>Rotenone, a toxin found in the stems and roots of certain tropical plants, has been found to block one of the steps of the electron transport chain. A eukaryotic cell exposed to rotenone will thus be unable to proceed beyond the citric acid cycle (Kreb's cycle) stage of aerobic cellular respiration.</p> <p>What is the net ATP production from ONE molecule of glucose consumed by a rotenone-treated eukaryotic cell?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>Two ATP in glycolysis, two ATP in generation of acetyl-CoA, and two ATP in Krebs cycle</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>Two ATP in glycolysis, one ATP in generation of acetyl-CoA, and one ATP in Krebs cycle</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>One ATP in glycolysis, zero ATP in generation of acetyl-CoA, and one ATP in Krebs cycle</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 2px solid green; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input checked="" type="radio"/> </div> <div>Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, and two ATP in Krebs cycle</div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; display: flex; align-items: center; justify-content: center;"> <input type="radio"/> </div> <div>Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, and one ATP in Krebs cycle</div> </div>	

- net ATP production
- krebs cycle - gives 1 ATP per cycle, 2 pyruvate = 2 ATP

Question 2	1 / 1 pts
<p>Assume oxygen is available and glucose is completely broken down. How is CO₂ produced during eukaryotic cellular respiration?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> There are 6 CO₂ produced from one glucose molecule, 4 CO₂ are generated in cytosol and 2 CO₂ are generated in mitochondria. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input checked="" type="radio"/> There are 6 CO₂ produced from one glucose molecule, and all are generated in mitochondria. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> There are 6 CO₂ produced from one glucose molecule, 2 CO₂ are generated in cytosol and 4 CO₂ are generated in mitochondria. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> There are 6 CO₂ produced from one glucose molecule, and all are generated in cytosol. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> There are 3 CO₂ and one lactate produced from one glucose molecule, and all are generated in mitochondria. </div> </div>	

- in mitochondria
 - 2 CO₂ - during acetyl coA
 - 4 CO₂ - from kreb cycle

Question 3	1 / 1 pts
<p>Which of the following about exergonic reaction and endergonic reactions are TRUE?</p>	
<p>I. Endergonic reactions are not spontaneous.</p>	
<p>II. In general, metabolic reactions that involve creating chemical bonds are called "catabolic" reactions, while reactions that involve breaking bonds to release energy are called "anabolic".</p>	
<p>III. Glycolysis is an example of exergonic reaction.</p>	
<p>IV. Endergonic reactions require enzymes, but exergonic reactions do not require enzymes.</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> I, II and III </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> I and IV </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input checked="" type="radio"/> I and III </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> II and IV </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px; display: flex; align-items: center; justify-content: center;">!</div> <div> <input type="radio"/> II and III </div> </div>	

- endergonic reactions not spontaneous - requires energy to start
- catabolic reactions - break down bonds
- anabolic - create bonds
- glycolysis - break down glucose to release energy (exergonic)
- both endergonic and exergonic require enzymes to lower activation energy to start reaction

Question 4	1 / 1 pts
<p>Which of the following statement(s) is/are TRUE?</p> <p>I. 2 net ATP molecules are produced per glucose in glycolysis II. 10 NADH molecules are produced after one glucose molecule is broken down in the presence of oxygen III. 6 NADH molecules are produced per glucose in Krebs cycle IV. 2 FADH₂ molecules are produced per glucose in Krebs cycle V. Only one ATP molecule is produced per Krebs cycle</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> I, III, IV and V </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input checked="" type="radio"/> I, II, III, IV and V </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> II, III and IV </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> I, II, III and IV </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> I, III and IV </div> </div>	

- output of breaking down glucose for energy

Question 5	1 / 1 pts
<p>Suppose there is one glucose molecule which catabolized completely into CO₂, in the presence of oxygen. How many ATP molecules can be generated with ETC function and malate-aspartate shuttle?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Two ATP in glycolysis, two ATP in generation of acetyl-CoA, two ATP in Krebs cycle, and 36 ATP in ETC. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, one ATP in Krebs cycle, and 36 ATP in ETC. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, two ATP in Krebs cycle, and 32 ATP in ETC. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, one ATP in Krebs cycle, and 34 ATP in ETC. </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input checked="" type="radio"/> Two ATP in glycolysis, zero ATP in generation of acetyl-CoA, two ATP in Krebs cycle, and 34 ATP in ETC. </div> </div>	

- malate-aspartate shuttle gives 38 ATP (34 in ETC)
- Glycerol-phosphate gives 36 ATP (32 in ETC)

Question 6	1 / 1 pts
<p>Which cellular compartment becomes acidic (high concentration of hydrogen ions) during mitochondrial electron transport chain?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Cytoplasm </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Mitochondrial outer membrane </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input checked="" type="radio"/> Space between inner and outer mitochondrial membranes </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Mitochondrial matrix </div> </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #28a745; margin-right: 10px;"></div> <div> <input type="radio"/> Mitochondrial inner membrane </div> </div>	


- electron transport chain happens in intermembrane spaces in mitochondria
 - H^+ high in concentration during this phase

Question 7	1 / 1 pts
Which of the following molecule has the critical role in connection of carbohydrate, protein and lipid metabolic pathways?	
<input type="radio"/> DNA	
<input type="radio"/> CO ₂	
<input type="radio"/> Lactate	
<input type="radio"/> Glucose	
<input checked="" type="radio"/> Acetyl-CoA	


- carbs, protein, lipids can be converted into acetyl coA for energy conversion

Question 8	1 / 1 pts
During breathing, we take in oxygen and exhale carbon dioxide. Assume that oxygen is available and glucose is completely broken down. How is O ₂ used during glucose metabolism?	
I. The oxygen is used during glycolysis II. The oxygen is used during the formation of acetyl-CoA III. The oxygen is used during Krebs cycle IV. The oxygen is used in oxidative phosphorylation during electron transport chain reactions V. The oxygen is used in lactate fermentation	
<input type="radio"/> II and IV	
<input checked="" type="radio"/> IV only	
<input type="radio"/> I, II, III and IV	
<input type="radio"/> III only	
<input type="radio"/> III and V	

- oxidative phosphorylation
 - phosphorylation - $ADP + P = ATP$
 - oxidation - $H^+(\text{from NADH and FADH}) + O = H_2O$

Question 9	1 / 1 pts
<p>Compared to cellular respiration, fermentation is an extremely inefficient way to metabolize pyruvate; it produces no additional ATP. Why is it necessary?</p>	
	<p><input type="radio"/> To remove carbon dioxide from cells</p> <p><input checked="" type="radio"/> To replenish NAD⁺ for glycolysis</p> <p><input type="radio"/> To produce bread, cheese, wine and beer</p> <p><input type="radio"/> To allow for production of lactic acid</p> <p><input type="radio"/> To produce NADH for electron transport chain in mitochondria</p>

- glycolysis requires a lot of NAD⁺

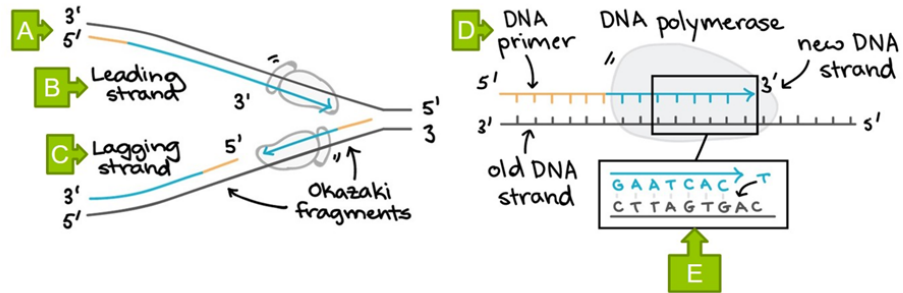
Question 10	1 / 1 pts
<p>In eukaryotic cell metabolism, glucose is degraded to carbon dioxide and water. The carbon dioxide is produced in _____.</p>	
	<p><input type="radio"/> the intermembrane space of a mitochondrion</p> <p><input type="radio"/> glycolysis</p> <p><input checked="" type="radio"/> the mitochondrial matrix</p> <p><input type="radio"/> the mitochondrial electron transport chain</p> <p><input type="radio"/> the cytosol</p>

DNA and Heredity

Question 1

1 / 1 pts

A student drew two simple diagrams to show DNA replication in one replication fork after watching online videos. The diagrams are quite nice but there is one error in the labels, please find the wrong label.



☐ C

☒ D

☐ A

☐ B

☐ E

- D should be RNA primer

Question 2

0 / 1 pts

The following schematic is a 'snapshot' of a replication bubble of a DNA molecule undergoing replication. At which location (I, II, III and IV) would Okazaki fragments be formed?



☐ II and III

☐ I and IV

☐ I only

☒ II only

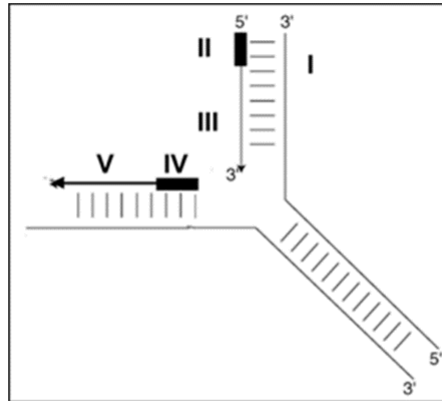
☐ II and IV

- look at direction of primer

Question 3

1 / 1 pts

The diagram below depicts the process of DNA replication at a replication fork. The strand labeled III represents the:



- ☐ RNA primer
- ☐ Template strand
- ☒ Leading strand
- ☐ Okazaki fragment
- ☐ Lagging strand

- III - leading strand
- V - okazaki fragment

Question 4

1 / 1 pts

Okazaki fragments are formed when DNA is replicating inside a cell because _____.

- ☐ DNA helicase sometimes inadvertently breaks the DNA
- ☒ DNA polymerases can only extend an existing nucleotide strand in a 5' to 3' direction
- ☐ DNA polymerase cannot start synthesis of a new strand without a primer
- ☐ DNA polymerase can only create a new strand of DNA from the 3' end to the 5' end
- ☐ newly formed DNA contains many RNA primers

- newly formed DNA contains many RNA primers - result of okazaki fragments

Question 5 0 / 1 pts

A bacterial genome has started its replication but not yet finished. A primase inhibitor is added to stop the primase function. Which of following will be directly affected?

☐ The synthesis of leading strand

☐ DNA polymerase function will be inhibited too

☐ Since the replication has already started, primase inhibitor will not affect DNA replication

☒ The synthesis of both leading and lagging strands

☐ The synthesis of lagging strand

- lagging strand - requires RNA primer multiple times for making okazaki fragments
- leading strand - only need RNA primer once as it is continuous

Question 6 0 / 1 pts

Cytosine makes up 24% of the nucleotides in a sample of DNA from a living organism. Approximately what percentage of the nucleotides in this sample will be thymine?

☒ 76

☐ 12

☐ 52

☐ 26

☐ 24

- C - 24%, G - 24% → C and G - 48%
- A and T - 52% → A / T - 26%

Question 7 1 / 1 pts

Which of the following enzymes functions to join two DNA fragments together during DNA replication inside a cell?

☒ Ligase

☐ DNA polymerase

☐ Helicase

☐ Amylase

☐ RNA polymerase

- ligase joins DNA fragments together by forming covalent bonds

Question 8	1 / 1 pts
<p>Which of the following is TRUE?</p> <p>I. DNA does not have hydrogen bonds. II. The two strands of a DNA double helix are parallel. III. In a DNA molecule, the amount of adenine is equal to the amount of thymine. IV. Phosphorus is absent in DNA. V. The likelihood of replication errors in DNA can be increased by toxic chemicals and radiation</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> I, II </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; background-color: #28a745; color: white; text-align: center; line-height: 20px;">!</div> <input checked="" type="radio"/> III, V </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> III, IV and V </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> II, III and IV </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> III, IV </div>	

- DNA strands are antiparallel
- Phosphorus (P) is present in the backbone of DNA

Question 9	1 / 1 pts
<p>Which of the following lead to genetic variability among brothers with the same pair of parents?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> Replication of homologous chromosome to form sister chromatids. </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> Combination of haploid gametes. </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> Segregation of sister chromatids during cell division. </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px;"></div> <input type="radio"/> Mutation during gamete formation. </div>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; border: 1px solid #ccc; border-radius: 50%; margin-right: 10px; background-color: #28a745; color: white; text-align: center; line-height: 20px;">▶</div> <input checked="" type="radio"/> Independent assortment of homologous chromosomes during meiosis I. </div>	

- same set of chromosomes can be combined differently - different characteristics exhibited
- replication and segregation of sister chromatids are essential for cell division

Question 10	0 / 1 pts
<p>If we radioactively label the DNA of bacteriophage and then allow them to infect bacteria, where should the radioactivity end up?</p>	
wered	<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> Inside the nuclei of the bacterial cells </div>
nswer	<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Inside the cell wall of the bacteria </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Inside the lipid bilayers of bacterial cell membrane </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Bacterial genome </div> <div style="border: 1px solid #ccc; padding: 5px;"> <input type="radio"/> The bacteriophage's genome </div>

- nuclei is another name for nucleus

Gene Expression

Question 1	0 / 1 pts
<p>A mutation changes the DNA template strand from 5'ACGTATTCGAT3' to 5'GTATTCGAT3'. Will this mutation wreak havoc on the production of the peptide?</p>	
wer	<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> No. It will produce a peptide that is functionally equivalent to the original peptide. </div>
red	<div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> No. It will produce a peptide that is different only at one amino acid. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> No. There will be no change in the peptide produced. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> Yes. This mutation will alter the reading of the entire peptide instruction. </div> <div style="border: 1px solid #ccc; padding: 5px;"> <input type="radio"/> Yes. This mutation will lead to no production of any peptides. </div>

- transcription starts from 3' end, so resulting mRNA will start from 5'
- only the last 2 nucleotide of the template strand is gone, will not affect the reading of mRNA (at least the front part)
 - thus will not affect the peptide produced

Question 2	1 / 1 pts
<p>A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px;"></div> <div style="flex-grow: 1;"> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 5' ACT 3' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input checked="" type="radio"/> 3' UCA 5' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 3' UGA 5' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 3' ACU 5' </div> <div style="display: flex; justify-content: space-between; padding-bottom: 5px;"> <input type="radio"/> 5' TCA 3' </div> </div> </div>	

- codon will be antiparallel, so 3' to 5'
- RNA complementary nucleotides - A-U, G-C
 - note that A is paired with U and not T

Question 3	1 / 1 pts
<p>If the mRNA transcript 5'AUGCGCUGCAAU3' were to leave the nucleus and undergo translation at a ribosome, what would be the sequence of anticodons translating this nucleotide into protein?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: #28a745; margin-right: 10px;"></div> <div style="flex-grow: 1;"> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 3'AUGCGCUGCAAU5' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input checked="" type="radio"/> 3'UACGCGACGUUA5' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 3'ATGCGCTGCAAT5' </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid #ccc; padding-bottom: 5px;"> <input type="radio"/> 3'TACGCGACGTTA5' </div> <div style="display: flex; justify-content: space-between; padding-bottom: 5px;"> <input type="radio"/> 3'UAACGUCGCGUA5' </div> </div> </div>	

- anticodon complementary to mRNA

Question 4

0 / 1 pts

A peptide has the sequence NH₂-phe-pro-lys-gly-phe-pro-COOH. Which of the following sequences in the coding strand (a.k.a. non-template strand) of the DNA could code for this peptide?

The Genetic Code				
		Second letter of codon		
First letter of codon	U	C	A	G
	U	C	A	G
U	UUU } Phenylalanine (Phe; F)	UCU } Serine (Ser; S)	UAU } Tyrosine (Tyr; Y)	UGU } Cysteine (Cys; C)
	UUC } Leucine (Leu; L)	UCC } Serine (Ser; S)	UAC } Tyrosine (Tyr; Y)	UGC } Cysteine (Cys; C)
	UUA } Leucine (Leu; L)	UCA } Serine (Ser; S)	UAA } Stop	UGA } Stop
	UUG } Leucine (Leu; L)	UCG } Serine (Ser; S)	UAG } Stop	UGG } Tryptophan (Trp; W)
C	CUU } Leucine (Leu; L)	CCU } Proline (Pro; P)	CAU } Histidine (His; H)	CGU } Arginine (Arg; R)
	CUC } Leucine (Leu; L)	CCC } Proline (Pro; P)	CAC } Histidine (His; H)	CGC } Arginine (Arg; R)
	CUA } Leucine (Leu; L)	CCA } Proline (Pro; P)	CAA } Glutamine (Gln; Q)	CGA } Arginine (Arg; R)
	CUG } Leucine (Leu; L)	CCG } Proline (Pro; P)	CAG } Glutamine (Gln; Q)	CGG } Arginine (Arg; R)
A	AUU } Isoleucine (Ile; I)	ACU } Threonine (Thr; T)	AAU } Asparagine (Asn; N)	AGU } Serine (Ser; S)
	AUC } Isoleucine (Ile; I)	ACC } Threonine (Thr; T)	AAC } Asparagine (Asn; N)	AGC } Serine (Ser; S)
	AUA } Isoleucine (Ile; I)	ACA } Threonine (Thr; T)	AAA } Lysine (Lys; K)	AGA } Arginine (Arg; R)
	AUG } Start Methionine (Met; M)	ACG } Threonine (Thr; T)	AAG } Lysine (Lys; K)	AGG } Arginine (Arg; R)
G	GUU } Valine (Val; V)	GCU } Alanine (Ala; A)	GAU } Aspartic acid (Asp; D)	GGU } Glycine (Gly; G)
	GUC } Valine (Val; V)	GCC } Alanine (Ala; A)	GAC } Aspartic acid (Asp; D)	GGC } Glycine (Gly; G)
	GUA } Valine (Val; V)	GCA } Alanine (Ala; A)	GAA } Glutamic acid (Glu; E)	GGA } Glycine (Gly; G)
	GUG } Valine (Val; V)	GCG } Alanine (Ala; A)	GAG } Glutamic acid (Glu; E)	GGG } Glycine (Gly; G)

Answer

☐ 5' TTT-CCC-AAA-GGG-TTT-CCC 3'

☐ 5' GGG-AAA-TTT-AAA-CCC-ACT-GGG 3'

☐ 3' UUU-CCC-AAA-GGG-UUU-CCC 5'

Correct

☒ 3' AUG-AAA-GGG-TTT-CCC-AAA-GGG 5'

☐ 5' ACT-TAC-CAT-AAA-CAT-TAC-UGA 3'

- phe - UUU coded
- only TTT is complementary to AAA (complement of UUU)

Question 5

1 / 1 pts

A possible partial sequence of nucleotides in the template strand of DNA that would code for the polypeptide sequence NH₂-Phe-Leu-Ile-Val- COOH would be

The Genetic Code				
		Second letter of codon		
First letter of codon	U	C	A	G
	U	C	A	G
U	UUU } Phenylalanine (Phe; F)	UCU } Serine (Ser; S)	UAU } Tyrosine (Tyr; Y)	UGU } Cysteine (Cys; C)
	UUC } Leucine (Leu; L)	UCC } Serine (Ser; S)	UAC } Tyrosine (Tyr; Y)	UGC } Cysteine (Cys; C)
	UUA } Leucine (Leu; L)	UCA } Serine (Ser; S)	UAA } Stop	UGA } Stop
	UUG } Leucine (Leu; L)	UCG } Serine (Ser; S)	UAG } Stop	UGG } Tryptophan (Trp; W)
C	CUU } Leucine (Leu; L)	CCU } Proline (Pro; P)	CAU } Histidine (His; H)	CGU } Arginine (Arg; R)
	CUC } Leucine (Leu; L)	CCC } Proline (Pro; P)	CAC } Histidine (His; H)	CGC } Arginine (Arg; R)
	CUA } Leucine (Leu; L)	CCA } Proline (Pro; P)	CAA } Glutamine (Gln; Q)	CGA } Arginine (Arg; R)
	CUG } Leucine (Leu; L)	CCG } Proline (Pro; P)	CAG } Glutamine (Gln; Q)	CGG } Arginine (Arg; R)
A	AUU } Isoleucine (Ile; I)	ACU } Threonine (Thr; T)	AAU } Asparagine (Asn; N)	AGU } Serine (Ser; S)
	AUC } Isoleucine (Ile; I)	ACC } Threonine (Thr; T)	AAC } Asparagine (Asn; N)	AGC } Serine (Ser; S)
	AUA } Isoleucine (Ile; I)	ACA } Threonine (Thr; T)	AAA } Lysine (Lys; K)	AGA } Arginine (Arg; R)
	AUG } Start Methionine (Met; M)	ACG } Threonine (Thr; T)	AAG } Lysine (Lys; K)	AGG } Arginine (Arg; R)
G	GUU } Valine (Val; V)	GCU } Alanine (Ala; A)	GAU } Aspartic acid (Asp; D)	GGU } Glycine (Gly; G)
	GUC } Valine (Val; V)	GCC } Alanine (Ala; A)	GAC } Aspartic acid (Asp; D)	GGC } Glycine (Gly; G)
	GUA } Valine (Val; V)	GCA } Alanine (Ala; A)	GAA } Glutamic acid (Glu; E)	GGA } Glycine (Gly; G)
	GUG } Valine (Val; V)	GCG } Alanine (Ala; A)	GAG } Glutamic acid (Glu; E)	GGG } Glycine (Gly; G)

☐ 5' TTG-CTA-CAG-TAG 3'

☐ 5' AUG-CTG-CAG-TAT 3'

☐ 3' AAC-GAC-GUC-AUA 5'

Correct

☒ 3' AAA-GAA-TAA-CAA 5'

☐ 3' AAA-AAT-ATA-ACA 5'

- NH₂ - 5' end
- COOH - 3' end

	Question 6	0 / 1 pts
	<p>A messenger RNA is 338 nucleotides long, its start codon locates at 9th-11th nucleotides from the 5' end and a termination codon at the last three nucleotides at the 3' end. The number of amino acids in the protein translated from this mRNA is:</p>	
Answered	<div style="border: 2px solid red; padding: 5px; margin-bottom: 5px;"> <input checked="" type="radio"/> 108 </div> <div style="margin-bottom: 5px;"><input type="radio"/> 112</div> <div style="margin-bottom: 5px;"><input type="radio"/> 110</div> <div style="margin-bottom: 5px;"><input type="radio"/> 111</div> <div style="margin-bottom: 5px;"><input type="radio"/> 109</div>	
Answer		

- $338 - 8 \text{ (before start codon)} - 3 \text{ (stop codon)} = 327$
- $327 / 3 \text{ (3 nucleotide for 1 amino acid)} = 109 \text{ amino acids}$

	Question 7	1 / 1 pts
	<p>How does the lac operon regulate lactose digestion in bacteria?</p>	
Answered	<div style="margin-bottom: 5px;"><input checked="" type="radio"/> The repressor protein falls off the lac operon when lactose is present, and lactose-digesting genes are expressed.</div> <div style="margin-bottom: 5px;"><input type="radio"/> When lactose is present, it activates lac operon transcription by breaking down repressor proteins.</div> <div style="margin-bottom: 5px;"><input type="radio"/> When lactose is present, it binds to the operator region of the lac operon, activating transcription of repressor protein gene.</div> <div style="margin-bottom: 5px;"><input type="radio"/> The repressor protein binds to the lac operon when lactose is present, blocking transcription.</div> <div style="margin-bottom: 5px;"><input type="radio"/> The repressor protein becomes a lactose-digesting enzyme only when lactose is present.</div>	

- repressor binds to lactose when lactose is present, allowing the DNA polymerase to work on lac operon to make the protein to digest lactose

Question 8	1 / 1 pts
<p>Which option(s) are NOT a function of introns and exons?</p> <p>I. Allow a cell to produce several different proteins from a single gene by splicing exons together in different ways. II. Introns code for 10 amino acids and exons code for the other 10 amino acids. III. Introns elongate mRNA strands to allow for proper folding and transport in the cytoplasm IV. Fragmented genes may provide a quick and efficient way for eukaryotes to evolve new proteins with new functions. V. Exons code for amino acids while introns function as promoter regions</p> <div style="margin-top: 10px;"> <input type="radio"/> I, IV <input type="radio"/> I, III <input type="radio"/> I, II <input type="radio"/> IV, V <input checked="" type="radio"/> II, III, V </div>	

- intron doesn't code for any amino acids
- intron doesn't elongate mRNA strands
- promoter region - in front of where the gene for protein code starts
 - a region of DNA upstream of a gene where relevant proteins (such as RNA polymerase and transcription factors) bind to initiate transcription of that gene

Question 9	1 / 1 pts
<p>A fragment of DNA acts as a template for transcription. Which of the following statements regarding the DNA of a gene being transcribed is TRUE?</p> <div style="margin-top: 10px;"> <input type="radio"/> Transcription starts from the 5' end of the template DNA. <input type="radio"/> The DNA must be bound by a primer in order to start transcription. <input checked="" type="radio"/> Only one of the DNA strands is used as a template for the gene transcription after strand separation. <input type="radio"/> The two strands of a DNA must be separated by helicase before transcription. <input type="radio"/> If the DNA is from eukaryotes, transcription occurs randomly on either one of the two strands. </div>	

- transcription doesn't need helicase as RNA polymerase is able to unzip the DNA strands
- transcription starts from the 3' end

Question 10 0 / 1 pts

Suppose a certain gene contains the double-stranded sequence:

3' TAC TGT ACA AGG ATT ATA TT..... 5'

5' ATG ACA TGT TCC TAA TAT AA 3'

If the top strand is the template strand, which of the following would be the sequence of the mRNA? How many amino acids will be in the translated oligopeptide from the mRNA?

wer ☐ 5' AUG ACA UGU UCC UAA UAU AA 3'; and an oligopeptide with 4 amino acids.

☐ 5' AAU AUA AUC CUU CUA CAG UA 3'; and an oligopeptide with 5 amino acids.

☐ 5' UUA UAU UAG GAA CAU GUC AU 3'; and an oligopeptide with 5 amino acids.

☐ 5' AUG ACA UGU UCC UAA UAU AA 3'; and an oligopeptide with 3 amino acids.

red ☒ 5' AUG ACA UGU UCC UAA UAU AA 3'; and an oligopeptide with 5 amino acids.

- UAA is stop codon, so only 4 amino acids will be created
 - from AUG to UCC

Biotechnology

Question 1 0 / 1 pts

Which of the following statement about "complementary DNA" (cDNA) from human brain cells is **FALSE**?

☐ It could be amplified by the polymerase chain reaction.

☐ It lacks the introns of the human genes.

ered ☒ It is produced from mRNA.

☐ It could be used as a probe to detect genes expressed in the brain.

swer ☐ It is a direct copy from a template DNA.

- cDNA is a direct copy **OF** template DNA, not FROM template DNA
- made from mature mRNA (free of introns)

Question 2

0 / 1 pts

Which of the following enzymes is/are not necessary for DNA amplification by PCR, but is/are necessary for DNA replication in vivo (i.e. in cells)?

I. DNA polymerase;
 II. DNA helicase;
 III. Primase;
 IV. DNA ligase;
 V. Restriction Enzyme

Answer

☒ II only

☐ II, III and IV

☐ II and IV

☐ I, III, IV and V

☐ I, II and IV

- polymerase needed for both replication and amplification
- helicase to open/unzip the DNA strands
 - needed for replication
 - not needed for amplification - heat is used instead
- primase - to generate primer
 - forward and reverse primer used in amplification, dont need primase
- ligase - to join DNA fragments (okazaki fragments)
 - replication - lagging strand generates okazaki fragments, need ligase to join them
 - amplification - no need to join DNA fragments
- restriction enzyme - used for gene editing, cleaves DNA at restriction sites to extract the gene there
 - not required in both replication and amplification

Question 3	1 / 1 pts
<p>What is the most logical sequence of steps for constructing a foreign DNA into a plasmid and delivering the recombinant plasmid into a bacterium?</p> <p>I. Transform bacteria with recombinant DNA molecule. II. Cut the plasmid DNA and foreign DNA using same restriction enzymes. III. Extract plasmid DNA from bacterial cells. IV. Hydrogen-bond the plasmid DNA to the foreign DNA fragments, forming complementary base pairs. V. Use ligase to seal plasmid DNA to the foreign DNA.</p>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 20px; height: 20px; background-color: #28a745; border-radius: 50%;"></div> <div style="width: 80%;"> <p><input type="radio"/> III, IV, V, I, II</p> <p><input type="radio"/> II, III, V, IV, I</p> <p><input checked="" type="radio"/> III, II, IV, V, I</p> <p><input type="radio"/> IV, V, I, II, III</p> <p><input type="radio"/> I, II, IV, III, V</p> </div> </div>	

- take out vector (3) → edit vector (2, 4, 5) → insert into target (1)

Question 4	0 / 1 pts
<p>If a restriction enzyme cuts between the G and the A whenever it encounters the sequence GAATTC, how many fragments will be produced when the following piece of double-stranded DNA is being digested with the enzyme?</p> <p>5' TGAGAATTCAACTGAATTCAAATTCGAATTCCTAGC 3'</p> <p>3' ACTCTTAAGTTGACTTAAGTTAAGCTTAAGAATCG 5'</p>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 20px; height: 20px; background-color: #6c757d; border-radius: 50%;"></div> <div style="width: 80%;"> <p><input type="radio"/> Eight</p> <p><input type="radio"/> Five</p> <p><input type="radio"/> Two</p> <p><input type="radio"/> Four</p> <p><input checked="" type="radio"/> Three</p> </div> </div>	

- read qn they asking for number of fragments ;~;
- cut 3 times → 4 fragments

Question 5	1 / 1 pts
<p>A principal problem with inserting an unmodified mammalian gene (a DNA molecule) into a bacterial plasmid, and then getting that gene expressed in bacteria, is that:</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #2e8b57; margin-right: 10px;"></div> <div style="flex-grow: 1;"> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Bacteria use a genetic code different from that of eukaryotes. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Bacterial DNA is not found in a membrane-bound nucleus and is therefore incompatible with mammalian DNA. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> Bacteria cannot remove introns from the eukaryotic gene. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Bacterial RNA polymerase cannot make RNA complementary to mammalian DNA. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Bacteria translate exons only. </div> </div> </div>	

- bacterial cant remove intron

Question 6	1 / 1 pts
<p>In the topic of biotechnology, viruses are introduced into the lung of cystic fibrosis patients. The function of virus is to</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #2e8b57; margin-right: 10px;"></div> <div style="flex-grow: 1;"> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> deliver a functional CFTR gene into lung cells. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> deliver antibiotics into lung cells. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> kill lung cells with gene mutations. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> deliver functional CFTR proteins into lung cells. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> kill bacteria in the lung. </div> </div> </div>	

- gene therapy - using virus to introduce normal/functional genes

Question 7	1 / 1 pts
<p>Investigators try to make a DNA fingerprint from a blood sample collected at a crime scene. Why are primers used in this technique?</p>	
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #2e8b57; margin-right: 10px;"></div> <div style="flex-grow: 1;"> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Primers bind to DNA polymerase to jump-start the reading of the DNA. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Primers make the DNA fragment visible. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Primers cut out the DNA immediately surrounding "short tandem repeats" (STRs). </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input type="radio"/> Primers prepare the DNA by making it unwind and unzip, separating the double strands. </div> <div style="border: 1px solid #ccc; margin-bottom: 5px; padding: 5px;"> <input checked="" type="radio"/> Primers bind exclusively to the DNA immediately surrounding "short tandem repeats" (STRs), so DNA polymerase knows where to start copying. </div> </div> </div>	

- specified primers designed to bind to regions around STRs to amplify them
- primers bind to DNA and not DNA polymerase

Question 8	1 / 1 pts
<p>All of the following are true concerning plasmids EXCEPT that they ____</p>	
<div style="background-color: green; width: 15px; height: 15px; margin: 0 auto;"></div>	<input checked="" type="radio"/> are usually essential for bacterial growth.
	<input type="radio"/> provide advantages for bacterial growth and reproduction.
	<input type="radio"/> are self-reproducing circular molecules of DNA.
	<input type="radio"/> are carriers of gene of interest to make recombinant DNA.
	<input type="radio"/> may have many copies in one single bacterium.

- plasmids are nonessential for growth but can be beneficial (e.g. antibiotic resistance)

Question 9	0 / 1 pts
<p>A DNA probe with the sequence 5' TCAGGCTTCAG 3' would bind most strongly to which of the following DNA fragment?</p>	
<div style="background-color: red; color: white; padding: 2px 5px; font-weight: bold;">wered</div>	<input checked="" type="radio"/> 3' AGTCCAAGTC 5'
<div style="background-color: #ccc; padding: 2px 5px; font-weight: bold;">answer</div>	<input type="radio"/> 3' AGTCCGAAGTC 5'
	<input type="radio"/> 5' AGTCCGAAGTC 3'
	<input type="radio"/> 3' AGTCGGAAGTC 5'
	<input type="radio"/> 3' AGTCCGGAAGTC 5'

- find the one with the highest number of complementary pairs
 - my answer is missing one G, between CC and AA

Question 10**1 / 1 pts**

An investigator finds semen at a crime scene. The specimen is dried out, and the sample contains only a small number of cells. What combination of following techniques could help to identify a suspect?

- I. DNA microarray
- II. Gel electrophoresis
- III. Genetic engineering
- IV. Restriction enzyme digestion
- V. Amplification of STRs by PCR

☐ I only

☐ III and V

☒ II and V

☐ IV and V

☐ V only

- gel electrophoresis - identify DNA present