



CSIR NET Life Sciences

June 2026

[Solution]

CSIR NET LIFE SCIENCES

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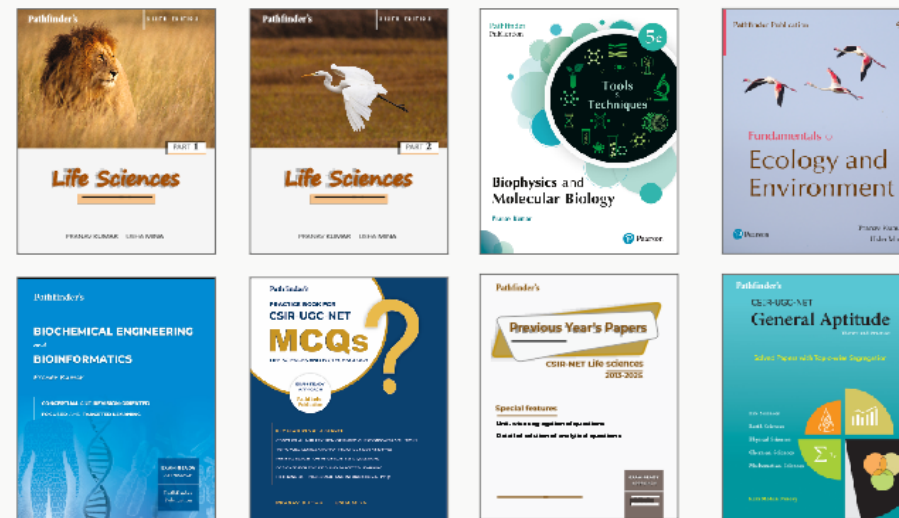
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PART - B





The correct taxonomic ranking is:

1. Family, Class, Order, Division, Kingdom
2. Family, Class, Division, Kingdom, Order
3. **Family, Order, Class, Division, Kingdom**
4. Family, Division, Class, Order, Kingdom



Life Sciences, fundamentals and practice Part-1 9th Edition

Taxonomists have defined seven ranks – kingdom, phylum (or *division*), class, order, family, genus and species. Each rank contains organisms with similar characteristics. The *kingdom* is the largest unit of classification. It splits into smaller units called *phyla* (singular, *phylum*). Phyla split into *classes*, classes into *orders*, orders into *families*, families into *genera* (singular, *genus*) and genera into *species*. This taxonomic system is known as **Linnaean classification system**. The most fundamental level of classification is the species. As one progresses down the hierarchy, the number of organisms in each taxon decreases, and the similarities between them increases.





A mutation in a gene wherein a mutant allele encoding for a protein impedes the functioning of the protein encoded by the wild. Type allele is frequently referred as:

1. Loss of function
2. A mutation causing synthetic lethality
3. **Dominant negative mutation**
4. A missense mutation with positional variegation effect

Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

A **dominant-negative mutation** gives rise to a mutant gene product that interferes with the function of the normal gene product, causing a loss-of-function phenotype even in the presence of a normal copy of the gene. This ability of a single defective allele to determine the phenotype is the reason why such an allele is said to be dominant.



Which of the following is an inducible promoter for plant genetic transformation?

1. 35S promoter of CaMV
2. rbcS
3. Cab3
4. **PR1**

PR1 (Pathogenesis-Related protein 1) promoter is an inducible promoter used in plant genetic engineering.

Question No. 24 / Question ID: 458908880



Match List I with List II

- | | |
|-------------------------|----------------|
| A. Excision repair | I. UmuCD |
| B. Translesion repair | II. UVR genes |
| C. Mismatch repair | III. Rec genes |
| D. Recombination repair | IV. Mut genes |

Choose the *correct* answer from the options given below:

- | | |
|---------------------------|---------------------------|
| 1. A-IV, B-III, C-II, D-I | 2. A-I, B-IV, C-II, D-III |
| 3. A-III, B-II, C-I, D-IV | 4. A-II, B-I, C-IV, D-III |

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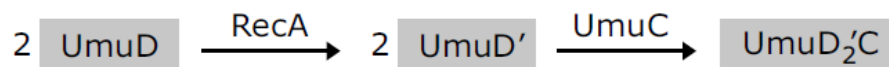
There are three mismatch repair systems in *E. coli*; on the basis of the relative lengths of the unmethylated strand excised and repaired by components of the repair system. These are categorized as *long patch*, *short patch* and *very short patch*. In *E. coli* the long patch system involves three **Mut proteins**, coded by the *mut* genes. These Mut proteins are **MutH**, **MutL** and **MutS**. Recognition of the sequence GATC and of the mismatch are specialized functions of the MutH and MutS proteins, respectively. MutS scans the DNA, recognizing mismatches from the



Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

The best-studied model of nucleotide excision repair is the **Uvr system** in *E. coli*. This system typically removes damaged segments about 12 nucleotides long. The core enzyme responsible is known as the **ABC excinuclease**, composed of three different proteins: the products of the *uvrA*, *uvrB*, and *uvrC* genes. Here's how the process works in bacteria:

When the genome is subjected to heavy damage through exposure to UV light or a DNA-damaging reagent, DNA repair becomes significantly less accurate and a high mutation rate is observed. Higher levels of DNA damage effectively bring normal DNA replication to a halt in *E. coli* because normal DNA replication with DNA polymerase III cannot proceed past many types of DNA lesions. In this situation, **DNA pol V** (or UmuD₂'C) carries out DNA replication. Pol V is known for its *low fidelity* and *error-prone replication*, allowing it to incorporate nucleotides opposite damaged bases that high-fidelity polymerases cannot replicate accurately. This process, called **translesion DNA synthesis** (TLS), is crucial for bypassing lesions that could otherwise stall replication, which is why Pol V is also referred to as an **error-prone DNA polymerase**. Notably, DNA Pol V lacks 3' → 5' exonuclease proofreading activity. The activation of DNA Pol V is triggered by the **RecA protein**, which plays a key role in the SOS response. DNA Pol V is a multi-subunit enzyme, typically composed of the **UmuC** and **UmuD** proteins. Under the influence of RecA protein, the UmuD protein is cleaved to form **UmuD'**. Two UmuD' subunits then combine with UmuC to form the active DNA Pol V (UmuD₂'C).



Question No. 24 / Question ID: 458908896



Which cells produce the largest amount of Heparin in humans?

1. **Basophilic mast cells**
2. Hepatocytes
3. Keratinocytes
4. Erythrocytes

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Basophil contains large basophilic cytoplasmic granules and stain blue-purple with basic dyes such as hematoxylin. They are quite similar structurally and functionally to *mast cells*, which never circulate in the blood but instead are dispersed in connective tissue throughout the body. Both basophils and mast cells synthesize and store *histamine* and *heparin*. Histamine release is important in allergic reactions, whereas heparin speeds up removal of fat particles from the blood.



Rh blood group system is used in clinical practice to detect the risk of _____ in new born.

1. *Diabetes insipidus*
2. **Hemolytic anaemia**
3. Leukemia
4. Thrombosis

Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

Erythroblastosis fetalis, also called hemolytic disease of the fetus and newborn.



Given below are two statements about the success of Mendel's inheritance experiments with true-breeding pea plant.

Statement I: He studied complex traits simultaneously with systematic statistical record.

Statement II: He studied contrasting traits simultaneously with systematic statistical record.

In the light of the above statements, choose the correct answer from the options given below

1. Both Statement I and Statement II are *correct*
2. Both Statement I and Statement II are *incorrect*
3. Statement I is *correct* but Statement II is *incorrect*
4. **Statement I is *incorrect* but Statement II is *correct***



Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

Quantitative traits arise from two conditions. Most of the quantitative traits arise due to **polygenic condition**. They are governed by many non-allelic genes at different loci and each contributes such a small amount to the phenotype that their individual effects cannot be detected by Mendelian methods. The effects of the non-allelic genes are also cumulative or additive. As more than one non-allelic genes determines the expression of a given trait, such quantitative traits are also referred to as **polygenic traits** and their inheritance are called **polygenic inheritance**. Other types of quantitative traits often arise when **environmental factors** affect the phenotype. In such cases, environmental differences result in a single genotype producing a range of phenotypes. Quantitative traits whose phenotypes result from both polygenic condition and environmental influences are termed **multifactorial**, or **complex traits**. Thus, basic differences between qualitative and quantitative traits involve the number of non-allelic genes contributing to the phenotypic variability and the degree to which the phenotype are modified by environmental factors.



Human heart develops from: ✓

1. **Mesoderm on day 18 or 19 post-fertilization**
2. Ectoderm on day 18 or 19 post-fertilization
3. Mesoderm after brain development
4. Mesoderm after lung development



Question No. 29 / Question ID: 458908877



The probability of a hemophilic carrier mother married to non-hemophilic healthy male to bear a hemophilic daughter and a hemophilic son is:

1. 50% daughter; 0% son
2. 0% daughter; 100% son
3. 0% daughter; 50% son ✓
4. 50% daughter; 50% son

Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

Problem ✓

Hemophilia is a recessive X-linked trait in humans. If a heterozygous woman has children with a normal man, what are the odds of the following combinations of children?

- a. An affected child
- b. Four unaffected children in a row
- c. Two out of five children that are affected



The "forever chemicals" used in nonstick cookware are:

1. Polyethylene
2. **Polyfluorinated alkyl substances** ✓
3. Glass
4. Hexachlorocyclohexane





The characteristics of the development of suspensor of plant embryo are:

- A. It develops from the upper cell resulting from the first cell division of the embryo.
- B. It connects the embryo to the embryo sac and the ovule tissue.
- C. It forms part of the root meristem, root initial cells, and root cap.
- D. It is short lived.

Choose the *correct* answer from the options given below:

- 1. A and B only
- 2. **B, C, and D only**
- 3. A, B, and C only
- 4. A, B, and D only



Life Sciences, Fundamentals and practice, Part-2 [Plant physiology] 9th Edition

proembryo. Since, the embryo proper is spherical in shape, it is often referred to as the **globular stage**. The basal cell (close to the micropyle) also divides, but all of its divisions are in horizontal plane (i.e., at right angles to the long axis). It gives a filament of six to nine cells known as the **suspensor** that attaches the embryo to the vascular system of the plant. At the globular stage, the uppermost cell (nearest the embryo) of the suspensor is specified to become the **hypophysis**. By the globular stage, the embryo divides into three domains. The top and bottom cell and a lower cell. These cells incorporated into the embryo to form the **quiescent center** and the **columella**, respectively. The suspensor supports early development of the embryo proper by providing it with nutrients and growth regulators, particularly gibberellins. It is short-lived, undergoing programmed cell death during the **torpedo stage** of development. It is, therefore, not present in the mature seed.





Which of the following soil formation process prevails in tropical climate?

1. **Laterization** ✓
2. Podzolization
3. Gleization
4. Salinization





A potent neurotoxin responsible for the death of hundreds of marine birds and sea lions is ____

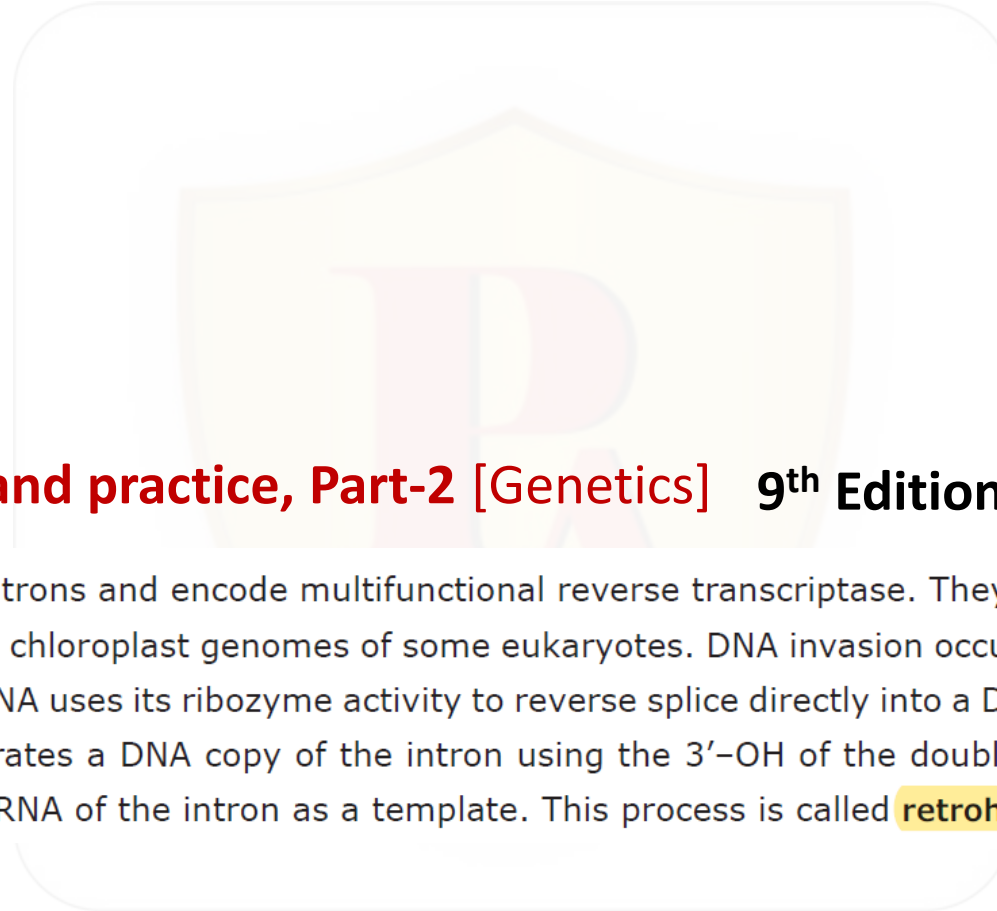
1. Alginic acid
2. **Domoic acid**
3. Silica
4. Xanthins





Reverse transcriptase activity is associated with the following natural ribozyme to complete homing:

1. Group I introns
2. **Group II introns**
3. Hammerhead ribozyme
4. Varkud satellite ribozyme



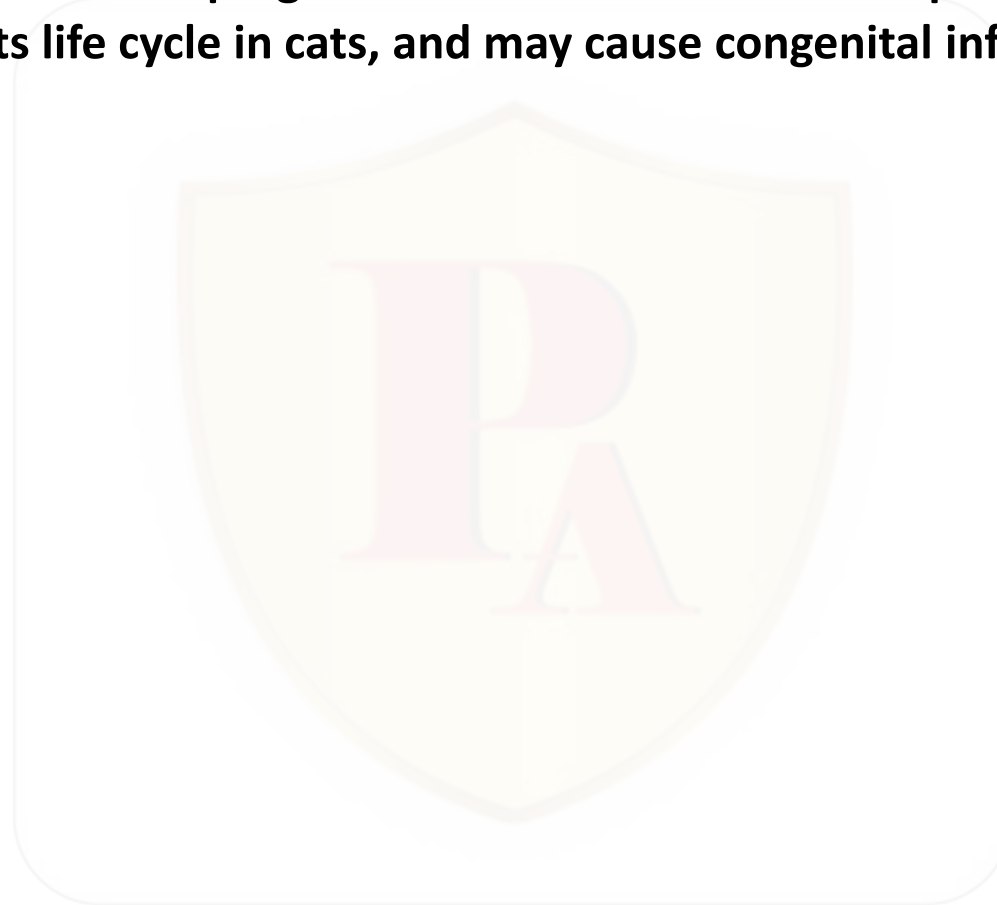
Life Sciences, Fundamentals and practice, Part-2 [Genetics] 9th Edition

Mobile **group II introns** are autocatalytic introns and encode multifunctional reverse transcriptase. They are found in bacteria, archaea and mitochondrial and chloroplast genomes of some eukaryotes. DNA invasion occurs by a remarkable mechanism in which the intron RNA uses its ribozyme activity to reverse splice directly into a DNA strand. After that, the **reverse transcriptase** generates a DNA copy of the intron using the 3'-OH of the double-stranded break as a primer for synthesis and the mRNA of the intron as a template. This process is called **retrohoming**.



Diagnostic test is usually conducted in pregnant women to detect the presence of which of the following parasite, with part of its life cycle in cats, and may cause congenital infections in utero?

1. *Babesia microti*
2. *Cryptosporidium*
3. *Cyclospora*
4. *Toxoplasma gondii* ✓





Two genes A and B on the same chromosome known to be 20 cM apart implies:

1. A and B are strongly linked and will always be inherited as a single block
2. The distance between A and B is 20 million bases
3. The frequency of recombination between A and B is 20% in the given population ✓
4. The frequency of double cross over between A and B is 40% in the given population

Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

Since recombination (crossing over) occurs more frequently as the distance between two specific gene loci increases, the *recombination frequency* can be used as a measure of the distance (map distance) between them. The recombination frequency is directly proportional to the physical distance separating the loci. By definition, **a 1% recombination frequency corresponds to 1 map unit**. By analyzing recombination frequencies among linked genes, scientists can construct a **genetic map**, arranging the genes in a linear order along the chromosome.

The unit of measurement for genetic map is known as a **map unit** or **centimorgan** (cM). It is important to note that genetic distance is not the same as physical distance, which is measured in term of base pairs. However, correlations between genetic maps and physical maps allow approximations to be made. In humans, **1 cM is roughly equivalent to 1×10^6 base pairs** (1 Mb).



Given below are two statements related to the neutral theory of molecular evolution:

Statement I: Most newly acquired mutations are neutral.

Statement II: Genetic drift acts on dominant alleles and leads to evolution.

In the light the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are *correct*
2. Both Statement I and Statement II are *incorrect*
3. **Statement I is *correct* but Statement II is *incorrect***
4. Statement I is *incorrect* but Statement II is *correct*



Which of the following statement is INCORRECT according to Charles Darwin's theory of Natural Selection?

1. Organisms produce a far greater number of progeny than ever survived to adulthood.
2. The number of individuals in species remains more or less constant.
3. The individuals in a species are not all identical but show variation in heritable characters.
4. **Parents for the next generation are randomly selected from the current generation.**

Life Sciences, Fundamentals and practice, Part-2 [evolution] 9th Edition

Natural selection is the **nonrandom process** by which heritable traits associated with reproductive fitness become more or less common in a population due to the differential reproduction of their bearers. It can act on any heritable phenotypic trait linked to differential reproductive fitness. If a trait variant is associated with greater reproductive fitness or success in specific environments, individuals with these advantageous traits are more likely to reproduce and pass them on to their offspring. This leads to an increase in the number of individuals with such traits in the population. This process is known as **natural selection** of traits. Thus, natural selection occurs when individuals with one version of a trait have higher reproductive fitness compared to those with an alternate version of the trait.



The specific activity of 1 μg of a pure enzyme catalyzing a reaction at a rate of 0.5 mmol/min under optimum conditions is:

1. 0.005 U/ μg
2. 0.05 U/ μg
3. **0.5 U/ μg** (500 U/ μg)
4. 0.1 U/ μg

1 Unit (U) = 1 μmol of substrate converted per minute, not 1 mmol/min

Question No. 40 / Question ID: 458908908

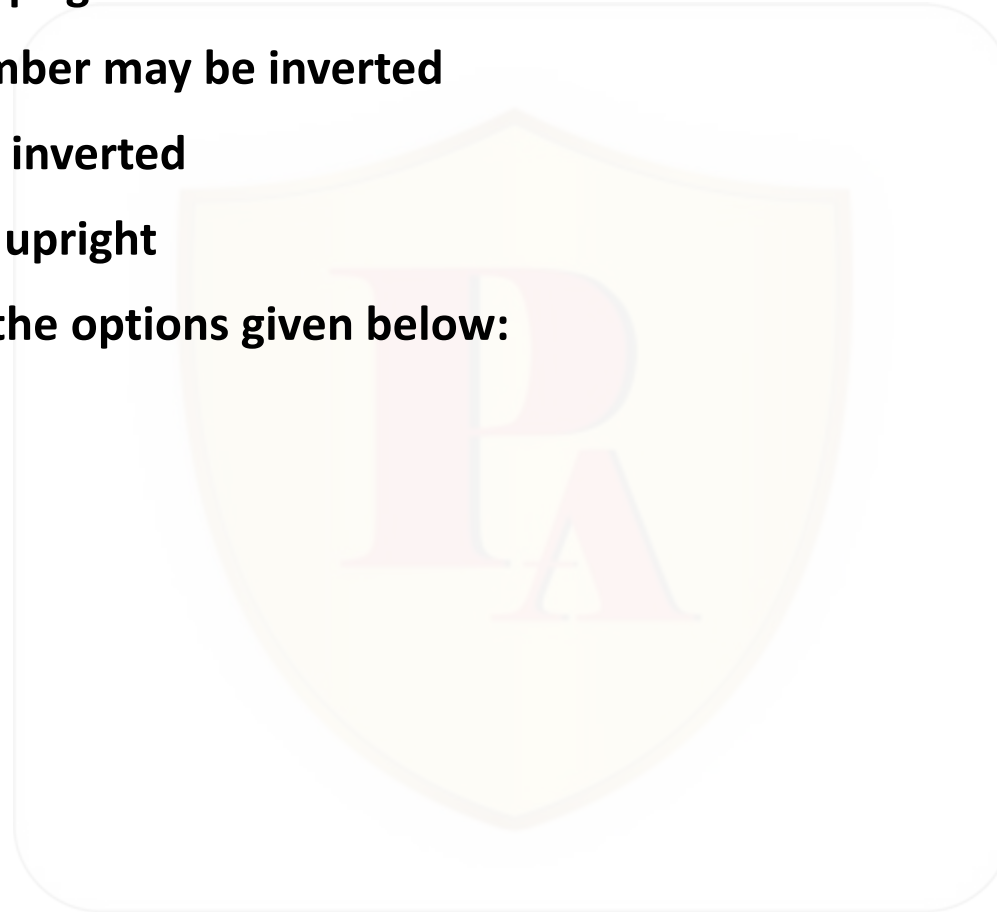


In the case of ecological pyramids:

- A. Pyramid of energy is always upright
- B. Pyramids of biomass and number may be inverted
- C. Pyramid of biomass is always inverted
- D. Pyramid of number is always upright

Choose the *correct* answer from the options given below:

- 1. **A and B Only**
- 2. A and C Only
- 3. B and C Only
- 4. A and D Only





Life Sciences, Fundamentals and practice, Part-1 [ecology]

However, it's important to note that there are certain ecological systems where the pyramid of numbers may be inverted. One example is when we consider a single tree and its associated insect population. In this case, the tree, as a primary producer, represents the base of the pyramid, and the dependent insects represent the second trophic level. However, since, at any given time, the total number of insects is higher compared to the number of trees, the pyramid of numbers would be inverted.

Pyramid of energy: A pyramid of energy shows the flow of energy from one trophic level of a community to the next. The units of pyramids of energy are energy/area/time, e.g., $\text{kcal m}^{-2} \text{yr}^{-1}$. An energy pyramid more accurately reflects the laws of thermodynamics, as energy loss occurs at each transfer from one trophic level to another. Therefore, *the pyramid is always upright*. In energy pyramids, a given trophic level always has a smaller energy content than the trophic level immediately below it. This is due to the fact that some energy is always lost as heat is going from one trophic level to the next.



Which of the following represents the ratio between experimentally observed results and theoretically expected results?

1. **Chi-square value** ✓
2. F ratio
3. Theta value
4. Variance ratio



Question No. 42 / Question ID: 458908884



Uptake of Na^+ and Ca^{2+} ions into plant vacuoles from the cytosol are carried out by:

1. **Proton antiporters** //
2. Ion channels
3. Receptor mediated endocytosis
4. Vesicular transport

Life Sciences, Fundamentals and practice, Part-2 [plant physiology] 9th Edition

Ion homeostasis to overcome ionic stress: High salt conditions disturb cellular ion balance. To maintain homeostasis, plants restrict Na^+ entry in to the root cells and actively extrude excess Na^+ via transporters such as salt overly sensitive 1 (**SOS1**) at the plasma membrane. Additionally, Na^+ is compartmentalized into vacuoles through Na^+/H^+ antiporters (**NHX proteins**), preventing its toxic accumulation in the cytosol. ⚡



ABC transporters are involved in

- A. Flipping phospholipids from one membrane leaflet to other
- B. ATP production
- C. Transport of cholesterol
- D. Transport of Cl^- ions

Choose the *correct* answer from the options given below:

- 1. **A, C, and D only** (A and D only)
- 2. B only
- 3. B, C, and D only
- 4. B and D only

Life Sciences, Fundamentals and practice, Part-1 [cell biology] 9th Edition

A second *ATP-dependent* activity, catalyzed by **floppases**, **ABC transport protein**, transports phospholipids in the opposite direction. The plasma membrane also contains phospholipid translocator termed **scramblase**, which **ABC** (ATP binding cassette) **transporters** constitute a large family of ATP dependent transporters that pump a wide range of solutes, including ions, sugars, and amino acids. Most ABC transporters are present in the plasma membrane, but sometimes are also found in membrane of ER, mitochondria and lysosome. ABC transporters utilize energy derived from **ATP hydrolysis to transport solutes**. A functional ABC transporter has two *transmembrane domains*



Match List I with List II

- A. Chlamydiae
- B. Chloroflexi
- C. Dictyoglomi
- D. Planctomycetes

- I. Aquatic
- II. Heat resistant
- III. Intracellular pathogen
- IV. Green non-sulfur

Choose the *correct* answer from the options given below:

- 1. **A-III, B-IV, C-II, D-I**
- 2. A-III, B-I, C-II, D-IV
- 3. A-IV, B-II C-III, D-I
- 4. A-II, B-III, C-I, D-IV

Life Sciences, Fundamentals and practice, Part-1 [Pk and virus] 9th Edition

Chlamydiae, like the *Rickettsias*, are obligate intracellular non-motile Gram-negative bacteria. Phylum *Chlamydiae* has one class, one order, four families and six genera. Among six genera, genus *Chlamydia* is best studied. Chlamydial



In B-cell development, the heavy chain locus is always rearranged first. The rearrangement starts with D-J locus followed by V-D-J arrangements. The enzyme involved in the process is:

1. Terminal deoxynucleotidyl kinase
2. Terminal oxynucleotidyl transferase
3. **Terminal deoxynucleotidyl transferase**
4. Deoxynucleotidyl phosphatase

Life Sciences, Fundamentals and practice, Part-1 [immunology]

9th Edition

Hairpin opening and end processing: Hairpins are opened up at the coding ends. **Artemis** is an endonuclease that randomly cuts the hairpins at the coding ends. It generates a short single strand of nucleotides at the end of the coding sequence. Addition of complementary nucleotides to this strand forms palindrome sequence (**P nucleotides**). A lymphoid-specific enzyme, called **terminal deoxynucleotidyl transferase (TdT)**, adds nucleotides to the DNA ends in a template-independent manner (**N nucleotides**). This enzyme can add up to 15 nucleotides randomly (non-genomic).



Which of the following statement is INCORRECT? ✓

1. Sickle cell gene in human confers resistance to *Plasmodium falciparum*.
2. *Plasmodium falciparum* increases the pH of the infected erythrocyte. ✓
3. *Plasmodium falciparum* favors deoxyhemoglobin formation through Bohr effect.
4. *Plasmodium falciparum* increases the sickling of the erythrocytes.

Life Sciences, Fundamentals and practice, Part-1 [Chapter 1]

9th Edition

The *sickle cell trait* confers resistance to malaria caused by the mosquito-borne protozoan *Plasmodium falciparum*. How does it do so? Plasmodia increase the acidity of infected erythrocytes by ~0.4 pH units. The lower pH favors the formation of deoxyhemoglobin via the Bohr effect, thereby increasing the likelihood of sickling in RBCs that contain HbS. RBCs damaged by sickling are normally removed from the circulation by the spleen. The parasite enhanced sickling probably allows the spleen to preferentially remove infected RBCs and also parasites.



Which of the following represents a model for floral organ identity?

1. **ABC model** ✓
2. NZY model
3. Turing model
4. Turgor model

Life Sciences, Fundamentals and practice, Part-2 [Plant physiology] 9th Edition

stages and responsible for their floral fate. **Floral organ identity** genes directly control floral identity. The proteins encoded by these genes are transcription factors that likely control the expression of other genes, whose products are involved in the formation and/or function of *floral* organs. In *Arabidopsis*, these genes include *APETALA1* (*AP1*), *APETALA2* (*AP2*), *APETALA3* (*AP3*), *PISTILLATA* (*PI*) and *AGAMOUS* (*AG*).

Question No. 48 / Question ID: 458908874



The frequency of affected individuals for a disease caused by a recessive mutation, in an isolated population is, $1/1100$. Assuming Hardy Weinberg equilibrium, what is the frequency of individuals who are carrier of this disease in the same population?

1. 0.03
2. 0.06 ✓
3. 0.97
4. 0.0009

Life Sciences, Fundamentals and practice, Part-2 [evolution] 9th Edition

Problem

A particular autosomal recessive disorder is present in one in ten thousand individuals. If the population is in Hardy-Weinberg equilibrium, what are the frequencies of the two alleles (A and a)?

Solution: In Hardy-Weinberg equilibrium, the frequencies of the two alleles (A and a) can be determined from the frequency of the *autosomal recessive* disorder in the population. The diseased individuals have genotype aa . If the population is in Hardy-Weinberg equilibrium, $f(AA) = p^2$, $f(Aa) = 2pq$ and $f(aa) = q^2$.

The frequency of recessive homozygotes must correspond to q^2 .

Since, $1/10,000$ shows the recessive trait, this is q^2 .

Therefore, $q = \sqrt{1/10,000} = \sqrt{0.0001} = 0.01$.

Since, $p + q = 1$, then $p = 1 - 0.01 = 0.99$.

So, in this population in Hardy-Weinberg equilibrium, the frequency of allele A (p) is approximately 0.99, and the frequency of allele a (q) is approximately 0.01.



Which of the following model represents logistic population growth curve?

1. $N_t = N_0 \lambda t$
2. $N_t = N_0 e^{rt}$
3. $\frac{dN}{dt} = rN(1-N/K)$ ✓
4. $\ln 2/r$



Question No. 50 / Question ID: 458908888

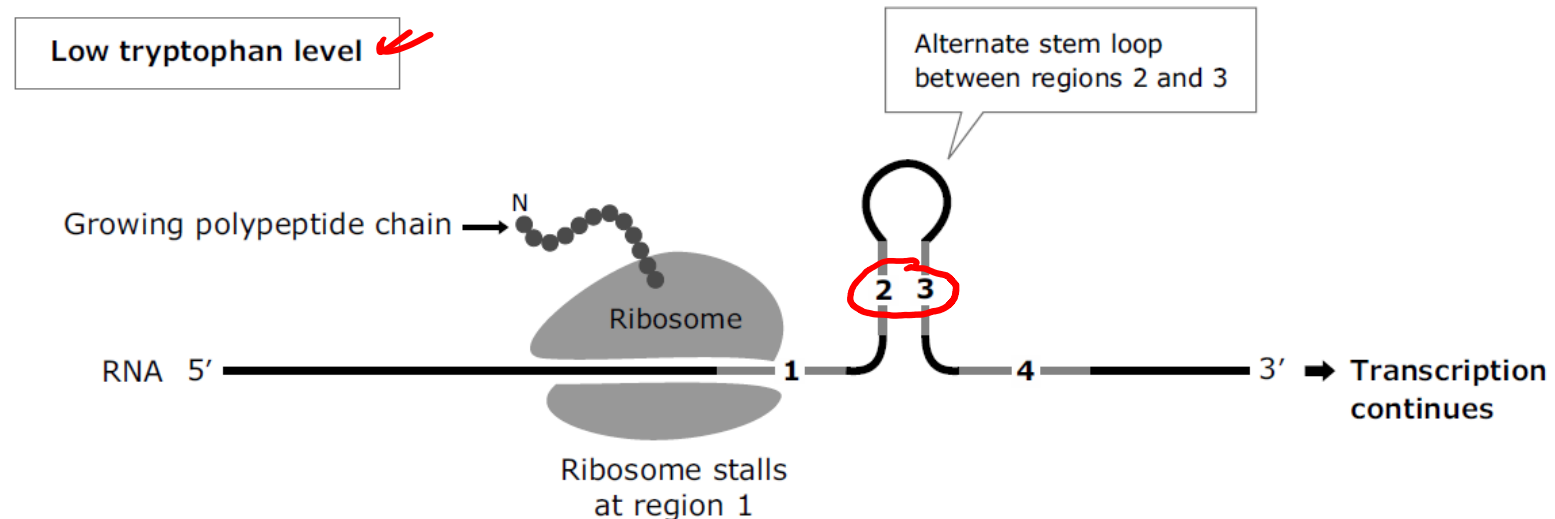


Escherichia coli cells are growing in a tryptophan-limiting condition.

Which is *correct* about leader region of the *trp* operon?

1. Ribosomes are able to synthesize the leader peptide.
2. Regions 3 and 4 in the leader sequence form the terminator hairpin.
3. **Region 2 base pairs with region 3 leaving terminator region of the leader sequence single stranded.** ↙
4. Regions 1 and 2 base pair and prevent ribosome binding.

Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition





Which of the following best describes why some Iguana lizards shifted to marine life on the Galapagos islands?

1. **Pressure of Iguana overcrowding and competition for food drove some members of the population out of the terrestrial habitat. //**
2. Volcanic eruption wiped away all the terrestrial Iguana species.
3. Intense competition with pre-existing mammalian species drove them to the sea.
4. The Iguana lizard shifting to marine life is a consequence of modern human predatory activities.



Which one of the following statement is INCORRECT according to the Hardy-Weinberg law?

1. This law is applied to calculate the genotype frequencies in the next generation from the allele frequencies in the current generation.
2. **Hardy-Weinberg equilibrium applies only to X-linked loci.** ✓
3. This law can be used to calculate allele frequencies from the genotype frequencies within a single generation.
- 4.. **This law does not apply when the two alleles have differential effect on the phenotype.** ✓

Question No. 53 / Question ID: 458908898



The layer of the shoot apical meristem that gives rise to the vascular bundles during leaf development in dicots is _____.

1. L1
2. L2
3. L3 ✓
4. L4

Life Sciences, Fundamentals and practice, Part-2 [plant physiology] 9th Edition

Figure 3.66 Longitudinal section through the center of the shoot apex. Shoot apical meristem having three cell layers (L1, L2

Question No. 54 / Question ID: 458908910



Arrange the following events in chronological order:

- A. Splicing of RNA molecule
- B. Migration of RNA molecule to cytoplasm
- C. Guanyl capping of RNA molecule
- D. Degradation of mRNA molecule

Which of the following is *correct*?



Correct Option: 2

Question No. 55 / Question ID: 458908913



Which of the following statement is *correct* with respect to cleavage of the given peptide?

Cys - Ser - Pro - Lys ↓ Gly - Met

1. Trypsin will cleave at the N terminus of Gly
2. Trypsin will cleave at the C terminus of Gly
3. Trypsin will cleave at the N terminus of Lys
4. Trypsin will cleave at the C terminus of Lys ✓

Life Sciences, Fundamentals and practice, Part-1 [chapter 1] 9th Edition

Problem ✓

Which of the labeled bonds (a–e) is cleaved by trypsin at pH 7.0?

Lys a Arg b Pro c Lys d Arg e Gly

Solution: Trypsin is an endopeptidase that breaks internal peptide bonds. Hence, it will not cleave peptide bonds at *a* and *e*. Its cleavage site is the carboxyl side of Lys and Arg, but there should be no proline at the carboxyl side. Hence it will not cut at *b*. Thus, only the cleavage site is *d*.



Catechol-O-Methyltransferase (COMT) is not involved in breakdown of which of the following neurotransmitters?

1. Epinephrine
2. Nor-epinephrine
3. 3,4 dihydroxymandelic acid
4. **Acetylcholine**



Question No. 57 / Question ID: 458908917



Which of the following statement is *correct*?

1. **r -strategic species reproduce profusely with a short vegetative growth period. ✓**
2. K-strategic species have short vegetative growth period and allocate more energy to reproduction.
3. r -strategic species have long vegetative growth period and allocate relatively less energy to reproduction.
4. Both r -and K-strategists have long vegetative growth period .

Life Sciences, Fundamentals and practice, Part-2 [ecology] 9th Edition

	r-Selection	K-Selection
Environment	Variable and unpredictable; uncertain	Fairly constant or predictable; more certain
Mortality	Nondirected, density independent	More directed, density dependent
Survivorship	Often type III	Usually types I or II
Population size	Variable in time, nonequilibrium, usually well below carrying capacity of environment	Fairly constant in time, equilibrium, at or near carrying capacity of the environment
Rate of development	Rapid development	Slower development
r	High	Low
Age of reproduction	Early reproduction	Delayed reproduction
Body size	Small	Larger
Reproductive event	Semelparity	Iteroparity
Number of offspring	Many small offsprings	Fewer, larger offsprings
Social organization	Low level	High level
Parental care	Minimal	Usually great
Competitive ability	Usually poor	Usually high
Investment in defence	Low energetic investment	High energetic investment



Methylene blue and crystal violet are examples of:

- ✓ 1. Basic dyes
2. Basic and acidic dyes, respectively
3. Acidic and basic dyes, respectively
4. Acidic dyes

✓ Life Sciences, Fundamentals and practice, Part-1 [PK and virus]

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Staining is a biochemical technique of coloring specimens. Dyes are used to stain specimens. Generally, dyes are organic compounds consisting of two functional chemical groups – one group gives dyes its characteristic color, while another group contains an ionizable chemical structure, which helps to solubilize the dye and facilitates its binding to different structures. Previously, dyes were classified as acidic or basic, depending upon whether the dye was negatively or positively charged at neutral pH. More accurately, dyes can be referred to as anionic or cationic. **Cationic** or **basic dyes** (such as crystal violet, methylene blue, safranin, malachite green) will react with groups that have a negative charge. **Anionic** or **acidic dyes** (such as eosin, acid fuchsin) will react with groups that have a positive charge.



Which of the following is correct about the synthesis of carbohydrates in plants?

1. **Starch is synthesized in the chloroplast and sucrose is synthesized in the cytosol.** ✓
2. Sucrose is synthesized in the chloroplast and starch is synthesized in the cytosol.
3. Both are synthesized in the chloroplasts.
4. Both are synthesized in the cytosol.

Life Sciences, Fundamentals and practice, Part-1 [metabolism] 9th Edition

Starch synthesis: It is synthesized from triose phosphate in chloroplasts. Triose phosphate is converted into glucose 1-phosphate. Glucose-1-phosphate is activated to **ADP-glucose**. This reaction is catalyzed by the enzyme ADP-glucose pyrophosphorylase. The glucose residue is finally transferred by *starch synthases* from ADP-glucose to the nonreducing end (carbon 4) of the terminal glucose of a growing starch chain. Branches are formed by a *branching enzyme*. At certain chain lengths, the polysaccharide chain is cleaved at the ($\alpha 1 \rightarrow 4$) glycosidic bond and the chain fragment thus separated is connected via a newly formed ($\alpha 1 \rightarrow 6$) bond to a neighboring chain.

Question No. 60 / Question ID: 458908895



Which of the following characterizes the Dauer stage larvae of *C.elegans*? ✓

1. Feeding and metabolically active
2. Feeding and metabolically dormant
3. Non-feeding and metabolically active
4. **Non-feeding and metabolically dormant**





Which RNA virus causes cancer in humans?

1. Human Herpes virus
2. Human Papilloma virus
3. **Human T-cell leukemia virus-I**
4. Epstein-Barr virus

Life Sciences, Fundamentals and practice, Part-1 [cell biology] 9th Edition

RNA-containing oncovirus, such as transforming retrovirus contain oncogenes. Viral oncogenes were first reported in Rous Sarcoma virus by Peyton Rous in 1911, which transforms chicken embryo fibroblasts in culture and induces sarcoma. The first oncogene, originally found in the Rous sarcoma virus, was designated as the *src* oncogene. Some examples of *RNA-containing oncoviruses* that cause human cancer are Human T-cell lymphotropic virus-1, HTLV-1 (*Adult T-cell leukemia/lymphoma*), and HTLV-2 (*Hairy cell leukemia*).

Question No. 62 / Question ID: 458908911 ✓



The standard free energy change for the reaction: $\text{Glucose} + \text{Pi} \rightarrow \text{Glucose-6-phosphate}$ $\Delta G = 15 \text{ kJ/mol}$

And the standard free energy change for the reaction: $\text{ATP} \rightarrow \text{ADP} + \text{Pi}$ $\Delta G = -30.5 \text{ kJ/mol}$ ✓

What is the free energy change for the following reaction?



1. - 45.5 kJ/mol

3. 15.5 kJ/mol

2. - 15.5 kJ/mol

4. 45.5 kJ/mol ✓

Life Sciences, Fundamentals and practice, Part-1 [chapter 1]

Standard free-energy changes of coupled reactions are additive

According to thermodynamics principles, the overall free-energy change for a chemically coupled series of reactions is equal to the sum of the free energy changes of the individual steps. For example, in the case of two sequential chemical reactions, $A \rightleftharpoons B$ and $B \rightleftharpoons C$, each reaction has its own equilibrium constant and characteristic standard free energy change, $\Delta G_1^{0'}$ and $\Delta G_2^{0'}$. As the two reactions are sequential, B cancels out to give the overall reaction $A \rightleftharpoons C$, which has its own equilibrium constant and thus its own standard free-energy change, $\Delta G_{\text{total}}^{0'}$. For the overall reaction $A \rightleftharpoons C$, $\Delta G_{\text{total}}^{0'}$ is the sum of individual standard free-energy changes, $\Delta G_1^{0'}$ and $\Delta G_2^{0'}$, of the two reactions: $\Delta G_{\text{total}}^{0'} = \Delta G_1^{0'} + \Delta G_2^{0'}$.

	$A \rightleftharpoons B$	Standard free energy change = $\Delta G_1^{0'}$
	$B \rightleftharpoons C$	Standard free energy change = $\Delta G_2^{0'}$
Overall reaction	$A \rightleftharpoons C$	Standard free energy change = $\Delta G_{\text{total}}^{0'} = \Delta G_1^{0'} + \Delta G_2^{0'}$



Which of the following statement is *correct* for a cell undergoing cell cycle exit in mitosis? ✓

1. **APC/C ubiquitin ligase is active.** ✓
2. p21 is active.
3. p16 is inactive.
4. Wee1 kinase is active.

Life Sciences, Fundamentals and practice, Part-2 [cell biology]

9th Edition

After the proper association of all chromosomes with spindle microtubules has occurred, the M-CDK complexes activate the APC/C. Thus, M-CDK not only triggers the early mitotic events leading up to metaphase, but it also sets the stage for progression into anaphase. APC/C acts on different substrates at different times. APC/C functions in coordination with two homologous mitotic coactivators, **Cdc20** and **Cdh1** (Cdc20 homologue 1). APC/C initiates the metaphase-anaphase transition through mediating the ubiquitination and degradation of *M-cyclin* and *securin*. **Securin** holds enzyme separase, a ubiquitous **cysteine protease**, in an inactive state. The destruction of securin allows separase to cleave **Sccl**, a subunit of the cohesin which holds the sister chromatids together.

Question No. 64 / Question ID: 458908909



Given below are two statements:

Statement I: β -oxidation of fatty acids generates NADPH.

Statement II: Pentose phosphate pathway generates ATP.

In the light the above statements, choose the *correct* answer from the options given below:

1. Both Statement I and Statement II are *correct*
2. **Both Statement I and Statement II are *incorrect***
3. Statement I is *correct* but Statement II is *incorrect*
4. Statement I is *incorrect* but Statement II is *correct*

Life Sciences, Fundamentals and practice, Part-1 [metabolism]

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The pentose phosphate pathway is fundamentally different from glycolytic pathway. In pentose phosphate pathway, oxidation of glucose 6-phosphate utilizes NADP^+ rather than NAD^+ and produces CO_2 , whereas glycolytic process utilizes NAD^+ and does not produce CO_2 . Similarly, no ATP is generated in the pentose phosphate pathway, whereas it is a major product of glycolysis.

Question No. 65 / Question ID: 458908918



Match List I with List II

List I

- A. Endospore ✓
- B. Flagella
- C. Capsule
- D. DNA

List II

- I. Carbofuchsin
- II. India ink
- III. DAPI
- IV. Malachite green

Choose the *correct* answer from the options given below:

- 1. A-IV, B-II, C-I, D-III
- 2. A-II, B-IV, C-I, D-III
- 3. **A-IV, B-I, C-II, D-III** //
- 4. A-II, B-I, C-IV, D-III

Life Sciences, Fundamentals and practice, Part-1 [PK and virus]

The endospore contains large amount of **dipicolinic acid** complexed with calcium ions. It is thought to contribute to the endospore's heat resistance. Endospore morphology and location vary with species. Hence staining is used to determine the morphology and location. The most commonly used endospore stain is the **Schaeffer-Fulton endospore stain**. Staining of endospore through *Schaeffer-Fulton* procedure first involves heating of bacteria with **malachite green** that penetrates endospores. It gives the endospore green color. After the malachite treatment cell is washed with water and is counterstained with safranin.

Question No. 66 / Question ID: 458908907



A specimen selected by a competent worker from the original materials studied by the author of the species when no holotype was designated or holotype is destroyed/ lost is known as

1. Isotype
2. **Lectotype** ✓
3. Neotype
4. Paratype

Life Sciences, Fundamentals and practice, Part-1 [diversity of life]

- Holotype:** A single specimen designated by the original author as the definitive reference for a newly described species.
- Paratypes:** Additional specimens cited in the original description that help illustrate the variability within a species. Paratypes are not holotypes but provide supporting evidence.
- Isotype:** An isotype is a duplicate specimen of the holotype, collected at the same time by the same person from the same population.
- Lectotype:** A single specimen selected later from a set of syntypes to serve as the primary reference when no holotype was designated initially.
- Neotype:** A specimen chosen to replace a lost, destroyed, or missing holotype when no original material is available.
- Syntype:** When multiple specimens were used in the original description but no single holotype was designated, all specimens used are considered syntypes.



Which one of the following is an INCORRECT statement related to eutrophication?

1. Cultural eutrophication is greatly accelerating eutrophication of lakes worldwide.
2. Planktons are less abundant in eutrophic lakes than oligotrophic and mesotrophic lakes.
3. Carp fish are often abundant in eutrophic lakes because they are adapted to live in warm, shallow, turbid, and oxygen poor waters.
4. Algal bloom is created when average concentration of soluble inorganic nitrogen exceeds 0.30 ppm and soluble inorganic phosphate content exceeds 0.01 ppm.

Life Sciences, Fundamentals and practice, Part-1 [ecology]

9th Edition

Cultural eutrophication: It occurs due to excessive discharge of inorganic nutrients into the water bodies due to human activities. Nutrients can come from many sources, such as fertilizers applied to agricultural fields and sewage treatment plant discharges. Excessive algal growth eventually leads to death and decomposition of algae which reduce dissolved oxygen in the water. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia and severe reductions in aquatic animal populations may occur.

Question No. 68 / Question ID: 458908886



In an *E. coli* cell, the fractions of various macromolecules are: -

1. Proteins 23%, Nucleic acids 9%, Lipids 55% ✗
2. Proteins 23%, Nucleic acids 55%, Lipids 9% ✗
3. ✓ Proteins [~]55%, Nucleic acids 23%, Lipids 9% ✓
4. Proteins 55%, Nucleic acids 9%, Lipids 23% ✓

Question No. 69 / Question ID: 458908891



Which of the following is/are characteristic feature(/s) of ~~CPSF~~ (cleavage and polyadenylation specificity factor) in the generation of 3' ends of mRNA?

- A. Recruit poly(A)polymerase
- B. Modifies the 5' end of a nascent mRNA by adding 7-methyl guanosine cap
- C. Is an endonuclease ✗
- D. Is an exonuclease

Choose the *correct* answer from the options given bellow:

- 1. A and D Only
- 2. ~~A~~ and ~~C~~ Only (only A is correct) //
- 3. B and D Only
- 4. B, C, and D Only



Life Sciences, Fundamentals and practice, Part-2 [genetics]

9th Edition

A single processing complex undertakes both the cleavage and polyadenylation. The signal is needed for both cleavage and polyadenylation. In mammals, polyadenylation is directed by a signal sequence called **poly(A) signal** in the mRNA, almost invariably 5'-AAUAAA-3'. It is located between 10 to 30 nucleotides upstream of the **polyadenylation site**. ≤30 nucleotides downstream of the polyadenylation site is a **GU-rich** (or U-rich) downstream element. Both the poly(A) signal sequence and the GU-rich elements are binding sites for multi-subunit protein complexes, which are, respectively, the **cleavage and polyadenylation specificity factor (CPSF)** and the **cleavage stimulation factor (CstF)**. Generation of poly-A tail at 3' terminus first requires cleavage factors – CFI and CFII – which act as endonucleases to cleave the RNA at polyadenylation site. Cleavage is followed by polyadenylation in a tightly coupled manner. The poly(A) polymerase catalyzes the polyadenylation reaction in **template independent manner**. Its substrate is ATP. The polyadenylation reaction passes through two stages. First, a rather short oligo-A sequence (~10 residues) is added to the 3' end. In the second phase, the oligo-A tail is extended to the full ~200 residue length. This reaction requires another stimulatory factor that recognizes the oligo-A tail. This additional factor includes **poly-adenylate-binding protein (PABP)**, which helps the polymerase to add the adenosines, possibly influences the length of the poly-A tail that is synthesized and appears to play a role in the maintenance of the tail after synthesis.



The region of hippocampus in the adult brain where new neurons are formed is _____.

1. Granular layer.
2. **Subventricular zone.**
3. Cortex.
4. Ventricular zone.





PART - C



Question No. 71 / Question ID : 458908977



Given below are two statements:

Statement I: Ca^{2+} activates pyruvate dehydrogenase kinase.

Statement II: Pyruvate dehydrogenase activity is unaffected by cAMP.

In the light of the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are correct
2. Both Statement I and Statement II are incorrect
3. Statement I is correct but Statement II is incorrect //
4. Statement I is incorrect but Statement II is correct



The following statements are related to the regulation of the enzyme nitrate reductase.

- A. Light, carbohydrate levels, and other environmental factors activate the enzymes by dephosphorylation. ✓
- B. Light, carbohydrate levels, and other environmental factors inactivate the enzymes by dephosphorylation.
- C. Darkness and Mg^{2+} inactivate the enzyme by phosphorylation. ✓
- D. Darkness and Mg^{2+} activate the enzyme by dephosphorylation.

Choose the correct answer from the options given below:

- 1. **A and C Only** ✓✓
- 2. A and D Only
- 3. Band C Only
- 4. B and D Only

Question No. 73 / Question ID : 458908950



A typical NGS-based exome sequence experiment aims to achieve 100X coverage for a eukaryotic genome of 50 Mb. What is the minimum amount of sequence data needed to achieve this goal?

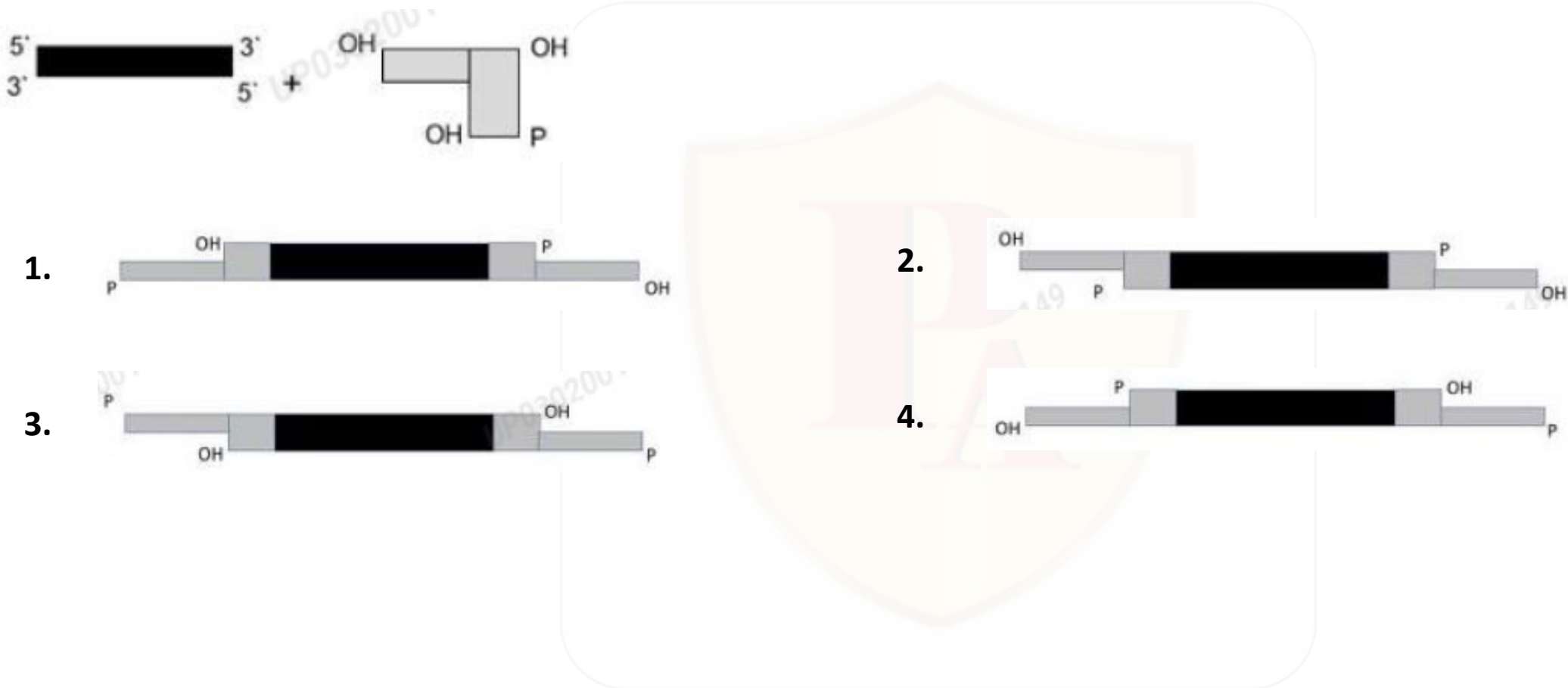
1. 500 Mb
2. 5 Gb
3. 50 Gb
4. 500 Gb



Question No. 74 / Question ID : 458908983



A researcher ligated a D A sequence with adaptors and phosphorylated the ends using T4 DNA polynucleotide kinase, as shown: Which of the following is the correct product?



Correct Option: 3 ✓



The activity of which enzyme of C3 pathway will be maximally inhibited when a plant is suddenly brought to dark from light?

1. Hexokinase
2. **Fructose-1,6-bisphosphatase** ✓
3. Transketolase
4. ATP synthase

Life Sciences, Fundamentals and practice, Part-1 [metabolism]

9th Edition

sensitive to the redox potential of the chloroplast stromal compartment. Bisphosphatases are active in their *reduced state* only sensing the oxidation state of PSI. The mediator molecule is the small protein **thioredoxin**. Thioredoxin is coupled to ferredoxin by ferredoxin-thioredoxin reductase. Thioredoxin also inhibits *phosphofructokinase*. In plant cells, light stimulates the Calvin cycle enzymes (PSI being the strong reductant) and inhibits glycolysis. The light activation is mediated by thioredoxin. In the light, thioredoxin is reduced by electrons moving from PSI through **ferredoxin** (Fd), then thioredoxin reduces critical disulfide bonds in enzymes such as sedoheptulose 1,7-bisphosphatase and fructose 1,6-bisphosphatase, activating these enzymes. In the dark, the -SH groups undergo reoxidation to disulfides, inactivating the enzymes.



Which of the following statement is INCORRECT about classical MHC genes?

1. MHC Class I genes encode proteins that present cytosolic peptide antigens to CD8⁺ T cells.
2. Proteins encoded by MHC Class III genes do not play a direct role in presenting antigen to T cells.
3. Glycoproteins encoded by MHC Class II genes primarily present exogenous peptide antigen to CD4⁺ T cells.
4. **MHC Class III gene products are predominantly expressed on macrophages, dendritic cells, and B cells.**

Life Sciences, Fundamentals and practice, Part-1 [immunology] 9th Edition



Regular chewing of bubble gum containing sucrose results in tooth decay because

1. **Sucrose in bubble gum causes a decrease in pH and the acid erodes tooth enamel**
2. Sucrose in bubble gum causes an increase in pH and alkalinity attacks tooth enamel
3. Sucrose in bubble gum causes no change in pH and promotes mechanical damage of tooth enamel
4. Sucrose in bubble gum causes no changes in pH and promote thermogenic damage of tooth enamel



Given below are two statements:

Statement I: To analyze rolling circle replication, Southern blotting is performed under non-denaturing conditions. ✓

Statement II: UV crosslinking primarily involves pyrimidine nucleotides.

In the light of the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are correct ✓
2. Both Statement I and Statement II are incorrect
3. Statement I is correct but Statement II is incorrect
4. Statement I is incorrect but Statement II is correct

Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

Question No. 79 / Question ID : 458908935



Rhodopsin, photosensitive GPCR in rod cells comprises the protein linked to 11-cis retinal. The presence of light induces:

1. **Isomerization of the 11-cis retinal moiety to all-trans retinal** ✓
2. Isomerization of trans retinal moiety to all-cis retinal
3. Polymerization of 11-cis retinal moiety and trans retinal
4. Breakdown of 11-cis retinal moiety to small components which further couples with GPCR

Life Sciences, Fundamentals and practice, Part-1 [cell biology] 9th Edition

Retinal is a component of the visual pigments of rod and cone cells. **Rhodopsin**, the visual pigment of the rod cells in the retina, consists of **11-cis retinal** specifically bound to the protein **opsin**. In the dark, retinal of rhodopsin is in the *11-cis form*. When rhodopsin is exposed to light, **11-cis retinal** undergoes a series of photochemical reactions that convert it to **all-trans retinal**. This process triggers a nerve impulse that is transmitted by the optic nerve to the brain. Regeneration of rhodopsin requires the isomerization of all-trans retinal back to 11-cis retinal.

Question No. 80 / Question ID : 458908978



Match List I with List II

List I

- A. Glycine
- B. Threonine
- c. Cysteine
- D. Histidine

List II

- I. Imidazole side chain
- II. Sulfhydryl side chain
- III. Uncharged polar side chain ✓
- IV. non polar side chain

Choose the correct answer from the options given below:

- 1. A-IV, B-III, C-II, D-I ✓
- 2. A-III, B-IV, C-I, D-II
- 3. A-II, B-IV, C-III, D-I
- 4. A-IV, B-II, C-III, D-I

Life Sciences, Fundamentals and practice, Part-1 [chapter-1] 9th Edition

Question No. 81 / Question ID : 458908944



Identify the type of ecological succession based on gross production (P) and community respiration (R) relationship when $P > R$.

1. Allogenic
2. Autotrophic✓
3. Heterotrophic
4. Secondary

Life Sciences, Fundamentals and practice, Part-1 [ecology] 9th Edition

Autotrophic and heterotrophic succession

The succession where initially the photoautotrophs are much greater in quantity than the heterotrophs, is known as *autotrophic succession* i.e., succession begins with $P > R$. Such a succession takes place in a medium rich in inorganic substances. In *heterotrophic succession*, the heterotrophs, like animals and fungi are present in greater quantity in the initial stages i.e., succession begins with $P < R$. It begins, prominently in an organic environment, and there is a progressive decline in the energy content.

Question No. 82 / Question ID : 458908967



Which of the following rate equation is correct when malonate is added to a stereospecific dehydrogenation of succinate to fumarate catalyzed by succinate dehydrogenase?

1.
$$v = \frac{V_{max} [S]}{K_M + [S]}$$

2.
$$v = \frac{V_{max} [S]}{K_M (1 + [I]/K_I) + [S]}$$

3.
$$v = \frac{V_{max} (1 + [I]/K_I) \cdot [S]}{K_M + [S]}$$

4.
$$v = \frac{V_{max} [S]}{K_M + [S] (1 + [I]/K_I)}$$

Life Sciences, Fundamentals and practice, Part-1 [chapter -1]

K_I is the enzyme inhibition constant (also known as inhibitor dissociation constant) is an *equilibrium constant* used to describe the binding affinity between an inhibitor and its corresponding enzyme. In the presence of a competitive inhibitor, the Michaelis-Menten equation becomes

$$V_0 = \frac{V_{max} [S]}{\alpha K_m + [S]} \quad \text{Where, } \alpha = 1 + \frac{[I]}{K_I} \quad \text{and} \quad K_I = \frac{[E][I]}{[EI]}$$



A protein with four identical subunits shows:

- 1. Cyclic C₄ and Dihedral D₂ symmetry**
2. Cyclic C₂ and Icosahedral symmetry
3. Cyclic C₃ and Octahedral symmetry
4. Cyclic C₃ and Icosahedral symmetry .



Question No. 84 / Question ID : 458908976



The half-life of a radionuclide with a decay constant of $2 \times 10^{-2} \text{ min}^{-1}$ is:

1. 0.35 min
2. 3.46 min
3. 34.50 min (it should be) ✎
4. 346.50 min ·



Question No. 85 / Question ID : 58908965



An enzyme has K_M of $16 \mu\text{M}$ in the absence of a competitive inhibitor and K_M^{app} of $24 \mu\text{M}$ in the presence of $6 \mu\text{M}$ of the inhibitor. Calculate K_i

1. $8 \mu\text{M}$
2. $4 \mu\text{M}$
3. $6 \mu\text{M}$
4. $12 \mu\text{M}$ ✓

Life Sciences, Fundamentals and practice, Part-1 [chapter 1]

9th Edition

K_i is the enzyme inhibition constant (also known as inhibitor dissociation constant) is an *equilibrium constant* used to describe the binding affinity between an inhibitor and its corresponding enzyme. In the presence of a competitive inhibitor, the Michaelis-Menten equation becomes

$$V_0 = \frac{V_{\max} [S]}{\alpha K_m + [S]} \quad \text{Where, } \alpha = 1 + \frac{[I]}{K_i} \quad \text{and} \quad K_i = \frac{[E][I]}{[EI]}$$

$$\text{'Apparent' } K_m = \alpha K_m$$

Question No. 86 / Question ID : 458908956



Cancer cells de-emphasize oxidative phosphorylation even when oxygen is plentiful, taking up glucose in large quantity. This phenomenon is explained by:

1. Glycolysis is the most efficient way of ATP production required by the cancer cells to proliferate.
2. **Despite the inefficient way of ATP production, glycolysis subsequently leads to the production of intermediate metabolites essential for the synthesis of proteins and nucleic acids that enable cellular proliferation.**
3. Warburg effect states oxidative phosphorylation is preferred by the cancer cells under aerobic condition. Under anerobic condition glycolysis is the only option for cancer cells for energy production.
4. Oxidative phosphorylation is the most efficient way to manage energy production, hence cancer cells do not deemphasize but switch to oxidative phosphorylation despite glucose availability.

Life Sciences, Fundamentals and practice, Part-1 [metabolism]

Most cancer cells are characterized by increased glucose uptake and aerobic glycolysis. A very high rate of glycolysis followed by lactic acid fermentation, even in the presence of oxygen and fully functioning mitochondria is known as the **aerobic glycolysis** (or 'Warburg effect'). Increased aerobic glycolysis is uniquely observed in cancer cells. It was Otto Warburg who demonstrated in 1924 that cancer cells show an increased dependence on glycolysis to meet their energy needs, regardless of whether they were well-oxygenated. Converting glucose to lactate, rather than metabolizing it through oxidative phosphorylation in the mitochondria, is far less efficient as less ATP is generated per unit of glucose metabolized. Nevertheless, cancer cells perform aerobic glycolysis. Therefore, a high rate of glucose uptake is required to meet increased energy needs to support rapid tumor progression.

Previously, it was thought the Warburg effect was a consequence of damage to the mitochondria or an adaptation to hypoxic conditions during the early avascular phase of tumor development. But this hypothesis has been shown to be incorrect. In the last 90 years, several hypotheses have been suggested, to this date, there is no clear explanation of this rather unusual effect.



Which of the following transcription factor is involved in the functioning of phytochrome receptors in plants?

1. PIF
2. WRKY
3. SEUSS
4. STM

Life Sciences, Fundamentals and practice, Part-1 [plant physiology] 9th Edition

the COP1/SPA complex, **PIFs** (phytochrome-interacting factors) compose another key class of negatively acting transcription factors in the phytochrome signaling cascade. PIFs (PIF1 to PIF8) are a subset of bHLH transcription factors that negatively regulate photomorphogenesis. The PIF proteins contain phytochrome interacting domains in the N-terminal region and bHLH (basic helix-loop-helix) DNA binding and dimerization domains at their C-terminus.



Given below are two statements:

Statement I: Vapour Pressure Deficit (VPD) is the difference between the partial pressure of water vapour at saturation and the actual vapour pressure.

Statement II: VPD is a measure of moisture relation because evaporation tend to be proportional to VPD rather than to relative humidity.

In the light of the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are correct✓
2. Both Statement I and Statement II are incorrect
3. Statement I is correct but Statement II is incorrect
4. Statement I is incorrect but Statement II is correct



✓ Which of the following best describes how cDNA library is synthesized from human liver tissue? ^{SP -}

1. Use of oligo dT primers with reverse transcriptase followed by amplification with random hexamers
2. Use of random hexamers with Taq polymerase followed by amplification with oligo dT primers
3. Use of oligo dT primers with Taq polymerase and amplification with random hexamers
4. Use of random hexamers with reverse transcriptase followed by amplification with oligo dT primers

Question No. 90 / Question ID : 458908923



Tetramethyl silane (TMS) is used as an internal standard in proton NMR studies because:

- A. None of the protons in this compound are identical
- B. TMS is insoluble in most organic liquids
- C. TMS gives a single peak
- D. TMS is inert

Choose the correct answer from the options given below:

- 1. A, B, and C only ✗
- 2. B, C, and D only
- 3. A and C only ✗
- 4. C and D only

Biophysics and Molecular Biology: Tools and Techniques, 5th Edition

The less shielded a proton is, the greater is its chemical shift. Thus, protons *b* undergo resonance at a greater frequency than protons *a*. These frequency differences are due to the different chemical environments of protons *a* and *b*. Hence, there are two separate absorption peaks for protons *a* and *b* in ^1H NMR spectrum. This variation in frequency is known as the **chemical shift** and it is denoted by δ . It is defined as the difference between its resonance frequency and that of the protons in the reference compound *tetramethylsilane* (TMS). The absorption position of TMS defines the $\delta = 0$ position on the x-axis of each spectrum. TMS is used as a standard because it has a single strong absorption, it is chemically inert, and its chemical shift is smaller than that of most common organic compounds.

Question No. 91 / Question ID : 458908958



SOCS-2 is a negative regulator of cytokine signaling. *socs-2knockout* mice were phenotypically larger in size as compared to the wild type. Their lifespan was not affected. This defect is, therefore, due to:

1. Downregulated cytokine signaling and elevated levels of growth hormones
2. Reduced *SOCS-2* levels which could potentially promotes cytokine signaling
3. **Elevated cytokine signaling which could play** a significant role in regulating cell growth
4. Inhibition of mTOR pathway which is associated with cell size



Which of the following statement is correct for histidine biosynthesis in eukaryotes?

1. Transcriptional attenuation takes place because of pairing between leader regions 1 and 2.
2. Transcriptional attenuation takes place because of the formation of termination loops between leader regions 3 and 4.
3. Antitermination loop is formed between leader regions 2 and 3.
4. **Transcriptional attenuation will not take place.**

Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

Problem

Why gene regulation by the process of translation mediated transcriptional attenuation is absent in eukaryotic organisms?

Solution: The process of attenuation occurs when translation and transcription operate simultaneously. In eukaryotic organisms, these two processes occur at two different times and two different places. Hence, regulation of transcription by attenuation does not occur in eukaryotes. ✓

Question No. 93 / Question ID : 458908949



Which of the following statement is correct regarding heterodimeric transcription factor NF- κ B in resting cells?

1. It is composed of p50 and p65 subunits bound to I- κ Ba in the cytosol.
2. It is composed of p50 and p65 subunits bound to I- κ Ba in the nucleus.
3. It is composed of p53 and p65 subunits bound to I- κ Ba in the cytosol.
4. It is composed of p21 and p65 subunits bound to I- κ Ba in the nucleus.



Which of the following conditions must be used to separate two proteins with following characteristics?

Protein	Molecular weight (in kDa)	pI
A	115	5.1
B	115	7.0

1. 10% PAGE for IEF pH 3-12 and 20% SDS-PAGE
2. 4% PAGE for IEF pH 3-12 and 10% SDS-PAGE
3. 4% PAGE for IEF pH 3-12 and 20% SDS-PAGE
4. 12% PAGE for IEF pH 3-12 and 10% SDS-PAGE

Question No. 95 / Question ID : 458908971



Flower color and pollen grain shapes are linked in sweet peas. Purple (F) is dominant to red (f) flower color and long pollen grains (L) are dominant to round pollen grains (l). If the parental genotype is FL/fl, what would be the recombinant genotype in the gametes?

1. FL and fl
2. Ff and Ll
3. Fl and fL ✓
4. FF and ll





The contributing genome in fertile allopolyploid species may be quantitatively different under which of the following condition?

1. **Polyploids created by hybridization between different species**
2. Polyploids created by chromosome duplication within a species
3. Polyploids created by hybridization within same species
4. The univalent solitary chromosome yields aneuploid cells during anaphase of first meiotic division

Question No. 97 / Question ID : 458908927



You are required to make 50 ml TE buffer (pH 8) containing 50 mM Tris-chloride (Tris-Cl) and 10 mM EDTA. You are given a stock solution of 2 M Tris-chloride and 0.5 M EDTA, calculate the volume required from the stock in each case for making TE buffer.

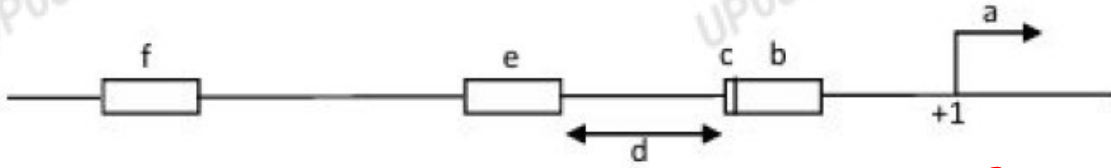
1. 1.0 ml Tris-Cl and 2.0 ml EDTA
2. 1.25 ml Tris-Cl and 1.0 ml EDTA ✓
3. 1.0 ml Tris-Cl and 1.25 ml EDTA
4. 2.0 ml Tris-Cl and 1.0 ml EDTA

Correct Option: 2

Question No. 98 / Question ID : 458908952



Match the labels (a-f) with the different components of a bacterial promoter as given below:



1. a: translation start site, b: extended - 10, c: - 10, d: spacer, e: - 35, f: UP element
2. a: transcription start site, b: extended - 10, c: - 10, d: spacer, e: - 35, f: UP element
3. a: translation start site, b: - 10, c: extended - 10, d: spacer, e: - 35, f: UP element
4. a: transcription start site, b: - 10, c: extended - 10, d: spacer, e: - 35, f: UP element



Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

The -10 sequence has the consensus 5' TATAAT 3' and the -35 sequence has consensus 5' TTGACA 3'. The -10 and -35 sequences are designated to reflect their approximate distances in nucleotides from the start site. The distance separating the -35 and -10 sequences is between 16 and 18 bp and -10 sequence, lying 6 to 7 bp upstream of the transcription start site. Some strong promoters have an AT-rich sequence located in 40 to 60 nucleotides upstream region. This is called the **UP element** (upstream promoter element). Unlike the -35 and -10 sequences within the promoter, it is not recognized by σ^{70} but is recognized by α CTD of the α -subunit of the RNA pol.

Question No. 99 / Question ID : 458908994



How will the photosynthesis be affected, if the atmospheric CO_2 concentration is doubled and temperature remains the same?

1. Photorespiration increases.
2. Decrease in carboxylation by RubisCo.
3. Calvin Cycle stops.
4. Increased carbon fixation by RubisCo. ✓



Question No. 100 / Question ID : 458908984



Two populations get geographically separated but during the initial stage of speciation they remain connected through gene flow. Which of the following best describes this mode of speciation?

1. Allopatric ✓
2. Parapatric ✓
3. Polyploid
4. Chromosomal speciation

Life Sciences, Fundamentals and practice, Part-2 [evolution] 9th Edition

Parapatric speciation is a form of speciation in which the evolution of reproductive isolating mechanisms occurs when a population enters a new niche or habitat *within the range of the parent species*. Generally, this occurs when there has been a drastic change in the environment within the original species habitat.

In parapatric speciation, there is no specific extrinsic barrier to gene flow. The population is continuous, but nonetheless, the population does not mate randomly. Individuals are more likely to mate with their geographic neighbours than with individuals in a different part of the population's range. In this mode, divergence may happen because of reduced gene flow within the population and varying selection pressures across the population's range.

Question No. 101 / Question ID : 458908931



Which would be the fractional saturation of Myoglobin when the partial pressure of oxygen is 30 torr?

- 1. 0.91 - 0.92 ✓
- 2. 0.84 - 0.85
- 3. 0.95 - 0.96
- 4. 0.88 - 0.89

Life Sciences, Part-1

$$Y = \frac{pO_2}{pO_2 + P_{50}}$$

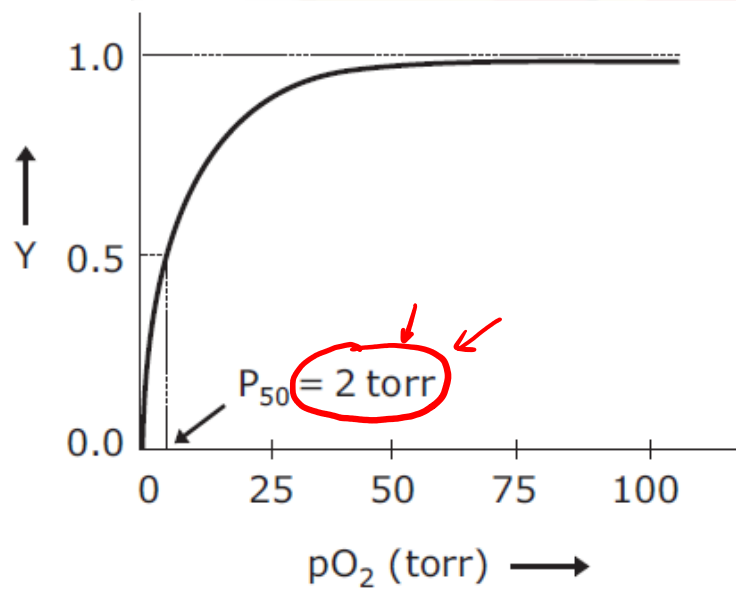


Figure 1.30

Oxygen binding curve of myoglobin.
(1 torr equals the pressure of 1 mm Hg at 0°C and standard gravity).



Which of the following event is NOT associated with jaundice?

1. Increased hemolysis, excess unconjugated bilirubin can appear in plasma
2. Blockage of intra hepatic biliary canaliculi
3. Blockage of bile duct
4. **Enhanced breakdown of bilirubin**





In relation to atmospheric gas composition and global warming:

- A. The atmosphere contains about 380 ppm CO₂ by volume.
- B. The concentration of CH₄ is about 1000 times less than that of CO₂ in the atmosphere but at least 20 times as potent at retaining heat.
- C. Ozone is more potent at retaining heat and is more in concentration compared to CO₂.
- D. Nitrogen oxides are more potent and persistent, and are in equal concentration compared to CO₂.

Choose the correct answer from the options given below:

- 1. **A and B Only**
- 2. B and C Only
- 3. A and C Only
- 4. A and D Only

Ecology and environment [climate change]



Which type of hypersensitivity is elicited in individuals injected intradermally with a filtrate derived from a mycobacterial culture?

- 1. Type 1
- 2. Type 2
- 3. Type 3
- 4. Type 4 ✓

Life Sciences, Fundamentals and practice, Part-1 [immunology] 9th Edition

Type IV hypersensitivity, commonly called **delayed type hypersensitivity**, is the only class of hypersensitive reactions which are triggered by antigen-specific T cells (cell-mediated immunity reactions). This is mediated by T cell dependent effector mechanisms involving T_H cells, primarily of the T_H1 subtype, but in a few cases T_C cells. Antibodies do not play a role in type IV hypersensitivity reactions. On activation, the T_H1 cells release cytokines that cause accumulation and activation of macrophages, which, in turn, cause local damage. The **tuberculin skin test** is an example of a type IV hypersensitivity. This test is done by putting a small amount of tuberculin purified protein derivative (PPD) under the top layer of skin. If any person has ever been exposed to the *Mycobacterium tuberculosis*, skin will react to the antigens by developing a firm red bump at the site within 2 days. It is a standard method of determining whether a person is infected with *Mycobacterium tuberculosis*.

Question No. 105 / Question ID: 458908960



An *E.coli* $seqA^-$ strain was constructed by an investigator. To make the *E.coli* $seqA^- lacZ^+$ strain, the *lacZ* gene can be transferred by:

- ✓ 1. Generalized transduction mediated via P1 phage ✓
2. Generalized transduction mediated via λ phage
3. Specialized transduction mediated via P1 phage
4. Specialized transduction mediated via P22 phage ✗

Question No. 106 / Question ID : 458908988



The common herbicide, paraquat, kills plants by disrupting:

1. Amino acid synthesis
2. Carotenoid biosynthesis
3. **Photosynthetic electron flow** ✓
4. Fatty acid synthesis

Life Sciences, Fundamentals and practice, Part-1 [metabolism]

9th Edition

Role of DCMU and paraquat: DCMU (3-(3,4 dichlorophenyl)-1,1 dimethylurea) or diuron, a herbicide, abolishes photosynthetic oxygen production because it competes with plastoquinone for the Q_B binding site of PSII and blocks electron flow from PSII to Cyt b_6f complex. Paraquat acts as a herbicide, blocks photosynthetic electron flow by intercepting electrons between the ferredoxin acceptors and $NADP^+$ and then reduces oxygen to superoxide ($O_2^{\bullet-}$). Superoxide is a free radical that reacts non-specifically with a wide range of molecules in the chloroplast, leading to the rapid loss of chloroplast activity.

Question No. 107 / Question ID : 458908947



Local anaesthetics like Procaine and Tetracaine act by:

- A. Blocking the sodium channels
- B. Exciting the sodium channels
- C. Reducing membrane excitability
- D. Increasing the membrane threshold

Choose the most appropriate answer from the options given below:

- 1. A and B Only
- 2. A, B, and C Only
- 3. A and C Only
- 4. D Only

Correct Option: 3 ✓

Question No. 108 / Question ID : 458908970



Analyze the sequence below:

ATG AAG TCA AAT CGA
 ↓

A change in the underlined C to G would result in:

1. Silent mutation
2. Frame shift mutation
3. **Nonsense mutation** ✓
4. Missense mutation



Question No. 109 / Question ID : 458908969



List I

- A. Facilitation ✓
- B. Initial floristic
- C. Tolerance ✓
- D. Inhibition ✓

List II

- I. Species traits are more important than model the prevailing environment
- II. One group of species may secrete model allelochemicals to prevent others to come
- III. A species creates favourable model environment for the next to come
- IV. Proposed by Connell and Slatyer model

Choose the correct answer from the options given below:

- 1. A-III, B-I, C-IV, D-II ✓
- 2. A-II, B-IV, C-I, D-III
- 3. A-I, B-IV, C-II, D-III
- 4. A-IV, B-II, C-III, D-I

Life Sciences, Fundamentals and practice, Part-1 [ecology] 9th Edition

Question No. 110 / Question ID : 458908990



Match List I with List II

List I

(Secondary metabolites)

A. Pyrethroids

B. Limonoids

C. Gibberellins

D. Carotenoids

List II

(Terpene type)

I. Triterpenes

II. Diterpenes

III. Monoterpenes

IV. Tetraterpenes

Choose the correct answer from the options given below:

1. A-IV, B-III, C-II, D-I

2. A-II, B-IV, C-I, D-III

3. **A-III, B-I, C-II, D-IV**

4. A-III, B-II, C-I, D-IV

Table 3.5 Classes of terpenes and their ecological significance

Terpene	Ecological significance	Example
Monoterpenes	Insecticidal activity	Pyrethroids
	Medicinal	Limonene, Camphor
Sesquiterpenes	Phytohormone	Abscissic acid
	Antibiotic	Pentalenolactone
	Anti-cancer	Gossypol
	Phytoalexin	Capsidiol
Diterpenes	Anti-cancer drug	Taxol
	Phytoalexin	Casbene
	Phytohormone	Gibberellin
	Antioxidant	Dihydroleucodine
Triterpenes	Membrane component	Sitosterol
Tetraterpenes	Plant pigment	β -carotene
Polyterpenes	Photosynthesis	Chlorophyll
	Electron transport	Plastoquinone
	Industrial raw material	Rubber

Life Sciences, Fundamentals and practice, Part-2

Question No. 111 / Question ID : 458908946

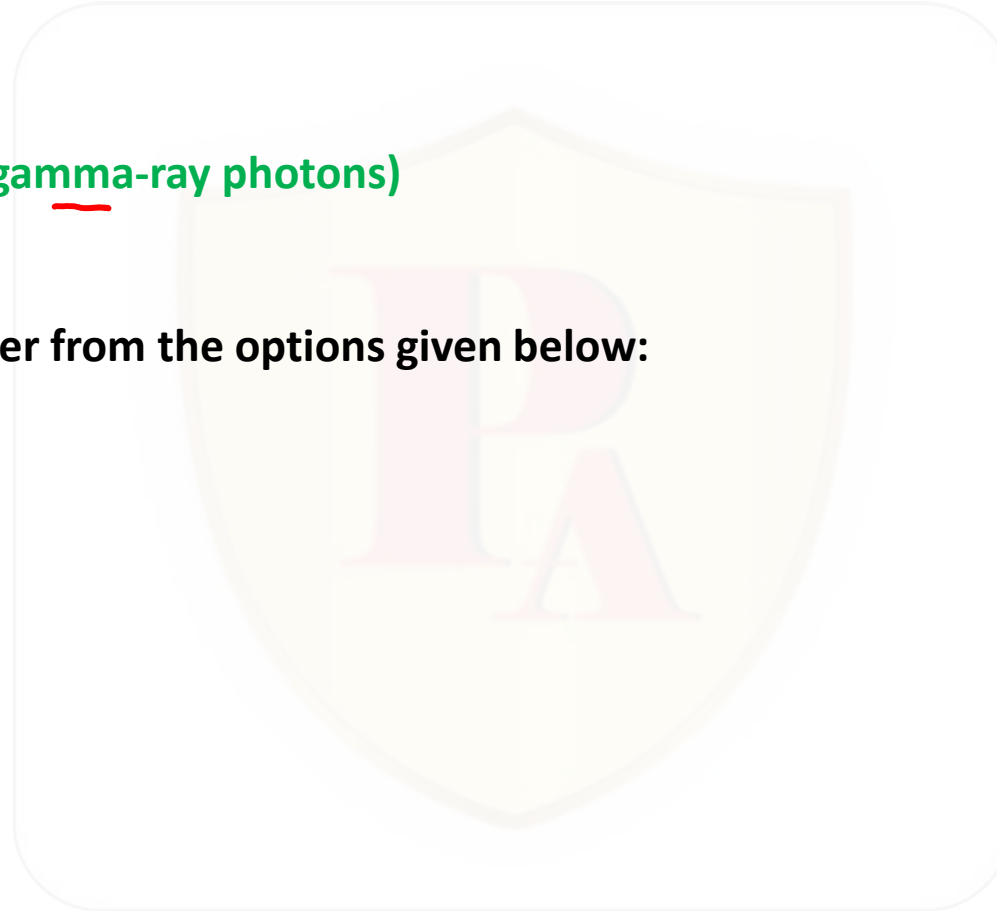


Which of the following diagnostic techniques(/s) use radiofrequency? ✓

- A. Magnetic Resonance Imaging ✓
- B. X-Ray
- C. Positron Emission Tomography (gamma-ray photons)
- D. Ultrasound

Choose the most appropriate answer from the options given below:

- 1. A and B Only
- 2. A and C Only (only A) ✓
- 3. A, B, and C Only
- 4. D only



Question No. 112 / Question ID : 458908953



Which of the following is not a targeted therapy routinely used to treat cancer patients?

1. Palbociclib
2. Imatinib
3. Doxorubicin ✓
4. Herceptin





The fluidity of plasma membrane can be increased by introduction of:

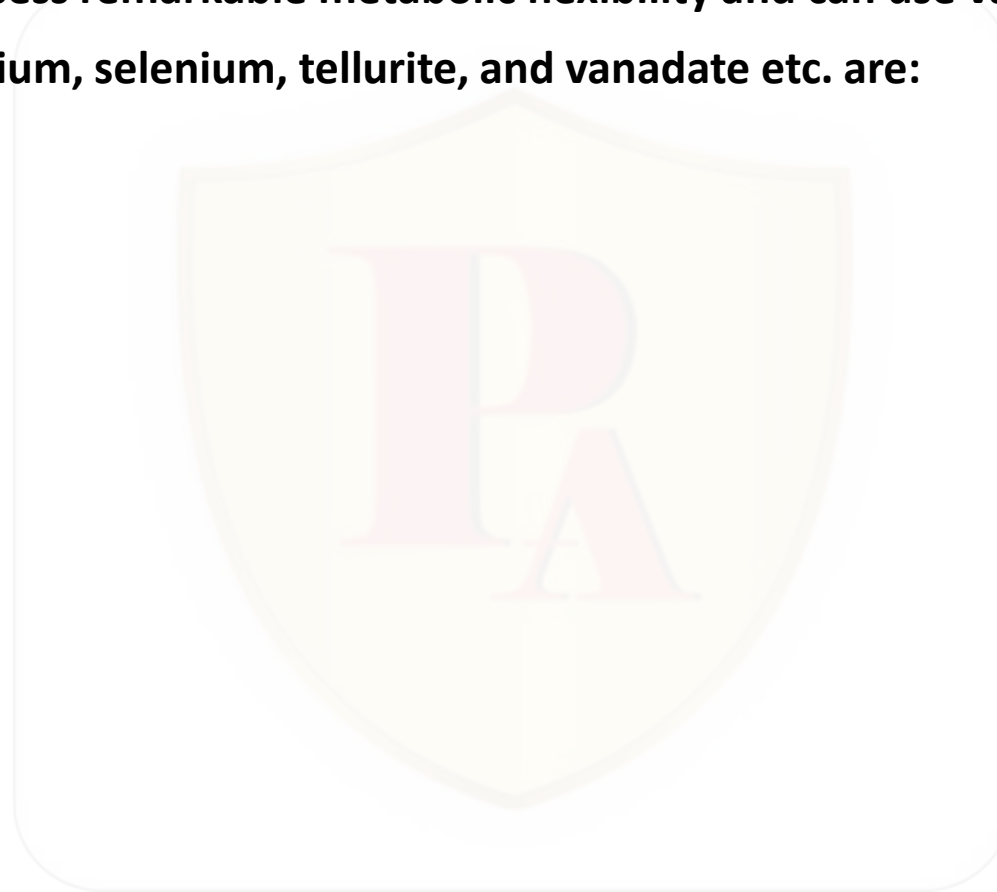
1. *cis* unsaturation in fatty acid chains
2. *trans* unsaturation in fatty acid chains
3. longer fatty acid chains
4. saturation in fatty acid chains

Life Sciences, Fundamentals and practice, Part-1 [cell biology] 9th Edition



The family of prokaryotes that possess remarkable metabolic flexibility and can use variety of metal electron acceptors such as uranium, neptunium, selenium, tellurite, and vanadate etc. are:

1. *Shewanellaceae*
2. *Vibrionaceae*
3. *Enterobacteriaceae*
4. *Pasteurellaceae*





Given below are two statements:

Statement I: Catabolite repressor protein (CRP) regulates both arabinose and lactose operons.

Statement II: Both *ara* and *lac* operon will be switched on when *E. coli* are grown in a medium containing arabinose and lactose.

In the light of the above statements, choose the correct answer from the options given below:

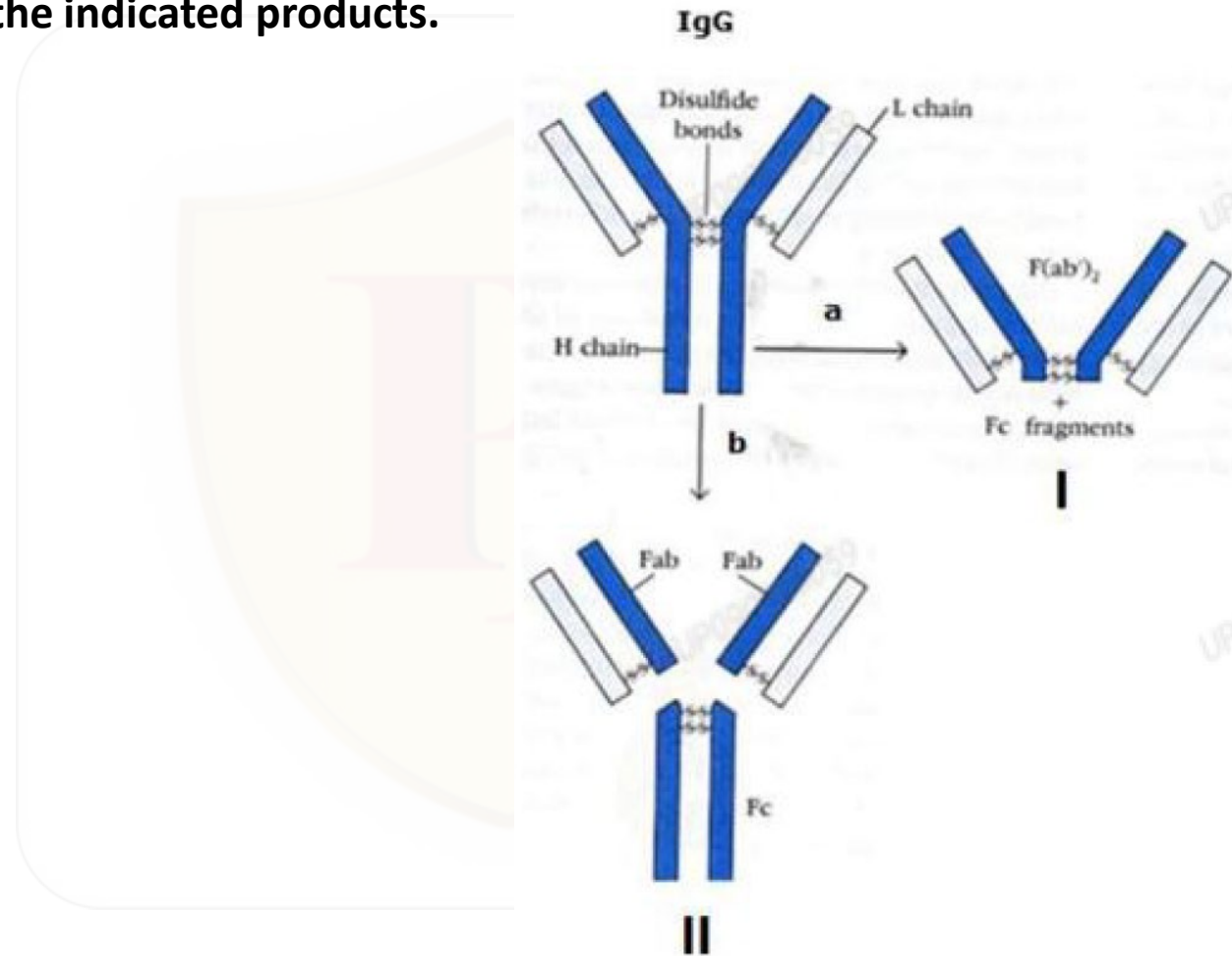
1. Both Statement I and Statement II are correct
2. Both Statement I and Statement II are incorrect
3. Statement I is correct but Statement II is incorrect
4. Statement I is incorrect but Statement II is correct

Question No. 116 / Question ID : 458908966



Treatment of IgG with enzymes / chemicals gives rise to different products I and II. Find 'a' and 'b' in the schematic given below that yields the indicated products.

1. a: pepsin; b: papain
2. a: papain; b: pepsin
3. a: mercaptoethanol; b: pepsin
4. a: papain; b: mercaptoethanol



Life Sciences, Fundamentals and practice, Part-1 [immunology] 9th Edition

Question No. 117 / Question ID : 458908942



The cellulose microfibrils are synthesized by the enzyme cellulose synthase in which part of the plant cell?

1. Cytosol
2. Endoplasmic reticulum
3. Golgi apparatus
4. **Plasma membrane** ✓✓

Life Sciences, Fundamentals and practice, Part-1 [cell biology] 9th Edition

Van der Waals forces and hydrogen bonding) between adjacent chains within a cellulose microfibril gives this structure a high tensile strength. Cellulose is also water insoluble, chemically stable and relatively resistant to chemical and enzymatic attack. Cellulose microfibrils are synthesized by plasma membrane-bound enzyme cellulose synthase (CESA), which are oligomerize into six-lobed rosette structures termed **cellulose synthase complex**. Different isoforms of cellulose synthase are responsible for cellulose synthesis during primary and secondary cell wall synthesis. In *Arabidopsis*, CESA1, CESA3 and CESA6 are involved in primary wall cellulose synthesis, and CESA4, CESA7 and CESA8 in secondary wall synthesis.

Question No. 118 / Question ID : 458908961



Which of the following parameter best assesses the efficacy of a conjugate vaccine against SARS-CoV-2?

1. Cytokine levels in blood
2. IgM and IgG antibody titers
3. IgA and IgD antibody titers
4. IgE antibody titer



Correct Option: 2

Question No. 118 / Question ID : 458908961



Which of the following parameter best assesses the efficacy of a conjugate vaccine against SARS-CoV-2?

1. Cytokine levels in blood
2. **IgM and IgG antibody titers**
3. IgA and IgD antibody titers
4. IgE antibody titer





Which of the following is INCORRECT regarding the mRNA decay in eukaryotes?

1. An exonuclease removes the poly(A) tail of mRNA.
2. Decapping enzyme Dcp1/Dcp2 removes 5' m⁷G cap leaving mRNA with a 5' monophosphate.
3. RNase E binds to 5' monophosphate of mRNA and cleaves it as an endonuclease.
4. A 5'-3' exonuclease, Xnl completely digests 5'-mono phosphorylated mRNA.

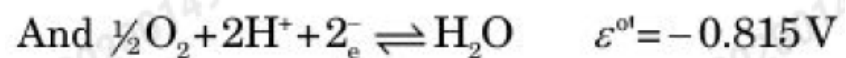
Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

The average half-life of bacterial mRNAs is only about 1.5 minutes. Degradation of mRNA occurs in the 3'–5' direction and is mediated by several endo- and exonucleases. No enzyme capable of RNA degradation in 5'–3' direction has yet been reported in bacteria. Endonucleases (RNase E and RNase III), make an internal cut in RNA molecules whereas exonucleases (RNase II and polynucleotide phosphorylase, PNPase), remove nucleotides sequentially from the 3' end of an mRNA. In *E. coli*, RNase E and PNPase along with RNA helicase are located within a multiprotein complex called the **degradosome**.

Most eukaryotic mRNA degradation is **deadenylation-dependent**. In this degradation process, removal of poly(A) tail occurs first. Removal of the tail is catalyzed by *deadenylase* enzyme. The deadenylated mRNA then may either (1) be decapped and degraded by a 5'–3' exonuclease or (2) be degraded by a 3'–5' exonuclease. In the major 5'–3' degradation pathway, deadenylation at the 3' end triggers decapping at the 5' end. This shows that each end of the mRNA influences events that occur at the other end. Decapping reaction occurs by cleavage of 1–2 bases from the 5' end. Removal of the cap triggers the 5'–3' degradation pathway in which the mRNA is degraded rapidly from the 5' end, by the 5'–3' exonuclease.



Standard reduction potential of the half reactions of ADH oxidation by O_2 are the following:



What would be the standard free energy change ($\Delta G^{0'}$) for overall reaction?



1. -142 kJ mol^{-1}
2. -218 kJ mol^{-1}
3. 500 kJ mol^{-1}
4. $-1130 \text{ kJ mol}^{-1}$

Correct Option: 2



The Shannon-Weiner diversity index (H') for four different forest types are 4.78, 2.71, 2.96, and 3.62. Arrange the Simpson's concentration of dominance (CD) values of 0.04, 0.72, 0.68, and 0.06 as per the H' values.

1. **4.78 - 0.04, 2.71 - 0.72, 2.96 - 0.68, 3.62 - 0.06**
2. 4.78 - 0.72, 2.71 - 0.04, 2.96 - 0.06, 3.62 - 0.68
3. 4.78 - 0.04, 2.71 - 0.06, 2.96 - 0.68, 3.62 - 0.72
4. 4.78 - 0.72, 2.71 - 0.68, 2.96 - 0.06, 3.62 - 0.04

Life Sciences, Fundamentals and practice, Part-1 [ecology] 9th Edition



Fresh LB medium was inoculated with 4000 bacterial cells. After 12 hours, the cell numbers reached to 256000. Considering that the bacteria exponentially multiply by binary fission, the generation time of bacteria is:

1. 30 min
2. 1 hour
3. 1.5 hours
4. 2 hours



Life Sciences, Fundamentals and practice, Part-1 [PK and virus] 9th Edition

Generation time = t (duration of the log phase, in minutes or hours) / n (number of generations)

If N_0 = number of bacteria at the beginning of a time interval;

N = number of bacteria at the end of the time interval and

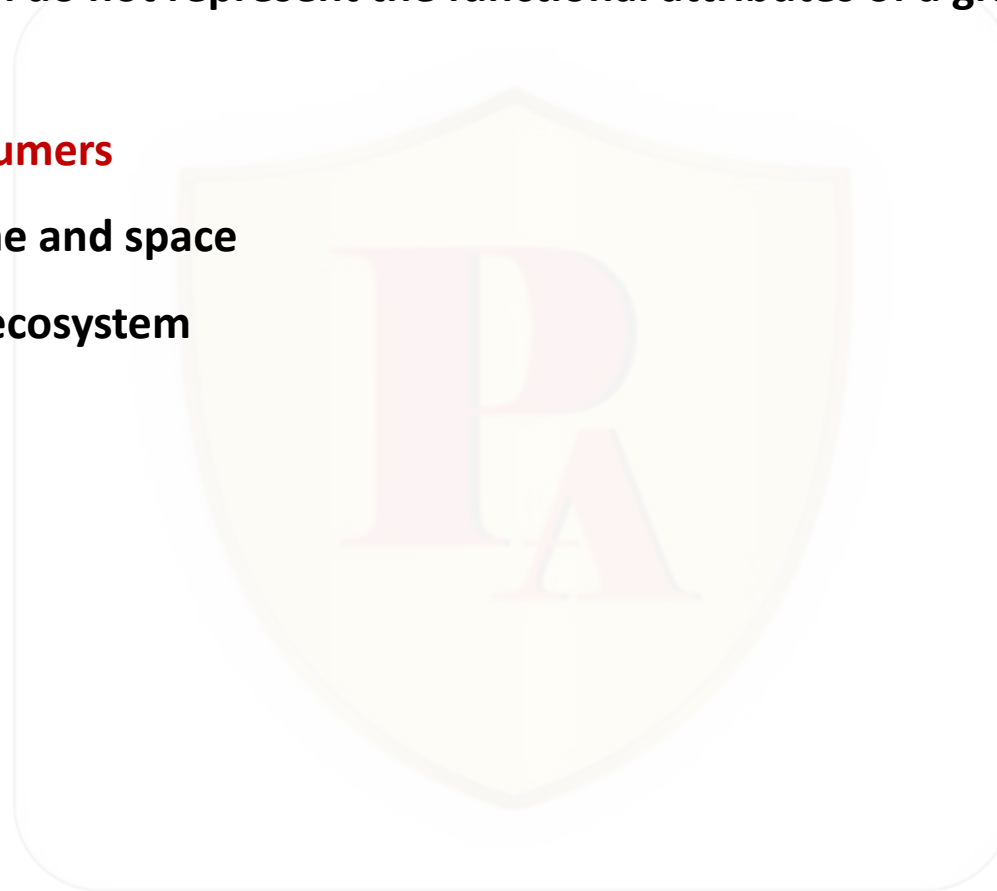
n = number of generations (number of times the cell population doubles during the time interval) then

$N = N_0 \times 2^n$ (this equation is an expression of bacterial growth by binary fission during log phase).



Which of the following combination do not represent the functional attributes of a grassland ecosystem?

1. nutrient cycling and energy flow
2. **macroconsumers and microconsumers**
3. homeostasis, and diversity in time and space
4. food chain and development of ecosystem





Which of the following Cas enzymes can be used to target specific genomic loci without creating nick or break?

1. Cas9
- 2. dCas9**
3. SpCas9
4. CasI2

dCas9 (dead Cas9) is a catalytically inactive version of Cas9. Its nuclease activity has been disabled by mutations in its catalytic domains.



Question No. 126 / Question ID : 458908951



The rate of synonymous site substitutions in a particular gene was higher than the rate of non-synonymous substitutions. Which of the following statement best describes the mode of evolution operating on this gene?

1. It is undergoing positive selection.
2. It is undergoing diversifying selection.
3. It is evolving neutrally.
4. It is undergoing negative selection.

Life Sciences, Fundamentals and practice, Part-2 [evolution] 9th Edition

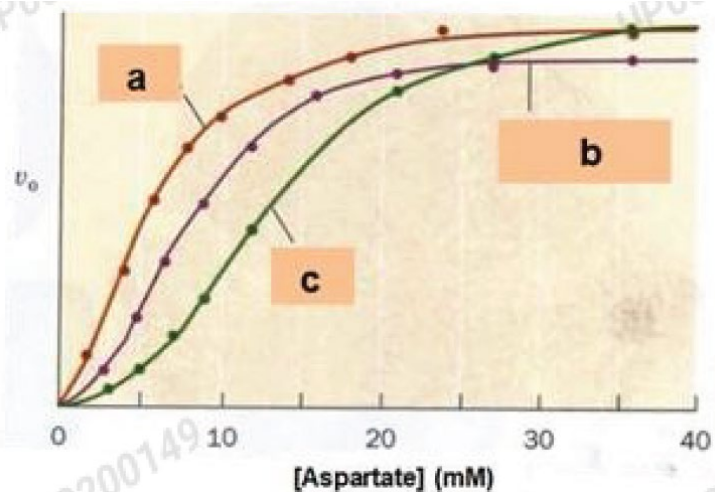
Synonymous vs non-synonymous mutations: It has been found that in coding regions, **synonymous mutations** (which do not change the amino acid sequence of a protein) occur much more frequently than **non-synonymous mutations** (which do change the protein sequence). Since non-synonymous mutations can disrupt protein function and are often harmful, they are usually removed by natural selection (a process called **purifying selection** or **negative selection**). In contrast, synonymous mutations do not alter the amino acid sequence of a protein and are generally considered neutral with respect to natural selection. Therefore, they can accumulate over time. This explains the higher rate of accumulation of synonymous mutations in the coding regions of the genome compared to non-synonymous mutations.

Question No. 127 / Question ID : 458908932



Aspartate transcarbamoylase catalyzes the reaction between carbamoyl phosphate and aspartate to form N-carbamoyl aspartate. Following plot represents the rate of reaction vs increasing concentration of aspartate. ATP and CTP are the allosteric effectors of the enzyme. Identify the curves which are obtained in the presence of ATP or CTP.

1. a : ATP, b : No effectors, c : CTP
2. a : No effectors, b : ATP, c : CTP
3. a : ATP, b : CTP, c : No effectors
4. a : No effectors, b : CTP, c : ATP



Correct Option: 1



A female mouse, homozygous for 'a' allele of the Igf2 gene, is crossed to a male which is homozygous for 'b' allele of this gene. Which of the following statement best describes the most appropriate outcome regarding the expression of Igf2 in the F1 progeny?

1. Igf2 locus is maternally imprinted, hence allele 'b' will be expressed.
2. Igf2 locus is maternally imprinted, hence allele 'a' will be expressed.
3. Igf2 locus is paternally imprinted, hence allele 'b' will be expressed.
4. Igf2 locus is paternally imprinted, hence allele 'a' will be expressed.

Life Sciences, Fundamentals and practice, Part-2 [genetics] 9th Edition

and the paternal copy remains silent. In such cells, the imprinted gene is said to exhibit *functional hemizygosity*. For example, the gene encoding **insulin-like growth factor 2** (Igf2) is only expressed from the wild-type copy inherited from the father whereas the maternal copy remain transcriptionally silent.



Which of the following is NOT a precursor for the biosynthesis of IAA?

1. Indole
2. Indole-3-glycerol phosphate
3. Tryptophan
4. Mevalonic acid

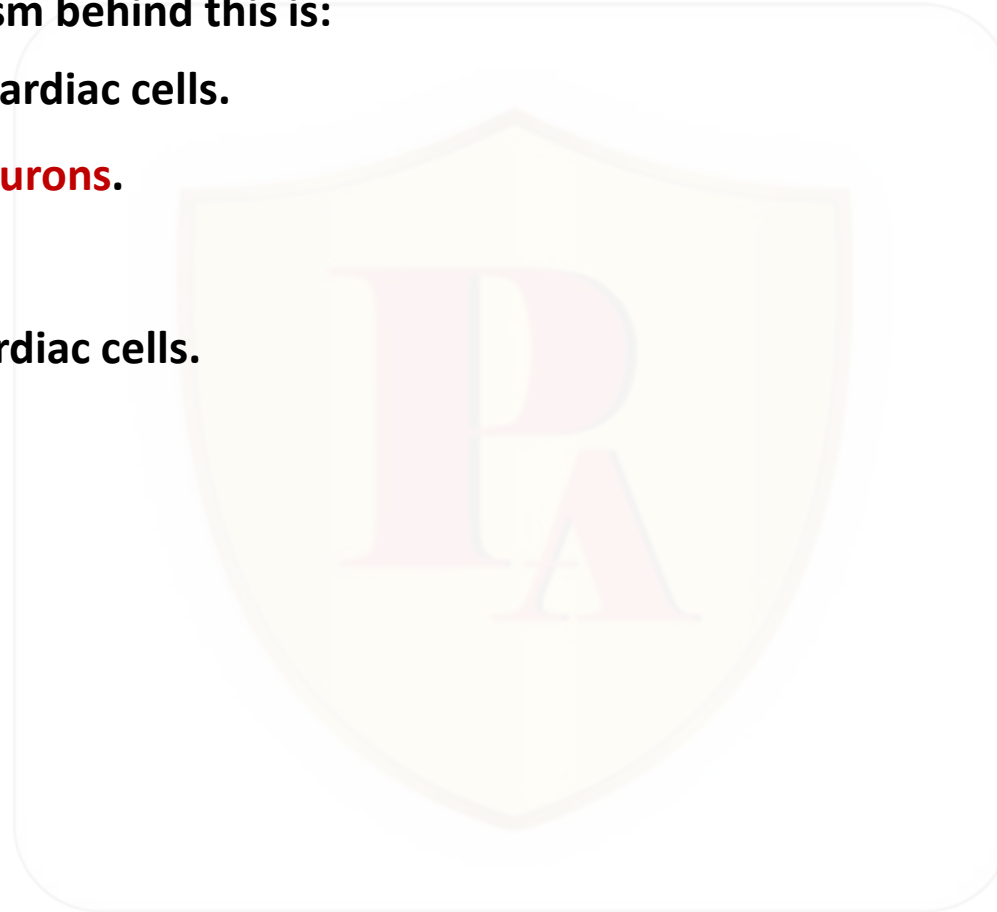


Question No. 130 / Question ID : 458908936



"Nitrogen Narcosis", also called as "raptures of the depth", can occur during deep sea diving due to compressed nitrogen. The mechanism behind this is:

1. It dissolves cytosolic proteins of cardiac cells.
2. **It dissolves fatty substances in neurons.**
3. It enhances neuronal excitability.
4. Excess calcium secreted out of cardiac cells.



Question No. 131 / Question ID : 458908972



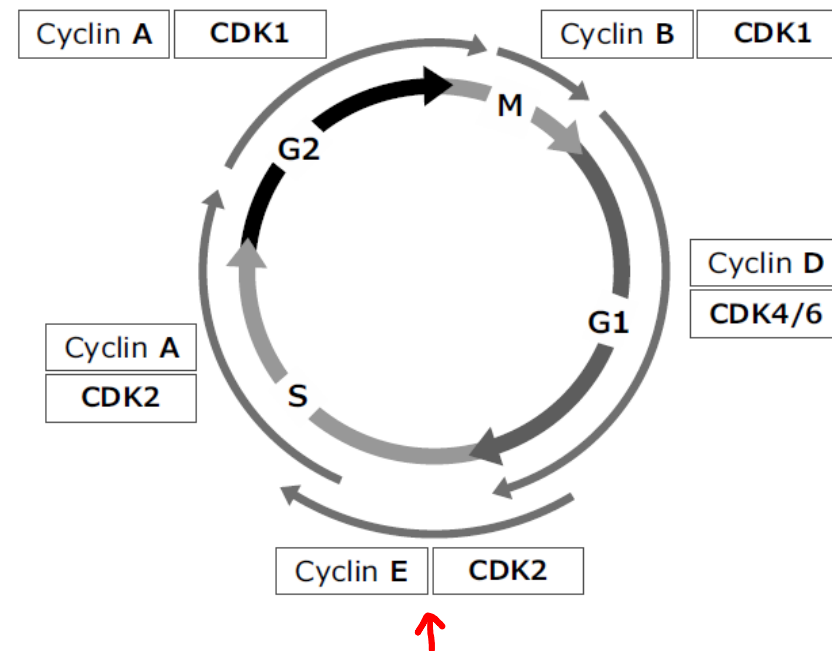
Given below are two statements:

Statement I: In metazoans, cyclin D in G1 phase binds to CDK4 and CDK6, but do not show a strong stage-dependent fluctuation.

Statement II: Cyclin E in metazoans is a S/G2 cyclin, which binds to CDK2 to trigger S/G2 transition.

In the light of the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are true
2. Both Statement I and Statement II are false
3. **Statement I is true but Statement II is false**
4. Statement I is false but Statement II is true



Life Sciences, Fundamentals and practice, Part-1 [cell biology]

Question No. 132 / Question ID : 458908979



Which of the following statement is correct for F_1 -component of ATP synthase? ✓

1. It has tetrahedral symmetry. ✓
2. It has dihedral symmetry. ✓
3. It has pseudo-three-fold symmetry. ✓
4. It has pseudo-four-fold symmetry.



Correct Option: 3



As per Woese's three-domain classification, which of the following cannot be used to differentiate between Eubacteria, Archaea and Eukaryota?

1. Sensitivity to antibiotics
2. Structure of membrane lipids
3. Sequence of rRNA
4. Type of locomotion

Table 4.12 Comparison between bacteria and archaea

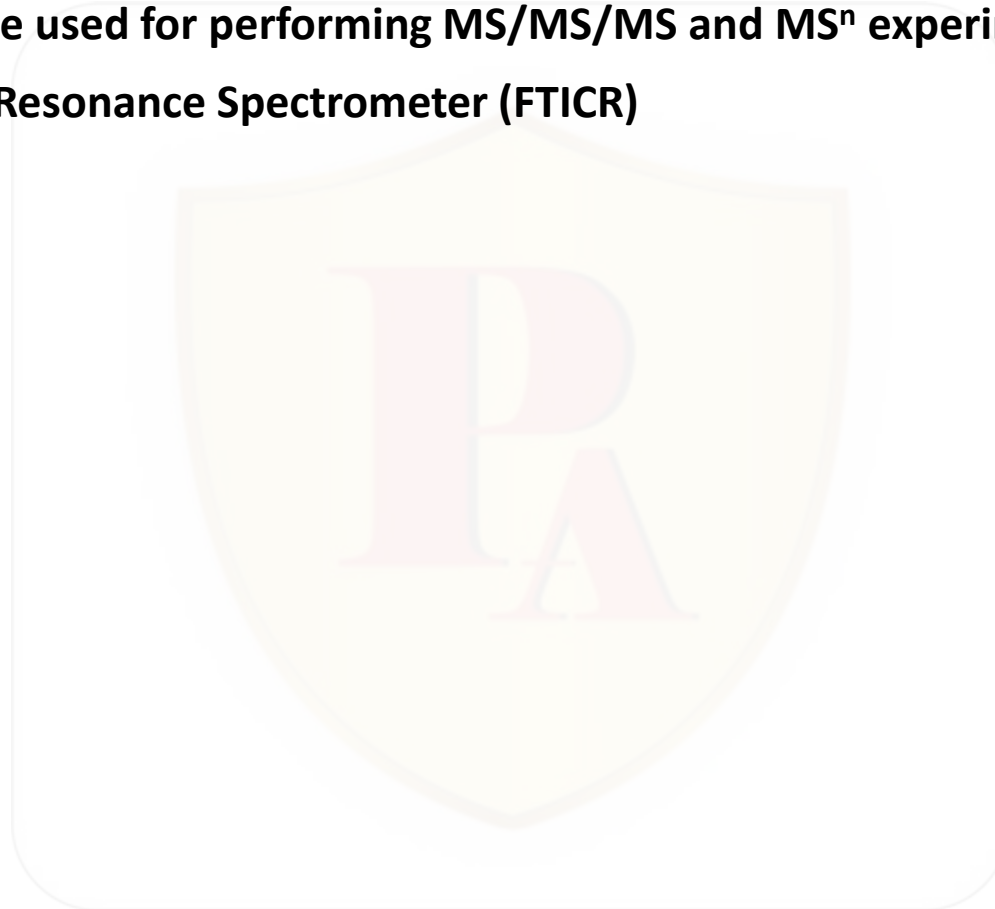
Property	Bacteria (<i>Eubacteria</i>)	Archaea (<i>Archaeobacteria</i>)
Nucleus	Absent	Absent
Unit membrane-bound organelles	Absent	Absent
Cell Wall	Peptidoglycan	Variety of types, no peptidoglycan
Membrane lipid	Have ester-linked, straight-chained fatty acid	Have ether-linked, branched aliphatic chains
tRNA	Thymine present, <i>N</i> -formylmethionine carried by initiator tRNA	No thymine in T ψ C arm, Methionine carried by initiator tRNA
Ribosomes		
Elongation factor 2	Does not react with diphtheria toxin	React with diphtheria toxin
Sensitivity to chloramphenicol	Sensitive	Insensitive
Sensitivity to anisomycin	Insensitive	Sensitive
DNA-dependent RNA polymerase		
Number of enzymes	One	Several
Rifampicin sensitivity	Sensitive	Insensitive
Polymerase II type promoters	Absent	Present
Metabolism		
Methanogenesis	Absent	Present

Life Sciences, Fundamentals and practice, Part-1 [PK and virus]



Which mass spectrometer should be used for performing MS/MS/MS and MSⁿ experiments?

- 1. Fourier Transform Ion Cyclotron Resonance Spectrometer (FTICR)**
- 2. TOF**
- 3. qTOF**
- 4. TOF-TOF**



Correct Option: 1 ✓

Question No. 135 / Question ID : 458908934



Given below are two statements:

Statement I: The lambda repressor cI acts at the O_L and O_R operators to block immediate early genes.

Statement II: Cro binds to the same operator as the lambda repressor but with different affinities to establish lysogeny.

In the light of the above statements, choose the correct answer from the options given below:

1. Both Statement I and Statement II are correct ✓
2. Both Statement I and Statement II are incorrect ✓
- ✓ 3. Statement I is correct but Statement II is incorrect ✓
4. Statement I is incorrect but Statement II is correct

Life Sciences, Fundamentals and practice, Part-1 [genetics]

Lytic process

The *lytic mode* of growth is the default mode. When DNA of a lambda phage enters a new host cell, RNA polymerase binds promoters p_L and p_R (which stand for Leftward and Rightward promoters, respectively). The promoters p_L and p_R lie on either side of the cI gene. p_L and p_R are strong promoters. p_R acts as promoter for *cro* and other rightward early genes. Product of *cro* gene (i.e., **Cro protein**) facilitates lytic mode. p_L acts as a promoter for *N* and other leftward early genes. So the first event when phage DNA enters a bacterium is the expression of genes *N* and *cro*. Gene *N* codes for an *antitermination protein*, whose action allows transcription to proceed into the delayed early genes. This allows *cIII* to be transcribed on the left, while genes *cII*, *O*, *P* and *Q* are transcribed on the right.



Which of the following type of structural proteins in plant cell walls are implicated in the growth, nutrition, and guidance of pollen tubes through stylar tissues?

1. Arabinogalactan proteins
2. Glycine-rich proteins
3. Hydroxyproline-rich glycoproteins
4. Proline-rich proteins

Life Sciences, Fundamentals and practice, Part-1 [cell biology]

Correct Option: 1



Which of the following is a free-living anaerobic nitrogen fixer?

- 1. *Clostridium***
- 2. *Azotobacter***
- 3. *Calothrix***
- 4. *Nostoc***

Life Sciences, Fundamentals and practice, Part-2 [plant physiology] 9th Edition

Free-living nitrogen-fixing prokaryotes: Many nitrogen-fixing bacteria live in the soil and fix nitrogen without direct interaction with other organisms. Examples of nitrogen-fixing bacteria include aerobic bacteria such as *Azospirillum*, *Azotobacter* and anaerobic bacteria such as *Rhodospirillum* (photosynthetic) and *Clostridium* (non-photosynthetic).

Correct Option: 1



Which of the following nitrogen fixing legumes is NOT an amide exporter?

1. Pea
2. Clove
3. Broad bean
4. Soyabean



Correct Option: 4



The protein yields of five bacterial cultures are 3, 5, 2, 4 and 1 mg/ml, respectively. The standard error of the mean in the ungrouped data is:

1. 0.55
2. 0.71
3. 0.22
4. 0.33



Correct Option: 2



If X ray treatment with 1000 roentgens (R) increases the mutation rate of a gene by 2%, what approximate percent increase in mutation rate of the gene would be expected if the organism is treated with X ray doses of 500 R in three independent rounds of treatment or 1500 R in a single treatment?

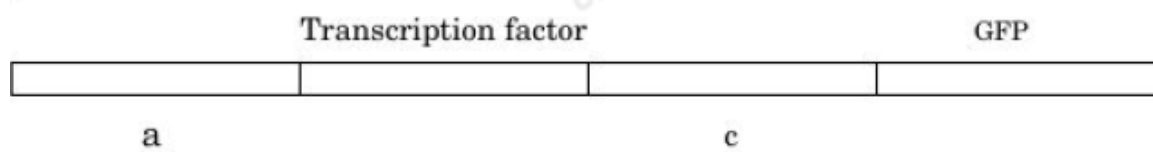
1. 3% increase in both the rounds of treatment.
2. 6% increase in fragmented rounds compared to -3% in single round.
3. 9% increase in both the rounds of treatment.
4. 6% increase in fragmented rounds compared to -9% in single round.

Correct Option: 1 ✓

Question No. 141 / Question ID : 458908926



Shown below is a diagram of a biosensor:



Which of the following strategies would result in a better biosensor? ✓

1. Use of constitutive promoter at 'a' and inducible promoter at 'c'.
2. Use of constitutive promoter at 'c' and inducible promoter at 'a'.
3. Use of repressive promoters at 'a' and 'c'.
4. Use of constitutive promoters at 'a' and 'c'.

Correct Option: 1 ✓



Which of the following statement regarding translation in bacteria is correct?

1. UAG is recognized by RF1, UGA by RF2, and UAA by both RF1 and RF2.
2. UAG is recognized by RF1 and RF2, UGA by RF2, and UAA by RF1.
3. UAG is recognized by RF2, UGA by RF1, and UAA by both RF1 and RF2.
4. UAG is recognized by RF1, UGA by both RF1 and RF2, and UAA by RF2.

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<u>RF-1</u>	<u>RF-2</u>
5' UAA 3'	5' UAA 3'
5' UAG 3'	5' UGA 3'



UDP Glucoronyl tranferase is involved in which of the following function?

- 1. 1n spleen, for conversion of biliverdin to bilirubin**
- 2. 1n liver, for metabolizing bilirubin**
- 3. 1n liver, for metabolizing glucose**
- 4. 1n kidney, for transfer of bilirubin to liver**

Correct Option: 2



Match List I with List II

List I

- A. Prolactin**
- B. Insulin**
- C. Oxytocin**
- D. Dopamine**

List II

- I. Posterior pituitary**
- II. Hypothalamus**
- III. Anterior pituitary**
- IV. Pancreas**

Choose the correct answer from the options given below:

- 1. A-III, B-IV, C-I, D-II**
- 2. A-IV, B-III, C-II, D-I**
- 3. A-III, B-IV, C-II, D-I**
- 4. A-I, B-III, C-II, D-IV**

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***BRCA1* loss of function mutations are associated with ovarian and breast cancer. The best-known mechanism to cause transformation of cells due to loss of *BRCA1* is:**

- 1. *BRCA1* is essential for homologous recombination repair. Loss of *BRCA1* leads to genomic instability leading to cancer.**
- 2. *BRCA1* is essential for nucleotide excision repair. Pyrimidine dimers caused due to UV exposure cannot be repaired with loss of *BRCA1*.**
- 3. *BRCA1* is essential for base excision repair. Spontaneous deamination of cytosine and uracil due to carcinogen cannot be repaired in cells lacking *BRCA1*.**
- 4. *BRCA1* is essential for non-homologous end joining (NHEJ) pathway. Loss of *BRCA1*, thus, leads to genomic instability due to loss of NHEJ activity.**

Correct Option: 1