Case Based Questions

Solution 1

(i) Thalassemia is an inherited blood disorder with less haemoglobin and fewer red blood cells in the body as compared to normal person. So, thalassemia is caused due to quantitative problem of haemoglobin.

Hence, the correct answer is option (b).

(ii) When a person inherits both defective genes for beta-haemoglobin (one from each parent), beta thalassemia intermedia or beta thalassemia major (Cooley's anemia) results.

Hence, the correct answer is option (c).

(iii) Four genes are required to make alpha-globin chains and a person inherits two, not four, genes from each parent.

Hence, the correct answer is option (c).

(iv) Alpha-thalassemia is controlled by two closely linked genes for alpha globin chain. The genotype of a heterozygous individual for alpha-thalassemia will have one defective gene of this pair of closely linked genes. This is shown in option (c).

Hence, the correct answer is option (c).

(v) Inheritance of four mutated genes for alpha globin chain usually results in stillbirth. This condition is called alpha thalassemia major or hydrops fetalis.

Hence, the correct answer is option (b).

Solution 2

(i) Out of five histones, two molecules each of H2A, H2B, H3 and H4 are organised to form a unit of eight molecules called histone octamer.

Hence, the correct answer is option (b).

(ii) Histones are rich in the basic amino acid residues lysine and arginine.

Hence, the correct answer is option (c).

(iii) Histones are basic proteins, and their positive charges allow them to associate with DNA, which is negatively charged due to phosphate groups in its phosphate-sugar backbone.

Hence, the correct answer is option (a).

(iv) Nucleosomes consist of a segment of DNA wrapped around histone octamer and are linked to the next nucleosomes with the help of a linker DNA. Thus, nucleosomes constitute the repeating unit of a structure in nucleus called chromatin and are seen as beads in 'beads-on-string' structure when viewed under electron microscope.

Hence, the correct answer is option (d).

(v) In a typical nucleus, some regions of chromatin stain light and are referred to as euchromatin and other regions stains dark and are called heterochromatin. Euchromatin stains light due to less compact DNA packaging and heterochromatin stains dark due to dense packaging of DNA. So, both assertion and reason are true, but the reason is not the correct explanation of the assertion.

Hence, the correct answer is option (b).

Solution 3

(i) HIV has RNA as genetic material so it belongs to retroviruses. After getting into the body of the person, the virus enters the helper T lymphocytes, a type of white blood cells. A congenital disease is a condition present at birth regardless of its cause. But AIDS is acquired during lifetime of a person. So, AIDS is not a congenital disease.

Hence, the correct answer is option (c).

(ii) HIV spreads only through body fluids.

Hence, the correct answer is option (d).

(iii) When HIV fuses with the surface of the host cell, its capsid containing the virus's genome and proteins enter the host cell. Once entered, RNA genome of the virus transcribed into viral DNA with the help of the HIV enzyme reverse transcriptase.

Hence, the correct answer is option (b).

(iv) On exposure to HIV, a person's immune system makes antibodies to destroy the virus. The test carried out to find these HIV antibodies or antigens in urine, saliva, or blood is ELISA which stands for enzyme-linked immunosorbent assay.

Hence, the correct answer is option (b).

(v) The treatment of AIDS is the antiretroviral treatment which is the combination of several different types of drugs, each of which targets a different stage in the HIV lifecycle.

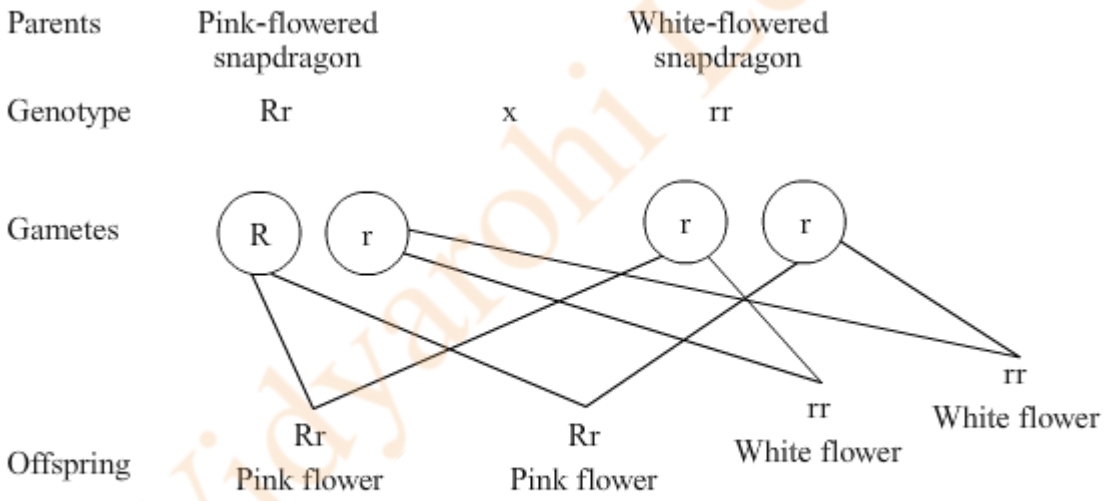
Hence, the correct answer is option (b).

Solution 4

(i) Since neither of the two alleles is completely dominant over the other and F_1 hybrid has a blend of the parents' phenotypes, such a phenomenon is called incomplete dominance.

Hence, the correct answer is option (c).

(ii) The results of the cross between a pink-flowered snapdragon and a white-flowered snapdragon is as follows:



Hence, the correct answer is option (b).

(iii) The genotypic ratio of a cross between two pink-flowered snapdragons will be 1(RR):2(Rr):1(rr) as expected in any Mendelian monohybrid cross. But, due to incomplete dominance, the phenotypic ratio of 1Red (RR):2Pink (Rr):1White (rr) will be obtained instead of Mendelian monohybrid phenotypic ratio of 3:1.

Hence, the correct answer is option (d).

(iv) The phenomenon followed by the inheritance of flower colour in

snapdragons is the incomplete dominance in which F_1 hybrid exhibits the phenotype intermediate between the phenotypes of the parents. The cross between a black Andalusian fowl and white Andalusian fowl results in a hybrid Andalusian fowl with an intermediate fur colour of the parents' phenotypes, that is, blue.

Hence, the correct answer is option (b).

(v) Wavy coat is intermediate of straight and curly coats in dogs. So, the dogs with heterozygous condition will have wavy coat.

Hence, the correct answer is option (b).