

Fill ONLY one option (i.e. one of a/b/c/d/e) in the last column

S. No. (Marks)	Question	Answer
1 (2)	<p>Glucose can either be stored in form of a polymer called glycogen or can be immediately broken down to give energy essential for survival of a cell. Which one of the following statements must be true for the cell to survive?</p> <ol style="list-style-type: none"> Only glucose concentration, and not the affinities (for glucose) of molecules involved in the first steps of glycogen formation or energy production, determines the fate of glucose inside the cell. The molecule involved in the first step towards glycogen formation has higher affinity for glucose compared to the molecule involved in the first step towards energy production. The molecule involved in the first step towards glycogen formation has the same affinity for glucose compared to the molecule involved in the first step towards energy production. The molecule involved in the first step towards glycogen formation has a lower affinity for glucose compared to the molecule involved in the first step towards energy production. 	d ✓
2 (2)	<p>Myoglobin is the oxygen binding protein in muscle cells and hemoglobin is the oxygen binding protein in red blood cells. During respiration, oxygen in the inhaled air binds to hemoglobin in RBCs and is extracted by myoglobin (since myoglobin-oxygen binding constant is higher than that for hemoglobin-oxygen) when blood containing oxygen rich RBCs flows in the vicinity of the muscle cells. Which one of the following statements cannot be true?</p> <ol style="list-style-type: none"> An individual who develops a change in hemoglobin such that it has a much higher binding constant for oxygen than myoglobin will not survive. ✓ An individual who develops a change in hemoglobin such that it has a much higher binding constant for oxygen than myoglobin will be healthier. An individual who develops a change in myoglobin leading to a much higher binding constant for oxygen than (myoglobin of) a regular individual will have a much higher respiration rate. An individual who develops a change in hemoglobin leading to a much lower binding constant for oxygen than (hemoglobin of) a regular individual will have a much higher respiration rate. 	b ✓
3 (1)	<p>Sultan and Aarfa had a biological child (i.e. not adopted) with a blood group of O-. Out of the two parents, only the father (Sultan) can be a blood donor for the child – i.e. Aarfa cannot be a blood donor for the child. Which of the following statements is the only one with the possibility of being true?</p> <ol style="list-style-type: none"> Both Sultan and Aarfa have a blood group of O-. Aarfa has either of the following blood groups: A- or B- or AB- or O- Aarfa has either of the following blood groups: A+ or B+ or AB+ or O+ Aarfa has either of the following blood groups: A+ or A- or B+ or B- or AB+ or AB- or O+ or O- Both Sultan and Aarfa have a blood group of O+. 	c
4 (2)	<p>From the information given above and assuming no child was adopted, which of the following statements about the child's grandparents (total four – two paternal and two maternal) is the only one with the possibility of being true?</p> <ol style="list-style-type: none"> Neither of the child's grandparents can have a blood group of AB. Maximum one (out of four) of the child's grandparents can have a blood group of AB. Maximum two (out of four) of the child's grandparents can have a blood group of AB. Maximum three (out of four) of the child's grandparents can have a blood group of AB. All four of the child's grandparents can have a blood group of AB. 	b ✓
5 (2)	<p>Following are some ways of maintaining uni-directionality of chemical reactions in solutions: (i) Sustained and increasing concentration of reactants, (ii) Immediate removal of products from the site of reaction by chemical modifications, (iii) Immediate removal of products from the site of reaction into specific compartments, (iv) Ensuring use of reactants that react only irreversibly (i.e. products formed are not reactive under the same temperature and pressure conditions). However, all biochemical conversions inside a cell (also considered as a "unit" of life) can be reversible. Which of the mechanisms amongst those listed above are used inside living cells to maintain uni-directionality of biochemical conversions:</p> <ol style="list-style-type: none"> (i) only (i) and (ii) only (i), (ii) and (iii) only (i), (ii), (iii) and (iv) 	c ✓

6
(2)

A = Assertion: Evolution does not signify an "objective function" or a "goal". However, scientific evidence shows that single-celled organisms eventually gave rise to multi-cellular organisms. ✓
R = Reason: Single-celled organisms giving rise to multi-cellular organisms is an example of progression towards "higher" forms of life with a goal to progress.
Which of the following is correct?

- a. A is true, R is false
- b. A is true, R is true but is not the reason for A
- c. A is true, R is true and is the reason for A
- d. A is false, R is false

b +

7
(2)

A = Assertion: Hardy-Weinberg equilibrium is a neutral equilibrium – when Hardy-Weinberg assumptions are violated in a population, evolution occurs. ✓
R = Reason: In a population maintained in an isolated and fixed/controlled environment, allele frequencies are constant over time and generations.
Which of the following is correct?

- a. A is true, R is false
- b. A is true, R is true but is not the reason for A
- c. A is true, R is true and is the reason for A
- d. A is false, R is false

b ✓

8
(2)

In a population of "X" individuals of a single species "S", a gene is found to have "n" different alleles. From the given observation, which one of the following is most likely to be true?

- a. Higher n implies higher probability for survival of S in a dynamic environment over time.
- b. Lower n implies higher probability for survival of S in a dynamic environment over time.
- c. There can be no more than "X-n" identical individuals within the population of S.
- d. There will be least "X-n" identical individuals within the population of S.

a ✓

9
(1 extra credit)

Consider two species of living systems, call them A and B respectively. Species A has no two individuals with a genotypic similarity of more than 89%. Species B has no two individuals with a genotypic similarity of less than 98%. If there are exactly a 10000 individuals in both the species, which of the following statements is most likely to be true?

- a. Species A has individuals with more fecundity.
- b. Species A is more likely to survive in case of an epochal event.
- c. Species B has individuals with more fecundity.
- d. Species B is more likely to survive in case of an epochal event.

c +

Space for rough work

Please do not write any abusive/indecnt/personal remarks here!