

Q1. Tick the correct answer: $1 \times 5 = 5$

- a) The stop codon for translation is-
 - i) UGA
 - ii) CAG
 - iii) GAA
 - iv) All the above
- b) Which eukaryotic polymerase is responsible for synthesis of rRNA precursors?
 - i) RNA polymerase I
 - ii) RNA polymerase II
 - iii) RNA polymerase III
 - iv) None of these.
- c) In which phase of the cell cycle are the chromosomes aligned at the equator?
 - i) Metaphase
 - ii) Prometaphase
 - iii) Anaphase
 - iv) Telophase
- d) Left-handed DNA is called
 - i) Z-DNA
 - ii) A-DNA
 - iii) B-DNA
 - iv) None of the above
- e) Mendel's 2nd law states that
 - i) Alleles at separate loci separate independently, if they are linked.
 - ii) Each individual always possesses two alleles encoding the same trait.
 - iii) A pair of trait segregates independently of another pair.
 - iv) None of the above

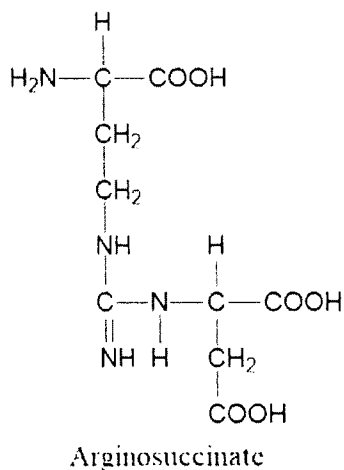
Q2. Answer the following questions: $3+3+3+1=10$

- a) Albinism, a recessive condition in humans that causes reduced pigmentation in the skin, hair, and eyes. Both parents having heterozygous alleles for albinism ($Aa \times Aa$) have five children. Calculate the probability of having two children affected with albinism and three unaffected.

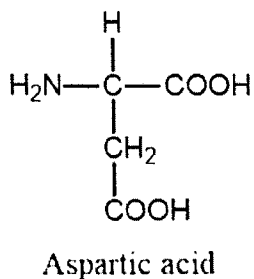
- b) A student examines a thin section of an onion-root tip and records the number of cells that are in each stage of the cell cycle. She observes 98 cells in interphase, 12 cells in prophase, 4 cells in prometaphase, 4 cells in metaphase, 6 cells in anaphase, and 1 cell in telophase. If the complete cell cycle in an onion-root tip requires 23 hours, what is the average duration of each stage in the cycle? Assume that all cells are in the active cell cycle (not G_0).
- c) A Tall (TT) and yellow coloured (YY) pea plant crossed with dwarf (tt) and green coloured (yy) pea plant - Make a punnet square and find out the phenotypic ratios of F₂ generations in the progeny.
- d) The fruit fly (*Drosophila melanogaster*) has four pairs of chromosomes, whereas the mountain pine beetle (*Dendroctonus ponderosae*) has 12 pairs of chromosomes. Other things being equal, in which species would you expect to see more genetic variation among the progeny of a cross? Explain your answer.

Q3. Complete the reactions: 1×5=5

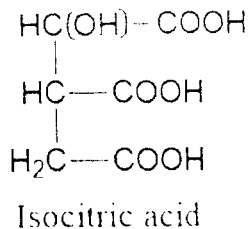
- a) Cleavage of Arginine:



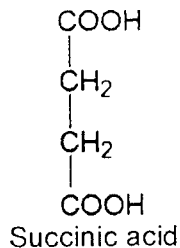
- b) Conversion of Aspartic acid to Asparagine:



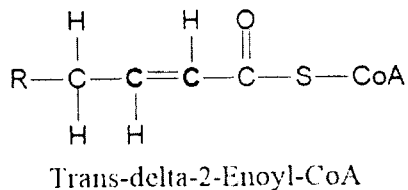
c) Isocitric acid to Oxalo succinic acid:



d) Dehydrogenation of succinic acid:



e) Hydration of trans-delta-enoyl-CoA:



Q4. Write answers in one sentence: 1× 5=5

- What is the function of ω subunit of RNA polymerase?
- What is the function of single-strand DNA-binding proteins (SSBs) during DNA replication?
- Name two non-proteinogenic amino acids that are not present in protein structures.
- How many cycles of β -oxidation are required for the complete breakdown of a 16-carbon palmitic acid?
- Which micronutrient needs emulsification for its proper digestion?

Q5. Write short answers: 3× 7=21

- Briefly explain rho-dependent termination of transcription. [3]
- Name the three coenzymes involved in the oxidative decarboxylation of pyruvic acid. Draw a schematic representation of carbohydrate metabolism showing the points of ATP production. [1+2]

- c) Name the precursor molecule of glycerol. How is glycerol synthesized from this precursor molecule? [1+2]
- d) Name the amino group acceptor in a transamination reaction. Write the transamination reaction of alanine. [1+2]
- e) Name the shuttle system associated with fatty acid synthesis. Write the sequential reactions of this shuttle system. [1+2]
- f) Name three disaccharides and the enzymes reacted on them and the resultant products. [1+1+1]
- g) Define omega-3 and omega-6 fatty acids. Write the sequential steps of fatty acid synthesis. Name two types of cells in which β -oxidation of fatty acids does not take place. [1+1+1]

Q6. Draw and briefly explain the following steps during M phase: $2 \times 2 = 4$

- a) Anaphase
- b) Cytokinesis

[Open notes are not allowed; Scientific calculators are allowed]