1. If an origin of replication is deleted from a human chromosome, then during the replication

    a) the DNA on either side of the deleted origin of replication will be lost

    b) the DNA from the left side of the deleted origin of replication will be lost

    c) the DNA from the right side of the deleted origin of replication will be lost

    d) the DNA from both side of the origin of replication will be replicated

2. Many transcription factors form dimers of identical or slightly different subunits when binds to the DNA. Consider the following three explanations for the above phenomenon.

(I) binding affinities of dimers are more than monomers

(II) combinatorial pairing of different subunits can increase the number of DNA binding specificities

(III) a monomer cannot bind to DNA

    a) (I) and (II) are correct explanations, but not (III)

    b) (II) and (III) are correct explanations, but not (I)

    c) (I) and (III) are correct explanations, but not (II)

    d) all three explanations (I), (II) and (III) are correct

3. Milk is deficient in

    a) Vitamin C

    b) Vitamin A

    c) Vitamin B2

    d) Vitamin K

4. Which of the following techniques would serve the best as the basis for a rapid, highly sensitive blood test to detect circulating cancer cells that carry the Bcr-Abl fusion gene?

    a) Western blotting
    b) PCR analysis
    c) Flow cytometry
    d) DNA sequencing

5. In rare cases, monozygotic twins develop nearly identical leukaemia. In each case, analysis of cancer cells from pairs of twins demonstrated that they share an identical chromosomal rearrangement, a rearrangement not found in normal cells of twins. In most cases twins developed leukaemia at different times in their live. What does the different timing of the appearance of cancer in the twins indicate about the mechanism of cancer development?

    a) Cancer cells are genetically unstable
    b) Cancer is caused by somatic mutation
    c) Cancer requires loss of tumor suppressors
    d) Cancer requires multiple mutations

6. The average molecular weight of proteins encoded in the human genome is about 50,000, and the average molecular mass of amino acids is about 110 Daltons. Estimate how long it will take a keratinocytes to translate an mRNA coding for a protein that is 60 times bigger than the average protein. (Assume that the translation rate is two amino acids per second).

    a) 15.2 minutes
    b) 3.8 minutes
    c) 15.2 hours
    d) 3.8 hours

7. Over 30 different mutations have been found within the gene for transcription factor Tbx5 in patients with congenital heart defects. To carry out its function, Tbx5 must bind to another transcription factor called Nkx2-5. Imagine that you can isolate developing cardiac cells with homozygous Tbx5 mutations and study the molecular defects caused by the mutations. In one mutant cell line, you find that the normal, mature Tbx5 mRNA is present at its normal level, but the full length Tbx5 protein cannot be detected. What kind of mutation most likely accounts for this phenotype?

    a) A mutation that blocks binding of Tbx5 to Nkx2-5

    b) A mutation that causes splicing defect

    c) A mutation that disrupts the normal folding of Tbx5

    d) A mutation that introduces a premature stop codon

8. Which one of the following best describes the place within the cell where snRNP would be found?

    a) In the cytoplasm, near ribosomes.

    b) In the cytoplasm, near the nucleus

    c) In the nucleus, near RNA polymerase II

    d) In the nucleus, near RNA polymerase III

9. Haemophilia are inherited in an x-linked recessive pattern. A normal women, whose father had haemophilia, married a normal man. What is the chance of haemophilia in their children?

    a) ½ for a son, 0 for a daughter

    b) 0 for a son, ½ for a daughter

    c) ½ for a son as well as for a daughter

    d) ½ for a son, ¼ for a daughter

10. Class switching during B lymphocyte differentiation occurs at the

    a) RNA level
    b) DNA level
    c) protein level
    d) none of the above levels

11. The concordance of Psoriasis is 65% for monozygotic twins compared to 37% for dizygotic twins. Which of the following statement is the most appropriate conclusion about the disease?

    a) The disease has influence of epigenetic elements
    b) The disease has strong environmental effect
    c) The disease has strong genetic elements
    d) The disease has a major influence of sex

12. Cryptic T-cell epitopes are capable of triggering autoimmune disease. These epitopes

    a) are presented by MHC class I but not MHC class II molecules.
    b) are unable to bind in the MHC groove.
    c) can be derived by antigen processing.
    d) negatively select T-cells.

13. Which of the following is an autoimmune disease

    a) Sickle cell anaemia
    b) Type I diabetes mellitus
    c) Type II diabetes mellitus
    d) none of the above

14. If a mother carried the sex linked gene for colour blindness and the father was normal, then

   a) their son could be colour blind but not the daughter
   b) their daughter could be colour blind but not the son
   c) both son and daughter could be colour blind
   d) neither son nor daughter would be colour blind

15. If Down-Syndrome occurs in about 1 in 500 and Turner Syndrome occurs in about 1 in 7000 in the general population, and each syndrome is separately and randomly distributed in the population. What is the chance that a baby will be born with both these abnormalities?

   a) 1/35,00,000
   b) 2/35,00,000
   c) 1/35,000
   d) 2/35,000

16. Double stranded DNA is heated from 25° C to 70° C. The absorbance of the DNA

   a) will increase with increase in temperature
   b) will decrease with increase in temperature
   c) will remain same with increase in temperature
   d) cannot be predicted

17. A man has two dominant traits: T1, which he inherited from his father, and T2, which he inherited from his mother. His wife has neither T1 nor T2. If the genes for these two traits are closely linked, which of the following trait combinations is most likely for their offspring?

   a) exactly one of T1 and T2
   b) both T1 and T2
   c) neither T1 nor T2
   d) all the above trait combinations have the same probability

18. If a biallelic locus is in Hardy-Weinberg Equilibrium, then

a) the proportion of heterozygotes is equal to the proportion of homozygotes

b) the proportion of heterozygotes cannot be less than the proportion of homozygotes

c) the proportion of heterozygotes cannot be greater than the proportion of homozygotes

d) none of the above statements is necessarily true

19. Which of the following is **not** a possible reason for deviation from Hardy-Weinberg Equilibrium?

a) mutation

b) selection

c) inbreeding

d) none of the above

20. Which of the following enzyme is responsible for copying methylation marks from the parental to the daughter strand of DNA during replication?

a) DNMT1

b) DNMT3a

c) DNMT3L

d) MeCP2

21. The digestive enzymes of cellular compounds are confined to

a) lysosomes

b) ribosomes

c) peroxisomes

d) polysomes

22. Fatty acid can be transported into and out of cell membrane by

  a) active transport
  b) facilitated transport
  c) diffusion
  d) osmosis

23. Enzymes catalysing electron transport are present mainly in the

  a) ribosomes
  b) endoplasmic reticulum
  c) lysosomes
  d) inner mitochondrial membrane

24. Which of the following method can be used for detecting *in vivo* Protein DNA interactions?

  a) Chromatin Immunoprecipitation
  b) Electrophoretic Mobility Shift Assay
  c) DNAse footprinting
  d) None of the above

25. After mapping the mRNA next-generation sequencing reads into the human genome, you found that the percent of unmapped reads is 50. What would be your first impression about the data?

  a) Input RNA had genomic DNA contamination
  b) Input RNA was from other eukaryotic organisms
  c) Quality of the RNA sequencing reads is poor
  d) Input RNA had bacterial contamination

26. In whole genome DNA sequencing many regions across the genome show low sequencing coverage. The most probable explanation is that these regions

    a) have deletion

    b) are part of heterochromatin regions

    c) are part of euchromatin regions

    d) are part of the repeat elements

27. Assume the number of misprints per page in observing 100 pages is distributed as Poisson. If the number of pages with no misprint is 10, then a good estimate of the average number of misprints in a page of the book is

    a) 0.1   b) 1

    c) 2.3   d) 5

28. For a binomial distribution with success probability 0.5,

    a) mean > variance

    b) mean < variance

    c) mean = variance

    d) none of the above is necessarily true

29. Based on the data on blood sugar level and BMI, the regression equation of MBI on blood sugar was found to be:

$$Y = 0.2X - 2$$

If the correlation co-efficient between X and Y is 0.2, then

    a) the means of X and Y are equal, and the variances of X and Y are equal

    b) the means of X and Y need not be equal, but the variances of X and Y are equal

    c) the means of X and Y are equal, but the variances of X and Y need not be equal

    d) neither the means of X and Y need to be equal, nor the variances of X and Y need to be equal.

30. For comparing the means of two normal populations based on two samples of sizes 5 and 6, when the variances are not same, one should use

    a) t-test

    b) F-test

    c) Chi-squares test

    d) none of the above tests