

Test of Knowledge of and Ability to use Core ideas in Biology

Scoring Rubric

Question 1: Describe the three basic principles of cell theory.

Check off each one that is observed in list A and B

- List A
- All living things are made of cells
 - All new cells are derived from pre-existing cells

- List B
- Cells are the basic unit of life

Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A	3 Points: Nuanced Response All from List A and B
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Question 2: Use the principles of cell theory to **explain** to if a virus is or is not a cell.

Check off each one that is observed in list A and B

- List A
- Viruses are not cells.
 - They cannot replicate on their own without assistance.

- List B
- New viruses do not come directly from existing viruses.

Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A	3 Points: Nuanced Response All from List A and B
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Question 3: Describe the process and end products of mitosis

Check off each one that is observed in list A and B

- List A
- Mitosis involves cellular division
 - The products are two identical daughter cells

- List B
- Mitosis is a regulated process

Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A	3 Points: Nuanced Response All from List A and B
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Question 4: Use your understanding of mitosis to **explain** why these starfish are considered to be clones

Check off each one that is observed in list A and B

- List A
- This process is asexual, meaning no new genetic material was introduced
 - The genetic material of the new cells is identical to the original cells

- List B
- Mitosis involves duplication of genetic material
 - When division occurs, each new cell gets one of the copies

Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A	3 Points: Nuanced Response All from List A and at least one from List B
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Question 5: Describe the process of *Photosynthesis*

Check off each one that is observed in list A and B

- List A
- The process generating sugar using sunlight and carbon dioxide
 - Requires CO₂
 - Requires light
 - Requires water
 - Produces Sugar (or 'own food')
 - Produces Oxygen
 - Produces Water

- List B
- The process requires the presence of special organelles, called chloroplasts
 - Chloroplasts have special pigments, mainly chlorophyll, that absorb light energy.
 - This process only occurs in plants and some bacteria.
 - Correct balanced chemical equation provided

Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A	3 Points: Nuanced Response All from List A and at least one from List B
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Question 6: Describe the process of *Cellular Respiration*

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> The process of breaking down sugar molecules using oxygen	<input type="checkbox"/> Requires organic sugar molecules	<input type="checkbox"/> The breaking of molecules results in the release of energy for use by organisms
	<input type="checkbox"/> Requires oxygen (aerobic)	<input type="checkbox"/> Requires water	<input type="checkbox"/> The process occurs in all kinds of living organisms, including plants
	<input type="checkbox"/> Produces energy molecules (ATP)	<input type="checkbox"/> Produces water	<input type="checkbox"/> Correct balanced chemical equation for aerobic respiration
	<input type="checkbox"/> Produces water		
	<input type="checkbox"/> Produces carbon dioxide		
	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response
Score:	None from List A or B	Some from list A and/or B	All from List A
			3 Points: Nuanced Response
			All from List A and at least one from List B

Question 7: Use the processes of *respiration* to **explain** the observed changes in the color of the water found inside the various test tubes.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Tube 1 – Plant produces small amount of CO ₂ through respiration , but CO ₂ is used by photosynthesis , so tube remains blue	<input type="checkbox"/> Generic description correctly connecting gas exchange to color change	<input type="checkbox"/> Tube 4 – No gas exchanged, so no color change
	<input type="checkbox"/> Tube 2 – snail produces CO ₂ through respiration so tube turns yellow		
	<input type="checkbox"/> Tube 3 – Snail and the plant produce CO ₂ through respiration , but plant uses CO ₂ through photosynthesis , so there is enough CO ₂ left in the water to turn it green, but not enough to turn it yellow		
	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response
Score:	None from List A or B	Some from list A and/or B	All from List A
			3 Points: Nuanced Response
			All from List A and the description of tube 4 from List B

Question 8: Describe the basic principles of Mendelian Inheritance.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Individuals inherit two copies of each gene (one from each parent)	<input type="checkbox"/> The two members of a gene pair (alleles) segregate (separate) from each other during the formation of gametes so that each gamete receives a copy of one of the two alleles.	<input type="checkbox"/> Genes serve as instructions that guide the development of traits
	<input type="checkbox"/> The presence of an allele doesn't mean that the trait will be expressed in the individual that possesses it.	<input type="checkbox"/> In heterozygous individuals the only allele that is expressed is the dominant allele. The recessive allele is present but its expression is hidden.	<input type="checkbox"/> A gene that determines a particular trait come in different versions (alleles)
			<input type="checkbox"/> Genes are passed unchanged from parent to offspring
			<input type="checkbox"/> Genes for different traits assort independently of one another in the formation of gametes.
	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response
Score:	None from List A or B	Some from list A and/or B	All from List A
			3 Points: Nuanced Response
			All from List A and at least one from List B

Question 9. Use the principles of Mendelian Inheritance to explain how two Himalayan rabbits can produce offspring that have solid white fur

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Parents are both heterozygous/have a dominant (Himalayan) and a recessive (white) allele.	<input type="checkbox"/>	White offspring must have two copies of the white allele
	<input type="checkbox"/> Offspring get one allele from each parent	<input type="checkbox"/>	White offspring are homozygous
	<input type="checkbox"/> Himalayan offspring could have the white allele but it won't be expressed/they could be homozygous or heterozygous		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and at least one from List B

Question 10: Describe the process and end products of meiosis.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Genetic material is copied once but divided twice	<input type="checkbox"/>	Meiosis results in the production of sex cells.
	<input type="checkbox"/> One diploid parent cell divides to form four haploid daughter cells.	<input type="checkbox"/>	The cells produced by meiosis pass genetic material from parent to offspring.
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and at least one from List B

Question 11: Use your understanding of meiosis to explain the presence of the extra chromosome.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Chromosomes did not properly split during gamete formation	<input type="checkbox"/>	The lack of segregation is called nondisjunction
	<input type="checkbox"/> Some gamete cells ended up with extra chromosomes	<input type="checkbox"/>	The gamete with the extra chromosome participated in a sexual reproduction event.
			The extra chromosome was then passed onto the rest of the offspring's cells through mitosis
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and at least one from List B

Question 12: Describe the process of Natural Selection.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Heritable traits become more or less abundant in a population	<input type="checkbox"/>	Process is driven by natural genetic variation. Populations experience natural selection, not individuals.
	<input type="checkbox"/> Traits that are selected for provide a reproductive advantage.	<input type="checkbox"/>	It is not an intentional process, rather due to completely random mutation events
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and at least one from List B

Question 13: Use the process of Natural Selection to explain the change in the size of the population of Mosquitoes over time.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> A selective pressure (DDT) was introduced to the mosquito population	<input type="checkbox"/>	The more they reproduced, the more abundant they became in the population
	<input type="checkbox"/> Many mosquitoes did not survive or reproduce, decreasing the population	<input type="checkbox"/>	As the DDT resistant mosquitoes became abundant, the total mosquito population increased
	<input type="checkbox"/> Surviving mosquitoes had a DDT resistance trait		
	<input type="checkbox"/> Those with the resistance trait survived to reproduce		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and B

Question 14: Describe the process of *speciation*.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> New species arise from older species	<input type="checkbox"/> Genetic variation can occur through mutations or the introduction of new alleles	
	<input type="checkbox"/> Within a species, genetic variation will accumulate over time	<input type="checkbox"/> These events occur over long periods of time, over hundreds of millions of years	
	<input type="checkbox"/> Speciation occurs when a subpopulation acquires enough variation to be considered a new species		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and at least one from List B

Question 15: Use what you know about the process of *speciation* to explain degree of relatedness between the various species, the common ancestors of each, and the time when the speciation took place.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Different species arose from common ancestors	<input type="checkbox"/> The more time between the speciation events means there will be more differences from the common ancestor	
	<input type="checkbox"/> Closely related species will have more similar genetic information		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and B

Question 16: Describe what is meant by the *biological species concept*.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> A species is a population of organisms that interbreeds in nature.	<input type="checkbox"/> The species concept serves as a classification scheme.	
	<input type="checkbox"/> Members of a species can only reproduce sexually viable offspring with other members of the same species.		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and B

Question 17: According to the biological species concept, are grizzlies and polar bears one species or two different species? Use your knowledge of the *biological species concept* to explain your answer.

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Crucial determination involve the sexual viability of the hybrids	<input type="checkbox"/> The bears are one species OR the bears are two species	
	<input type="checkbox"/> If hybrids are viable, then they are one species OR If hybrids are not viable, then they are two species		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and B

Question 18: Describe the structure of DNA

	List A		List B
Check off each one that is observed in list A and B	<input type="checkbox"/> Double stranded, helical Macromolecule	<input type="checkbox"/> Hydrogen bonds between the bases keep the two strands connected	
	<input type="checkbox"/> Has a sugar-phosphate backbone		
	<input type="checkbox"/> Nitrogenous bases (A, T, C, G) are attached to the backbone		
Score:	0 Points: Inaccurate Response None from List A or B	1 Point: Insufficient but Accurate Response Some from list A and/or B	2 Points: Adequate and Accurate Response All from List A
			3 Points: Nuanced Response All from List A and B

Question 19: Describe the concept of cladistics.

Check off each one that is observed in list A and B	List A		List B	
	<input type="checkbox"/>	Method for organizing relationship among species	<input type="checkbox"/>	Characteristics can be physical or molecular
	<input type="checkbox"/>	Based on similarities and differences in characteristics		
Score:	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response	3 Points: Nuanced Response
	None from List A or B	Some from list A and/or B	All from List A	All from List A and B

Question 20: Use the concept of DNA structure **to explain** what the A, T, C, and G in the figure above represents

Check off each one that is observed in list A and B	List A		List B	
	<input type="checkbox"/>	A is adenine, T is thymine, C is cytosine, G is guanine	<input type="checkbox"/>	The letters refer to the nitrogenous bases in the DNA molecule
	<input type="checkbox"/>	The string of letters represents the sequence of bases in the molecule		
Score:	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response	3 Points: Nuanced Response
	None from List A or B	Some from list A and/or B	All from List A	All from List A and B

Question 21: Use the concept of cladistics **to explain** the most likely source of the NY99 strain of WNV.

Check off each one that is observed in list A and B	List A		List B	
	<input type="checkbox"/>	Most similar (identical)/closely related to Isreal98	<input type="checkbox"/>	NY99 is highly similar to the other viruses, which suggests a similar origin
	<input type="checkbox"/>	Close similarity in sequence suggests close evolutionary relationship		
Score:	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response	3 Points: Nuanced Response
	None from List A or B	Some from list A and/or B	All from List A	All from List A and B

Question 22: Describe the concept of nutrient cycles.

Check off each one that is observed in list A and B	List A		List B	
	<input type="checkbox"/>	Involves the nutrient composition of a habitat or ecosystem	<input type="checkbox"/>	Nutrients can also be used by organisms in the system
	<input type="checkbox"/>	That composition changes in response to several factors	<input type="checkbox"/>	Factors include nutrient inputs and outputs of the system
Score:	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response	3 Points: Nuanced Response
	None from List A or B	Some from list A and/or B	All from List A	All from List A and B

Question 23: Use the concept of nutrient cycles **to explain** what could be causing the changes in the lake.

Check off each one that is observed in list A and B	List A		List B	
	<input type="checkbox"/>	There is an increase in algal populations due to change in nutrient composition	<input type="checkbox"/>	Organism diversity changes in response to changes in nutrient composition
	<input type="checkbox"/>	Animals that eat algae are also dying off, allowing for the increase		
	<input type="checkbox"/>	Animals dying off due to exposure to chemicals		
Score:	0 Points: Inaccurate Response	1 Point: Insufficient but Accurate Response	2 Points: Adequate and Accurate Response	3 Points: Nuanced Response
	None from List A or B	Some from list A and/or B	All from List A	All from List A and B