1. In order to increase the excitability of a patch of neuronal cell membrane
   (a) the number of Na⁺ and 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. (INBO 2014)

2. In an experiment the stem of a tomato plant was wounded in such a way that portions of vascular bundles were removed. After the experiment, which of the following will delay the recovery of the wounded tissue the most, by cutting off supply of cytokinins?
   (a) Cutting the young leaves and buds above the wound.
   (b) Removing the flowers and leaves below the wound.
   (c) Cutting the growing root tips and tilting the plant.
   (d) Cutting the mature and senescing leaves below as well as above the wound. (INBO 2014)

3. If the stroke volume of heart increases with the total volume of blood remaining the same, the heart beats per minute will
   (a) decrease  (b) remain unaltered
   (c) increase  (d) become erratic. (INBO 2014)

4. In a women suspecting pregnancy, blood analysis showed low levels of human chorionic gonadotropin (hCG), considerably high progesterone and very high levels of estrogen. This is indicative of
   (a) no pregnancy
   (b) early pregnancy
   (c) advanced pregnancy
   (d) pseudo pregnancy. (INBO 2014)

5. An artificial tank with a capacity of 15 kiloliters was used to study the changes in the number of phytoplanktons during a 10 month study. The following are the observations obtained from the study. (Ecological density is calculated using the space available for a species to occupy).

<table>
<thead>
<tr>
<th>Month</th>
<th>Amount of water capacity present (%)</th>
<th>Total no. of phytoplanktons (10⁵)</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>November</td>
<td>80</td>
<td>33</td>
</tr>
<tr>
<td>January</td>
<td>60</td>
<td>36</td>
</tr>
<tr>
<td>March</td>
<td>20</td>
<td>18</td>
</tr>
</tbody>
</table>

   Based on the above data which of the following statements would be true?
   I. The month of January would have the highest crude density.
   II. The month of March would have the highest ecological density.
   III. The highest amount of phytoplanktons is present in the month of January.
   IV. The lowest ecological density is present in the month of November.
   (a) (II) and (III)  (b) (I), (II) and (III)
   (c) (I), (II), (III) and (IV)  (d) (III) and (IV) (INBO 2014)

6. Though earlier cnidarians and ctenophores were classified under Coelenterata, ctenophores are now considered to have evolved later in the course of evolution. Which of the following characteristics support this?
   (i) True muscle cells  (ii) Ciliary locomotion
   (iii) Presence of anal pores  (iv) Bioluminescence
   (v) Retractable tentacles
   (a) All of the above  (b) only (i) and (iii)
   (c) only (ii) and (iv)  (d) only (i), (iii) and (v) (INBO 2014)
7. A graph depicting the carbon dioxide assimilation at various intracellular partial pressures of CO₂ is given below. Also a few statements regarding the CO₂ assimilation in C₃ and C₄ plants have been made. Choose the correct statement.

![Graph showing CO₂ assimilation and CO₂ compensation points for C₃ and C₄ plants](image)

(a) The CO₂ compensation point in C₃ plant reflects CO₂ production because of photorespiration.
(b) The C₃ plant does not exhibit increase in CO₂ assimilation as intracellular CO₂ concentration increases.
(c) The CO₂ compensation point in C₄ plants reflects high rate of CO₂ given out in light.
(d) C₄ plants are saturated at 15 Pa of CO₂ depicting that increasing CO₂ concentration does not change the rate of CO₂ assimilation and they are less efficient photo synthetically than C₃ plants.

(INBO 2014)

8. Choose the combination of conditions in a tissue that would influence the most rapid dissociation of oxyhaemoglobin.

![Temperature, Oxygen, and Carbon dioxide levels](image)

(a) Levels
(b) Levels
(c) Levels
(d) Levels

(NSEB 2012)

9. Which of the following is expected to have a lining of stratified epithelium?

(i) alveoli in lungs
(ii) oesophagus
(iii) duodenum
(iv) urinary bladder
(v) major arteries

(a) (i), (iv) and (v)
(b) only (ii)
(c) only (ii) and (v)
(d) (i), (ii), (iii) and (iv)

(NSEB 2012)

10. Antidiuretic hormone has the most abundant receptors in the kidneys of

(a) frogs in tropical pond
(b) rabbits in a grass land
(c) spotted deer in moist evergreen forest
(d) kangaroo rats in deserts.

(NSEB 2012)

11. The dominant alleles A and B each add 2 g weight to a basal weight (in homozygous recessive condition) of 6g of fruits of a certain plant. If two plants, each with fruits weighing 8g and having heterozygous condition for one gene each are crossed, what phenotypic ratio is expected among the offspring?

(a) 25% with 10g: 50% with 8g: 25% 6g fruit
(b) 50% with 10g: 50% with 6g fruits
(c) 25% with 12g: 25% with 10g: 25% with 8g: 25% with 6g fruits
(d) 12.55 with 14g: 25% with 12g: 25% with 10g: 25% with 8g: 12.5% with 6g fruits

(NSEB 2012)

12. A skull excavated from a place had large zygomatic arches, 2 pairs of large incisors, 2 pairs of premolars following a gap and 3 pairs of large molars. The foramen magnum was directed posteriorly. This skull belongs to a

(a) predatory mammal with bipedal locomotion
(b) predaceous dinosaur with bipedal locomotion
(c) herbivorous mammal with quadrapedal locomotion
(d) herbivorous dinosaur with quadrapedal locomotion.

(NSEB 2012)

13. A male child brought up in an orphanage was claimed by an old couple. This old couple had lost their daughter and son-in-law in an accident, when they were on a tour with the child, who was one year old. Another young couple also claimed that the child belonged to them, however, the wife got divorced after the child went missing and married another person. Which test will be most appropriate to solve the parentage problem?

(a) Blood group matching of the child, the old couple and wife among the young couple.
(b) Matching of Genomic DNA fingerprints of all the members, with that of the child.
(c) Mitochondrial DNA fingerprint matching of the old and young women with that of the child.
(d) Matching of the Y-chromosome of the old man with the child.

(INBO 2012)
14. Study the diagram of cross section of leaf carefully. The armed palisade tissue (seen dark) seems to have adapted to
(a) Diffused light from ground
(b) Diffused light from all around
(c) Intense sunlight from above
(d) Intense sunlight from all around. (NSEB 2011)

15. Which of the following joints are found only in children, till puberty?
(a) Symphysis (b) Synchondrosis (c) Synarthrosis (d) Synovial (NSEB 2011)

16. As shown in the picture below, microassay was used to find genes whose expression is regulated when a plant is treated with the ABA hormone.

ABA treatment

No ABA treatment

Fluorescent (green) nucleotides

Fluorescent labelled cDNA

DNA microarray

Hybridization

Scan

Which of the following explanations is not correct about the microarray experiment?
(a) All cDNAs of the expressed mRNA from both the experimental group and the control group hybridizes competitively with the corresponding genes on the DNA chip.
(b) Genes whose expressions are induced by ABA appear red after hybridization.
(c) Because we used different colored probes with each sample, we can measure the relative amount of genes which are expressed differentially.
(d) We can only know the expression profile of genes which are included on the microarray.
(e) This process includes reverse transcription and hybridization. (IBO 2010)

17. The following figures indicate changes in phosphate concentration as the filtrate passes through regions a and b, according to the increase in plasma phosphate concentration.

Using this information, choose the most appropriate graph that depicts the changes in the renal reabsorption rate of phosphate ions according to the increase of its concentration in the plasma.

(a)  
(b)  
(c)  
(d)  
(e)  

(IBO 2010)
18. The diagram below represents the development of a human zygote from fertilization to the late blastocyst stage.

Choose a correct statement from the following choices.
(a) If two sperm penetrate the oocyte membrane at the time of fertilization, conjoined twins with shared body parts will be born.
(b) During the process of *in vitro* fertilization with embryo transfer (IVF-ET), the embryo is transferred at the 2-cell stage to the mother’s uterus.
(c) The most appropriate stage for the collection of ‘Embryonic stem cells’ for regenerative-therapeutic purposes is the 8-cell stage.
(d) The outer cells (structure a) of the early-blastocyst embryo will eventually form the fetus.
(e) During the late blastocyst stage, the embryo is implanted in the uterine endometrium.

(IBO 2010)

19. Glucose is a high threshold substance and gets re-absorbed from ultra filtrate during urine formation. After consuming a lot of sweets, urine of the otherwise healthy person also shows presence of glucose. This proves that reabsorption of glucose:
(a) varies from time to time.
(b) is time independent.
(c) is concentration dependent.
(d) is energy intensive

(NSEB 2014)

20. Which of the following structures, absent in algae, is very important for complete and permanent invasion of land by plants?
(a) Chloroplasts
(b) Tracheids
(c) Sporangia
(d) Free living gametophyte

(NSEB 2009)

21. Water potential (\(\psi\)) plays important role in water absorption and conduction from soil to leaf. Under which condition the process will go on smoothly?

(a) \(\psi_{\text{atmosphere}} < \psi_{\text{leaf}} < \psi_{\text{root}} < \psi_{\text{soil}}\)
(b) \(\psi_{\text{atmosphere}} > \psi_{\text{leaf}} > \psi_{\text{root}} > \psi_{\text{soil}}\)
(c) \(\psi_{\text{atmosphere}} = \psi_{\text{leaf}} = \psi_{\text{root}} = \psi_{\text{soil}}\)
(d) \(\psi_{\text{atmosphere}} < \psi_{\text{leaf}} = \psi_{\text{root}} > \psi_{\text{soil}}\)

(NSEB 2013)

22. Which of the following tissue can be observed after boiling a piece of pinewood in nitric acid for 15 minutes?
(a) Transfusion tissue
(b) Xylem vessels
(c) Xylem tracheids
(d) Phloem parenchyma

(NSEB 2013)

23. In maize the colour of grains is controlled by 3 pairs of genes. Gene ‘C’ and ‘R’ independently do not form any colour but when together, they impart greenish-brown colour to the stem, while the grains remain colourless. In presence of an additional allele ‘A’ the stem as well as grains become violet. In a trihybrid cross what phenotypic ratio is expected in grains?
(a) 48 coloured : 16 colourless
(b) 36 coloured : 28 colourless
(c) 27 coloured : 37 colourless
(d) 40 coloured : 24 colourless

(NSEB 2009)

24. A cell when viewed under the microscope clearly revealed nucleus, glycogen granules and cell wall. The cell most likely belongs to
(a) a bacterium
(b) a plant cell
(c) fungal cell
(d) a protist

(NSEB 2009)

25. The accompanying figure depicts movement of a solute across a membrane without consumption of energy, ‘A’ and ‘B’ would be

(a) facilitated diffusion and passive diffusion
(b) passive diffusion and active transport
(c) passive diffusion and facilitated diffusion
(d) facilitated diffusion and active transport.

(NSEB 2009)
26. Evolutionary tree of land plants is shown in the diagram. The correct description of P, Q and R is:

- (a) P: Protist ancestor
  Q: Primitive tracheophyte
  R: Spermatophytes
- (b) P: Green algal ancestor
  Q: Primitive tracheophyte
  R: Bryophytes
- (c) P: Protist ancestor
  Q: Green algae
  R: Primitive vascular plant
- (d) P: Primitive tracheophyte
  Q: Origin of seeds
  R: Bryophytes

27. Which statement correctly describes the differentiation and development of cells and organs in flowering plants?

- (a) Organomorphogenesis involves cell movement as one of the important mechanisms.
- (b) Post-embryogenesis is a growth process, as all of the plant organs are pre-formed during embryogenesis.
- (c) Totipotency of plant tissues provides the original source of power to develop a complete plant by re-differentiation, without going through the de-differentiation process.
- (d) The direction of cell division determines cell type and function.
- (e) Lineage information obtained by genetic inheritance overrides environmental factors in determining the time for organ development.

(IBO 2010)

28. Select the chemical property that is shared by all types of lipids forming the plasma membrane.

- (a) Polar head
- (b) Sugar component
- (c) Glycerol backbone
- (d) Phosphate group
- (e) Hydrophobic region

(IBO 2010)

29. Plants with inferior ovary always bear

- (a) Pseudocarps
- (b) berries
- (c) aggregate fruits
- (d) seedless fruits.

(NSEB 2011)

30. Biochemical analysis of pyrenoids in algae would reveal the presence of

- (a) RNA and starch
- (b) Proteins and starch
- (c) Proteins and phosphates
- (d) Sugars and phospholipids.

(NSEB 2011)

**ANSWER KEY**

1. (a) 2. (a) 3. (a) 4. (c) 5. (b) 6. (b) 7. (a) 8. (a) 9. (b) 10. (d) 11. (a) 12. (c) 13. (c) 14. (d) 15. (b) 16. (b) 17. (d) 18. (e) 19. (c) 20. (b) 21. (a) 22. (c) 23. (c) 24. (c) 25. (a) 26. (b) 27. (d) 28. (e) 29. (a) 30. (b)