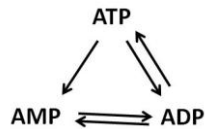


**INBO**  
**INDIAN NATIONAL BIOLOGY OLYMPIAD**  
**Solved Paper 2014**

**CELL BIOLOGY (6 points)**

1. (1 point) Many molecules are chiral i.e. their mirror images are non-superimposable. Which of the following could be affected if the chirality of a molecule is changed in a biological system?
  - I. Taste reception
  - II. Smell perception
  - III. Toxicity
  - IV. Mode of action
  - a. I and II only
  - b. I, II and III only
  - c. III and IV only
  - d. I, II, III and IV
  
2. (1 point) In order to increase the excitability of a patch of neuronal cell membrane:
  - a. the number of  $\text{Na}^+$  and  $\text{K}^+$  channels should be increased .
  - b. the capacitance of the membrane should be increased.
  - c. the thickness of the membrane should be reduced.
  - d. the content of charged lipids in the membrane should be increased.
  
3. (1 point) The best exercise regimen to lose excess body fat is the one which:
  - a. exercises as many muscles as possible.
  - b. results in very little shortness of breath.
  - c. results in shortness of breath with profuse sweating.
  - d. stresses and compresses body regions that store most of the fat.
  
4. (1 point) Lips are more sensitive to temperature or touch than forearm skin. This is because of the:
  - a. higher frequency of action potentials.

- b. greater height of the action potential.
  - c. faster transmission of the action potential.
  - d. larger number of neurons stimulated in the CNS.
5. (1 point) A cell has a fixed number of adenine nucleotides. Each of these adenine nucleotides will be in monophosphate (AMP), diphosphate (ADP) or triphosphate (ATP) form. Adenine nucleotides are constantly interconverted from one form to another due to the metabolic activities of the cell as shown below:



One of the key enzymes in this interconversion is adenylate kinase which catalyzes the following reaction:



Of the three forms, hydrolysis of only the triphosphate form (i.e., ATP) results in energy that can be used to perform “work” by the cells.

Which one of the following ratios best describes the energy potentially available to a cell?

a.  $\frac{[\text{ATP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$

b.  $\frac{[\text{ATP}] + \frac{1}{2}[\text{ADP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$

c.  $\frac{[\text{ATP}] + [\text{ADP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$

d. 
$$\frac{[\text{ATP}] + 2[\text{ADP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$$

6. (1 point) There are various types of ATPase pumps found in different types of cells. Of these, F-type ATPases, also known as ATP synthases, drive ATP synthesis. They are found in all of the following EXCEPT:
- inner membrane of mitochondria.
  - thylakoid membrane of chloroplasts.
  - plasma membrane of prokaryotes.
  - plasma membrane of fungi.

**PLANT SCIENCES (10 points)**

7. (1 point) Lignin is a secondary metabolite found in plants. Which of the following statement/s about this biomolecule is/are true?
- It is the most abundant organic compound on the earth.
  - In many plants, lignin is sequestered in vacuoles in order to protect other compounds of the cell.
  - It waterproofs the cell wall and helps in transportation of water in terrestrial plants.
  - Lignin is structurally very similar to tannins and like tannins, it is also an important deterrent to herbivores.
- I, II and III
  - II and IV
  - Only III
  - I, III and IV
8. (1 point) Study the photosynthetic pathway given. A few statements are made about this pathway. Choose the appropriate one.











































































































