

CSIR UGC NET

LIFE SCIENCE

SOLVED SAMPLE PAPER



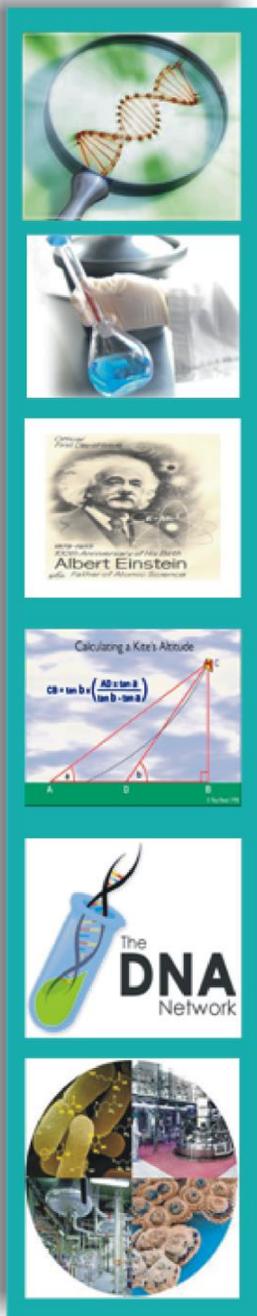
* DETAILED SOLUTIONS



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CSIR NET - LIFE SCIENCE

MOCK TEST PAPER

- *This paper contains 75 Multiple Choice Questions*
- *part A 15, part B 35 and part C 25*
- *Each question in Part 'A' and 'B' carries two marks*
- *Part 'C' carries 4 marks respectively.*
- *There will be negative marking @ 25% for each wrong answer.*
- *Pattern of questions : MCQs*
- *Total marks : 200*
- *Duration of test : 3 Hours*

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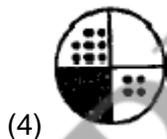
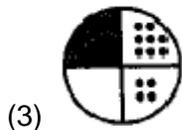
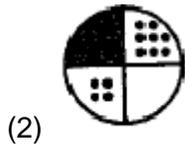
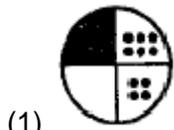
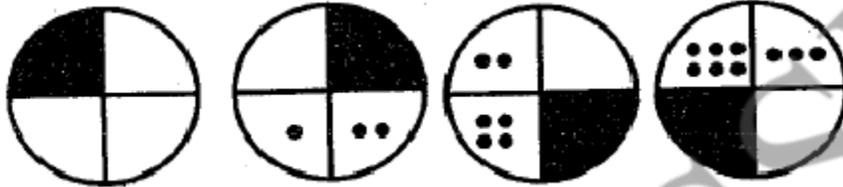
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PART-A (Q.1-15)

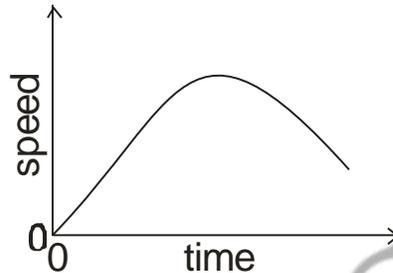
1. Identify the next figure in the sequence



2. A daily sheet calendar of the year 2013 contains sheets of 10×10 cm size. All the sheets of the calendar are spread over the floor of a room of $5\text{m} \times 7.3\text{m}$ size. What percentage of the floor will be covered by these sheets?

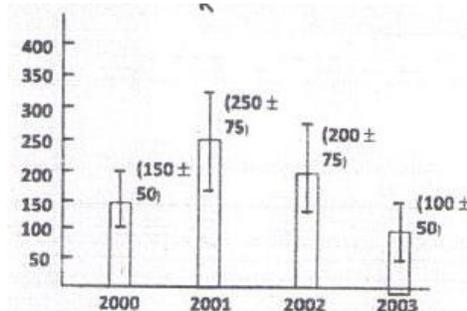
- (1) 0.1
(2) 1
(3) 10
(4) 100

3. A car is moving along a straight track. Its speed is changing with time as shown.

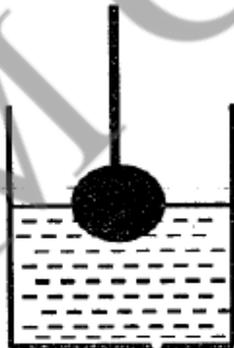


Which of the following statements is correct?

- (1) The speed is never zero.
 - (2) The acceleration is zero once on the path.
 - (3) The distance covered initially increases and then decreases.
 - (4) The car comes back to its initial position once.
4. There are 2 hills, A and B, in a region. If hill A is located $N30^\circ E$ of hill B, what will be the direction of hill B when observed from hill A? ($N 30^\circ E$ means 30° from north towards east).
- (1) S $30^\circ W$
 - (2) S $60^\circ W$
 - (3) S $30^\circ E$
 - (4) S $60^\circ E$
5. Average yield of a product in different years is shown in the histogram. If the vertical bars indicate variability during the year, then during which year was the percent variability over the average of that year the least?



- (1) 2000
(2) 2001
(3) 2002
(4) 2003
6. 20% of students of a particular course get jobs within one year of passing. 20% of the remaining students get jobs by the end of second year of passing. If 16 students are still jobless, how many students had passed the course?
- (1) 32
(2) 64
(3) 25
(4) 100
7. A sphere of iron of radius $R/2$ fixed to one end of a string was lowered into water in a cylindrical container of base radius R to keep exactly half the sphere dipped. The rise in the level of water in the container will be



- (1) $R/3$
(2) $R/4$
(3) $R/8$
(4) $R/12$

8. Three identical flat equilateral-triangular plates of side 5 cm each are placed together such that they form a trapezium. The length of the longer of the two parallel sides of this trapezium is

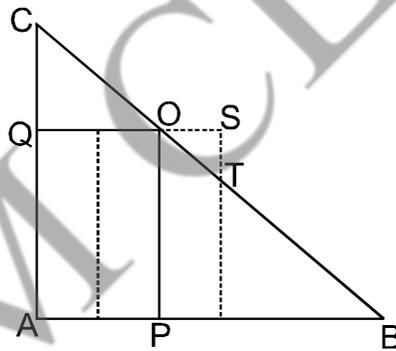
(1) $5\sqrt{4}$ cm

(2) $5\sqrt{2}$ cm

(3) 10 cm

(4) $10\sqrt{3}$ cm

9. Consider a right-angled triangle ABC where $AB = AC = 3$. A rectangle APOQ is drawn inside it, as shown, such that the height of the rectangle is twice its width. The rectangle is moved horizontally by a distance 0.2 as shown schematically in the diagram (not to scale).



Area of $\triangle ABC$

Area of $\triangle OST$

What is the value of the ratio ?

(1) 625

(2) 400

(3) 225

(4) 125

10. A code consists of at most two identical letters followed by at most four identical digits. The code must have at least one letter and one digit. How many distinct codes can be generated using letters A to Z and digits 1 to 9?

- (1) 936
- (2) 1148
- (3) 1872
- (4) 2574

11. Find the missing letter :

A	?	Q	E
C	M	S	C
E	K	U	A
G	I	W	Y

- (1) L
- (2) Q
- (3) N
- (4) O

12. If $3 \leq X \leq 5$ and $8 \leq Y \leq 11$ then which of the following options is TRUE?

(1) $\frac{3}{5} \leq \frac{X}{Y} \leq \frac{8}{5}$

(2) $\frac{3}{11} \leq \frac{X}{Y} \leq \frac{5}{8}$

(3) $\frac{3}{11} \leq \frac{X}{Y} \leq \frac{8}{5}$

(4) $\frac{3}{5} \leq \frac{X}{Y} \leq \frac{8}{11}$

13. If $y = 5x^2 + 3$, then the tangent at $x = 0, y = 3$.
- (1) passes through $x = 0, y = 0$
 - (2) has a slope of +1
 - (3) is parallel to the x-axis
 - (4) has a slope of -1
14. A student buys a book from an online shop at 20% discount. His friend buys another copy of the same book in a book fair for Rs. 192 paying 20% less than his friend. What is the full price of the book?
- (1) Rs. 275
 - (2) Rs. 300
 - (3) Rs. 320
 - (4) Rs. 392
15. A square pyramid is to be made using a wire such that only one strand of wire is used for each edge. What is the minimum number of times that the wire has to be cut in order to make the pyramid?
- (1) 3
 - (2) 7
 - (3) 2
 - (4) 1

PART B (16-50)

16. The hydrophobic effect is due to
- (1) nonpolar groups interacting with water
 - (2) polar group interacting with water
 - (3) nonpolar groups interacting with each other
 - (4) polar groups interacting with nonpolar groups

17. The amino acid with pK_a closest to physiological pH is
- (1) serine
 - (2) histidine
 - (3) threonine
 - (4) proline
18. One form of glycogen synthetase has a requirement for glucose-6-phosphate. What is the explanation for this phenomenon?
- (1) it is an example of negative feedback
 - (2) glucose-6-phosphate is a substrate
 - (3) it is an example of allosteric activation
 - (4) it inhibits an enzyme that hydrolyses UDP-glucose
19. Which of the following is not true about fatty acid synthesis
- (1) cofactors—NADPH
 - (2) precursor—two carbon unit
 - (3) site—cytosol
 - (4) carrier—carnitine
20. Specificity of transcription by RNA polymerases holoenzyme in *E. coli* is altered by changing the
- (1) alpha subunit
 - (2) sigma subunit
 - (3) beta subunit
 - (4) beta prime subunit
21. What is the role of the cl gene of phage lambda?
- (1) it encodes a protein that enables the phage to enter lysis
 - (2) its product helps the prophage to excise from the host DNA
 - (3) it encodes the lambda repressor which represses the lytic cycle

- (4) its gene product helps the prophage to integrate into the host DNA
- 22.** Which of the following statements is true about ion channels
- (1) they are opened either by binding of ligands or by changes in electric potential across the membrane
 - (2) they require ATP
 - (3) they are open most of the time
 - (4) the rate of transport is slow compared to the rate of transport via carrier proteins
- 23.** which of the following is not true about NO
- (1) acts as intracellular signaling molecule as well as neurotransmitter
 - (2) regulates the vasodilation
 - (3) synthesized from L-arginine
 - (4) induces adenylate cyclase, which catalyzes cAMP formation
- 24.** Cell cycle is controlled by
- P. certain cyclins
 - Q. certain cyclin-dependent kinases
 - R. certain inhibitory proteins
 - S. certain phosphatases
- (1) P and Q
 - (2) R and S
 - (3) P and R
 - (4) P, Q, R and S
- 25.** Primary and secondary antibody responses differ in
- (1) the predominant isotype generated
 - (2) the number of lymphocytes responding to antigen
 - (3) the speed at which antibodies appear in the serum
 - (4) all of the above

26. Mendel could not find recombination and crossing over as
- (1) traits he chose were either present on different chromosomes or were far apart
 - (2) traits chosen by him were not influenced by genes
 - (3) he did not have a high power microscope
 - (4) he selected only pure types
27. The condition in which there is one too many or one too few chromosomes is called
- (1) aneuploidy
 - (2) polytene
 - (3) polyploidy
 - (4) monoploidy
28. Which one of the following is the purpose of adding agar in the medium for tissue culture?
- (1) Enrichment of micro-nutrients
 - (2) Maintenance of pH
 - (3) Solidification of the medium
 - (4) Supply of energy for growth
29. Blue-white selection is used
- (1) blue-white screening
 - (2) growth in the presence of an antibiotic
 - (3) a restriction enzyme digests
 - (4) agarose gel electrophoresis
30. Which of the following methods would give you the most precise and accurate information about where and when a given gene is expressed?
- (1) in situ hybridization
 - (2) DNA microarray
 - (3) protein microarray
 - (4) reporter gene fusion including introns

31. Which of the following statement is false about Reporter genes
- (1) replace the coding region of a gene of interest with a coding region that is easily assayed
 - (2) replace the promoter region of a gene of interest with a promoter region that is easily assayed
 - (3) can be used to measure the activity of a promoter
 - (4) can be used to determine when and where a promoter is active
32. Three-dimensional images of the surface of the cells and tissues could be visualized through
- (1) transmission electron microscope
 - (2) scanning electron microscope
 - (3) compound microscope
 - (4) fluorescence microscope
33. In ion-exchange chromatography, the ion exchanger contains charged groups which are
- (1) Non-covalently linked
 - (2) linked through hydrogen bonds
 - (3) Covalently linked
 - (4) Linked via Van-der Waal forces
34. Bacteria that the resistant to penicillin and related antibiotics produce an enzyme that breaks the _____ in these antibiotics.
- (1) side groups (R groups)
 - (2) benzene ring
 - (3) beta-lactam ring
 - (4) disulfide bonds
35. A bacterial cell that is mostly haploid, but is diploid for some regions of the genome is called _____

- (1) heterodiploid
(2) pseudodiploid
(3) half diploid
(4) mesodiploid
- 36.** Calculate mean and median from the ungrouped data:
10, 8, 20, 22, 39 and 18.
(1) 19.5, 19
(2) 20, 19
(3) 19.5, 22
(4) 20.5, 20
- 37.** A certain place in India has (i) average annual temperature of 27°C, (ii) annual rainfall between 200 and 300 cm (iii) number of rainy days ranging from 115 to 150. Which one of the following forest types would be found in such a place?
(1) Tropical wet evergreen forest
(2) Tropical dry deciduous forest
(3) Himalayan temperate forest
(4) Moist alpine forest
- 38.** Which of the following statement is correct?
(1) the niche is the habitat where organisms live
(2) the realized niche is always larger than fundamental niche
(3) the niche includes the behavioral characteristics of organisms
(4) the niche is defined only in terms of the dominant environmental factors
- 39.** Which one of the following heme proteins serves as electron carrier in both respiration and photosynthesis?
(1) Phytochrome

- (2) Ferredoxin
 - (3) Cytochrome
 - (4) Cryptochrome
- 40.** The citric acid cycle:
- (1) contains intermediates for amino acid synthesis
 - (2) generates fewer molecules of ATP than glycolysis
 - (3) is an anaerobic process
 - (4) is the major anabolic pathway for glucose synthesis
- 41.** Transpiration pull depends on
- (1) adhesion of water molecules to the walls of phloem cells
 - (2) capillarity
 - (3) the very negative water potential of the atmosphere
 - (4) cohesion of water molecules to each other
- 42.** In some flowering plants, the requirement of long day-length or low temperature treatment for flowering can be effectively substituted by:
- (1) Morphactins
 - (2) Coumarins
 - (3) 2, 4-D
 - (4) Gibberellins
- 43.** Under water stress, plants increase the synthesis of
- (1) gibberellic acid
 - (2) cytokinin
 - (3) auxins
 - (4) abscisic acid
- 44.** In angiosperms, the egg is
- (1) completely surrounded by a wall

- (2) surrounded by a wall only at the micropylar end
(3) surrounded by a wall only at the chalazal end
(4) devoid of wall
45. Select the correct sequence of intermediates from the following biosynthetic pathway
- (1) testosterone to estrogen to progesterone
(2) testosterone to progesterone to estradiol
(3) estradiol to testosterone to progesterone
(4) progesterone to testosterone to estradiol
46. The perineurium is the connective tissue layer
- (1) surrounding an entire nerve
(2) surrounding individual axons in the CNS
(3) surrounding individual axons in the PNS
(4) surrounding fascicles of axons in the PNS
47. Which of the following has the greatest effect on the ability of blood to transport oxygen?
- (1) capacity of the blood to dissolve oxygen
(2) amount of hemoglobin in the blood
(3) pH of plasma
(4) temperature of the blood
48. The rate of water reabsorption from the proximal tubule is determined primarily by the
- (1) rate of dissolved particle (solute) reabsorption from the proximal tubule
(2) concentration of ADH (antidiuretic hormone) in the blood
(3) osmotic pressure developed by plasma proteins in the proximal tubule
(4) active transport of water molecules by the proximal tubule cells
49. The name for the type of cleavage in the mammalian embryo is called?
- (1) planar cleavage
(2) unequal cleavage

(3) rotational cleavage

(4) radial cleavage

50. An example of convergent evolution is

(1) Australian marsupials and placental mammals

(2) the flippers in fish, penguins, and dolphins

(3) the wings in birds, bats, and insects

(4) all the above

PART C (51-75)

51. Which statement about amino acids is correct?

(1) they always have at least one amino group and at least one carboxyl group

(2) in the formation of proteins, it is a condensation reaction that links the amino group of one amino acid to the variable side chain of the adjacent amino acid

(3) The variable side chains of all of the amino acids are highly reactive and carry a charge at neutral pH

(4) The peptide bond that links amino acids together in a protein is a type of ionic bond, which explains why proteins are unstable to high temperatures

52. Which one of the following statements is false?

a. double bonds in unsaturated fatty acids are generally in the cis configuration

b. in polyunsaturated fatty acid, double bonds are almost never conjugated

c. sphingolipids are involved in biological recognition

d. prostaglandins contain a five membered ring of carbon atoms

e. prostaglandins regulate the synthesis of the intracellular messenger cAMP

(1) only a

(2) both a and b

(3) c, d, and e

- (4) none
53. What is the turnover number (i.e., the k_{cat} or enzymatic activity) for an enzyme catalysed reaction which has a maximum velocity of $3.47 \text{ moles liter}^{-1} \text{ min}^{-1}$ when the enzyme concentration is $6.85 \times 10^{-1} \text{ g liter}^{-1}$? Molecular weight of the enzyme is $12,800 \text{ g mol}^{-1}$?
- (1) $6.48 \times 10^4 \text{ min}^{-1}$
(2) $5.258 \times 10^{-3} \text{ min}^{-1}$
(3) $1.579 \times 10^{-5} \text{ min}^{-1}$
(4) $12.7 \times 10^{-5} \text{ min}^{-1}$
54. DNA- dependent RNA polymerase of E. coli is characterized by which of the following properties?
- P. it requires a DNA polymerase, Mg^{2+} , and all four ribonucleoside triphosphates and forms a phosphodiester bond and pyrophosphate
Q. it is a polymeric protein
R. it requires a protein factor (σ factor) for initiation of transcription
S. it requires a primer with a free 3' hydroxyl group.
- (1) P, Q
(2) P, S
(3) R, S
(4) P, Q, R
55. Which of the following statements are true of DNA regulatory elements and of the proteins required for transcription in Archaeobacterial?
- (1) Operons are similar to those of eubacteria
(2) promoters are similar to those of eubacteria

(3) RNA polymerase does not have a large number of subunits similar to eukaryotic polymerases

(4) some of the RNA polymerase subunits do not have homology to eukaryotic polymerase subunits

56. Match each compound in the left column with its characteristic from the right column.

P. G proteins	1. exchanges with GDP on G_{α} subunits
Q. adenylate cyclase	2. binds epinephrine
R. IP3	3. is a second messenger arising from PIP_2
S. DAG	4. is a small G protein DTP ase
T. Ras membrane	5. transduces hormone stimulus from an activated 7 TM receptor to adenylate cyclase
U. β - Adrenergic receptor	6. is activated by G_{α} - GTP
	7. activates protein kinase C
	8. has inducible tyrosine kinase activity

(1) P - 5 ; Q - 6 ; R - 3 ; S - 7 ; T - 4 ; U - 2

(2) P - 5 ; Q - 7 ; R - 3 ; S - 1 ; T - 4 ; U - 8

(3) P - 2 ; Q - 5 ; R - 3 ; S - 1 ; T - 4 ; U - 8

(4) P - 8 ; Q - 4 ; R - 3 ; S - 7 ; T - 6 ; U - 1

57. The difference between a benign and a malignant tumor is

(1) malignant tumors are painful and benign tumors are not

(2) a malignant tumor has the ability to spread to other tissues and to initiate tumors at secondary sites, whereas benign tumors do not spread

(3) benign tumors cause a less severe form of cancer than malignant tumors

(4) malignant tumors are caused by viruses, but benign tumors arise spontaneously

58. What changes are made in B cells when they switch from producing IgM or IgD to IgG immunoglobulins?

- (1) this change is accomplished by alternative splicing of the RNA transcripts
- (2) this change occurs in the proteome as the IgM/ IgD constant regions are proteolytically removed from the IgG protein
- (3) this change occurs in the genome as the genes encoding the constant regions for IgM and IgD are deleted by the RAG1 and RAG2 proteins
- (4) this change occurs in the genome as the genes encoding the constant regions for IgM and IgD are deleted independently of the RAG proteins

59. Match the following

Column - I

Column II

- | | |
|-----------------------------|--------------------------------------|
| A. Down's syndrome | P. an additional sex chromosome |
| B. Cri - du - chat Syndrome | Q. loss of a part of chromosome |
| C. Klinefelter's Syndrome | R. absence of sex chromosome |
| D. Turner's Syndrome | S. presence of an extra chromosome |
| | T. presence of two extra chromosomes |

- (1) A - S, B - Q, C - P, D - R
- (2) A - T, B - S, C - P, D - Q
- (3) A - S, B - Q, C - Q, D - R
- (4) A - S, B - Q, C - R, D - P

60. Lambda phage integrates its double - stranded DNA into the bacterial genome where it becomes an integral part of the bacterial chromosome as a 'prophage'. Phage DNA integration is accomplished by

- (1) restriction of the bacterial genome with LamRI followed by integration of the phage DNA facilitated by integrase

(2) Site -specific (reciprocal) recombination between the phage att p and the bacterial att B sequences (staggered cleavage at the att B and att P sites provides complementary single stranded ends which can form a Holliday junction)

(3) by single - strand assembly (linear DNA is incorporated into the bacterial genome)

(4) homologous recombination (precise assimilation of identical DNA)

61. Restriction endonucleases are enzymes that

P. cleave the 5' terminal nucleotides from duplex DNA molecules

Q. make sequence - specific cuts in both strands of duplex DNA molecules

R. Promote circularization of the duplex DNA molecule by removal of the 5' terminal nucleotides

S. generate 3' hydroxyl and 5' - phosphate ends in the cut DNA strands

(1) P, Q

(2) P, R

(3) Q, S

(4) P, Q, R, S

62. Fluorescence Recovery After Photobleaching (FRAP)

P. is typically used to measure the rotational motion of membrane lipids and proteins

Q. is typically used to measure lateral diffusion of membrane lipids and proteins

R. involves fluorescent labelling of cell - surface molecules

S. has demonstrated that lipids diffuse freely over short distance, but generally not over longer distances in fibroblast membranes

(1) P, Q

(2) P, Q, R

(3) Q, R, S

(4) R, S

63. Which of the following statements are correct?

- Callus is the disorganised mass of cells formed under in vitro condition.
- Totipotency is the ability of a plant organ to regenerate an entire organism when cultured in a suitable medium.
- Embryoid is the embryo-like structure formed under in vitro condition which has the potentiality to develop into a plantlet.
- Explant is the excised portion of plant tissue or organ which used in tissue culture study.

Select the correct answer using the codes given below:

- a, b, and d
- a, c, and d
- a, b and c
- b, c, and d

64. In heterogenous population of cells containing T - cells and macrophages, the cells are separated in the following scheme:

Heterogenous \rightarrow cell suspension \rightarrow Supernatant cell \rightarrow nylon wool \rightarrow Flow
cell suspension left in petri-plate for 3hrs passed through adhered column nylon wool column through ce

identify the major population of cells present in petri plate, nylon wool adhered and nylon wool column flow through respectively

- Macrophase, B - cell , T - cell
 - T - cell, B - cell, macrophages
 - Macrophages, T - cell, B – cell
 - B - 6cell, T - cell macrophage
65. Which one of the following is the main cause of photochemical smog?
- Carbon dioxide acting as nuclei for water droplet formation
 - Increase in atmospheric carbon - dioxide concentration leading to green - house effect
 - Nitrogen oxides and hydrocarbons in the air, exposed to ultra violet light

(4) Environmental conditions favouring excessive evaporation resulting in smog formation in the morning.

Statement for linked Answer Question 66 and 67:

Two mammalian cell lines were found to express either epidermal growth factor receptor (EGFR) alone (cell Line A) or both EGFR and Ras (cell line B). These cell lines were treated with epidermal growth factor (EGF) and protein phosphorylation was examined in the membrane and cytosolic fraction using anti-phosphotyrosine and anti-phosphoserine antibodies.

- 66.** EGF - dependent tyrosine phosphorylation will be detected in
- (1) membrane and cytosolic fractions of both the cell lines
 - (2) only the membrane fraction of cell line A
 - (3) only the membrane fraction of both cell lines
 - (4) only the cytosolic fraction both cell lines
- 67.** EGF dependent serine phosphorylation will be detected in
- (1) membrane and cytosolic fraction of both the cell lines
 - (2) only the membrane fraction of cell line A
 - (3) only the membrane fraction of cell line B
 - (4) only cytosolic fraction of cell line A
- 68.** With reference to the water relation of plant, consider the following statements:
- A. The mechanical work done by a chemical system during any change at constant temperature is equal to the decrease in its free energy
 - B. In the case of imbibition, as water continues to move into the imbibant, the water potential of the water in the imbibant becomes less negative

C. Osmotic pressure is directly proportional to the number of solute molecules per solvent.

Which of these statements are correct?

- (1) A and B
- (2) B and C
- (3) A and C
- (4) A, B, and C

69. Double fixation of CO_2 takes place both in C_4 and CAM plants. Which one of the following statements brings out the main difference between the two?

- (1) The two carboxylising enzymes in the two plants are different
- (2) CO_2 fixation in C_4 plants is separated by space whereas in CAM plants, it is separated by time
- (3) The two pathways of CO_2 fixation are different in these two plants
- (4) The compensation points in these two plants are different

70. Consider the following statements regarding the plant growth substances

P. cytokinins make dormant buds active

Q. the richest concentration of cytokinins generally occur in endosperm

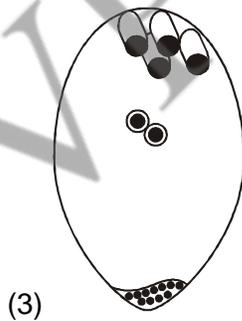
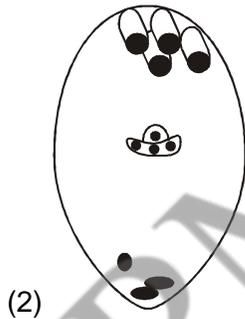
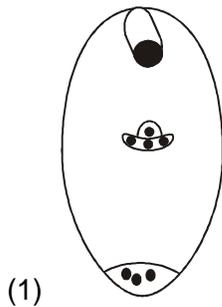
R. ethylene is involved in the formation of aerenchyma in submerged roots and stems

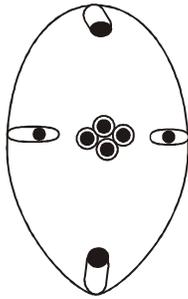
S. gibberellins are involved in the breaking of seed dormancy

Which of these statements are correct?

- (1) P, Q, R and S
- (2) Q, R and S
- (3) P and S
- (4) P, Q, and S

71. Which one of the following figures represent Fritillaria type of embryo sac.





(4)

72. Which one of the following statements is correct?
- (1) Chloride shift of Hamburger phenomenon occurs from the blood to liver in a fresh fish to maintain its osmotic balance
 - (2) Chloride shift takes place from stomach to the blood vascular system of man to produce HCl
 - (3) chloride shift involves the passage of chloride ions from the plasma to RBC to balance the bicarbonate ions which have passed out from RBC to plasma
 - (4) Chloride shift occurs to balance chloride ions and sodium ions in a muscle cell during muscle contraction
73. In the statement "there are several ventricles in the brain and some of these ventricles are connected by foramen of Monro. This foramen connects X which are located in the Y of the brain", X and Y stand respectively for
- (1) Lateral ventricles and cerebral hemisphere
 - (2) Third and fourth ventricles in cerebral hemisphere and medulla oblongata
 - (3) lateral ventricles and third ventricle in cerebral hemispheres and diencephalon
 - (4) lateral ventricles and third ventricle in cerebral hemisphere and mesencephalon
74. A new species is formed when
- (1) an individual with a new genotype is formed due to exchange of chromosome segments during crossing - over in gametogenesis

- (2) genotypic changes accumulate in a population resulting in its reproductive isolation
- (3) variants with new phenotypes are produced due to new combinations of genes during reproduction
- (4) homologous chromosome exchange segments during crossing over in gametogenesis.

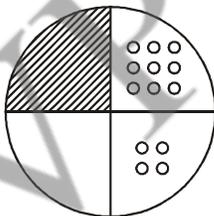
75. One of the objects of plant breeding experiments is to produce varieties having special properties, such as high yield, resistance to certain disease, etc. The method is to produce mutants in the laboratory and then subject them to the particular kind of solution needed. Form your commonsense knowledge, which of the following treatments for the seeds would be most effective in producing mutations

- (1) irradiation of seeds with visible light
- (2) treating the seeds with strong chemicals
- (3) irradiation of seed with X rays
- (4) heating the seeds.

ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Answer	3	1	2	3	2	3	4	3	3	3	4	2	3	2	3	1	2	3	4	2
Question	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Answer	3	1	4	4	4	1	1	3	4	2	2	2	3	3	4	1	1	3	4	1
Question	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	4	4	1	4	4	2	1	3	4	1	4	1	4	1	1	2	4	1	2
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75					
Answer	3	3	2	4	3	3	3	4	2	3	2	3	3	2	3					

Hints and Solution



1.(3)

on analysis we get this easily.

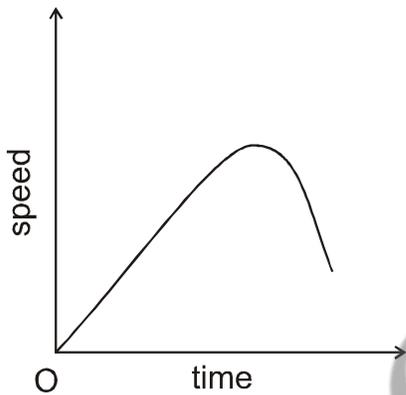
2.(1) A daily calendar shut size = 10 × 10 c.m.

Two sides printed month calendar have six sheets. So

Total area can be covered is = $6 \times 10 \times 10 \text{ c.m}^2$

Floor area = $5 \times 7.3 \text{ m}^2$

$$\% \text{ Area} = \frac{6 \times 10 \times 10}{5 \times 7.3 \times (100)^2} \times 100 = 0.1 \quad \text{Ans.}$$

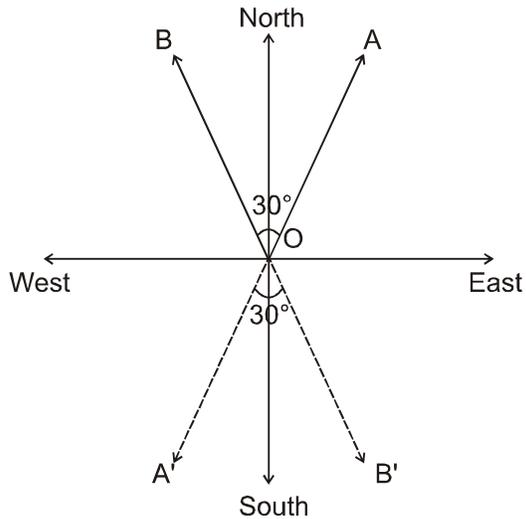


3.(2)

Given that the graph between the speed and time.

From the figure it is clear that speed is changing with time. In starting it increases and then decrease so that means at any instance speed will be zero. We know that acceleration is directly proportional to velocity.

So the acceleration will be zero once on the path.



4.(3)

From the fig $\angle BOA = 30^\circ = \angle A'OB'$ (\because these are alternate angles)

So the direction of hill B from hill A is N30°E or S30°E

S30°E given in option (3).

Option (3) is correct.

5.(2) The percentage of variability over the average of that year

$$\text{year 2000} \rightarrow \left(\frac{50}{150} \times 100 \right) = 33.33\%$$

$$\text{year 2001} \rightarrow \left(\frac{75}{250} \times 100 \right) = 30\%$$

$$\text{year 2002} \rightarrow \left(\frac{75}{200} \times 100 \right) = 37.5\%$$

$$\text{year 2003} \rightarrow \left(\frac{50}{100} \times 100 \right) = 50\%$$

Thus it is least for the year 2001.

6.(3) No. of students are x.

$$\frac{20}{100} \times x = \frac{x}{5} \quad \text{- get job, in 1st year}$$

$$\text{remaining students } x - \frac{x}{5} = \frac{4}{5} x$$

$$\frac{20}{100} \times \frac{4}{5} x = \frac{4}{5} x \quad \text{get job in II year}$$

$$\frac{4}{5} x - \frac{4}{5} x = 16$$

$$\frac{20x - 4x}{25} = 16$$

$$16x = 25 \times 16$$

$$x = 25$$

so no. of students is 25.

$$7.(4) \quad \text{Volume of cylinder} = \pi r^2 h \quad \dots (1)$$

where h is the height of water level.

After dipping, let height become h'

$$\text{then volume of cylinder} = \pi r^2 h' \quad \dots (2)$$

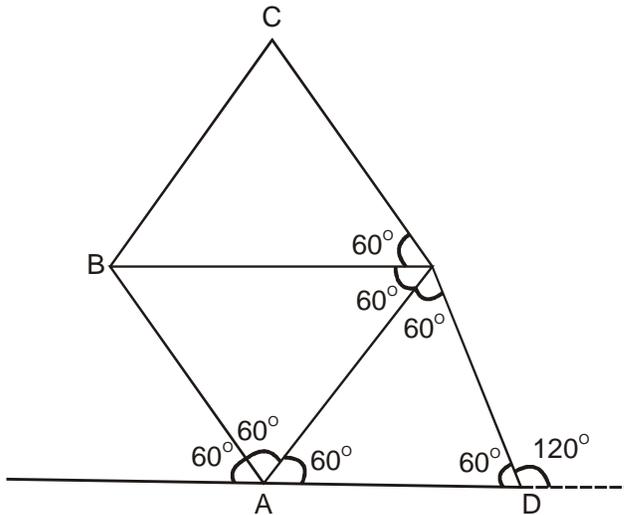
$$\text{Volume of hemisphere of radius } r/2 \text{ is } = \frac{2}{3} \pi \left(\frac{r}{2}\right)^3 \quad \dots(3)$$

It is clear that

$$\text{equation (1) + (3) = (2)}$$

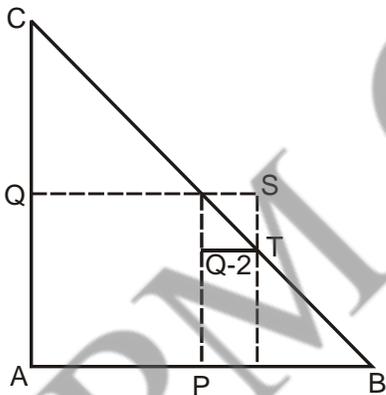
$$\Rightarrow \frac{2}{3} \pi \frac{r^3}{8} + \pi r^2 h = \pi r^2 h', \quad \Rightarrow \quad h' - h = \frac{r}{12} \quad \text{Ans.}$$

8.(3)



trapezium is 'A B C D'.

The length of the longer of the two parallel sides of trapezium is 10 cm.



9.(3)

$$AB = AC = 3$$

$$AQ = 2 AP$$

$$\text{Area of } \triangle ABC = \frac{1}{2} b \times h = \frac{1}{2} (3 \times 3) = \frac{1}{2}$$

$$\text{Area of } \triangle QST = \frac{1}{2} (Q.2 \times Q.2) = 0.02$$

$$\text{Ratio} = \frac{9 \times 100}{2 \times 0.02} = 225$$

10.(3) Total possible cases.

(i) A-Z Digit

26	9
----	---

(ii) A-ZA-ZDigit

26	1	9
----	---	---

(iii) A-Z A-Z Digit Digit

26	1	9	1
----	---	---	---

(iv) A-Z Digit Digit

26	9	1
----	---	---

(v) A-Z Digit Digit Digit

26	9	1	1
----	---	---	---

(vi) A-Z Digit Digit Digit Digit

26	9	1	1	1
----	---	---	---	---

(vii) A-Z A-Z Digit Digit Digit

26	1	9	1	1
----	---	---	---	---

(viii) A-Z A-Z Digit Digit Digit Digit

26	1	9	1	1	1
----	---	---	---	---	---

Total 8 type of configurations. Product of entries in each = 234

$$\text{Total} = 234 \times 8 = 1872$$

A O Q E

C M S C

E K 4 A

11.(4) G I W Y

Solution one letter is missing alternate are giving.

A _ O

B _ N

C _ M

D _ L

E _ K

F _ J

G → H → I

12.(2) For maximum $\frac{X}{Y} \Rightarrow X = \text{maximum} = 5; Y = \text{minimum} = 8$

$$\Rightarrow \text{maximum } \frac{X}{Y} = \frac{5}{8}$$

$$\text{For minimum } \frac{X}{Y} \Rightarrow X = \text{minimum} = 3; Y = \text{maximum} = 11$$

$$\Rightarrow \frac{X}{Y} = \frac{3}{11}$$

13.(3) $y = 5x^2 + 3$

$$y' = 5(2x) = 10(x)$$

$$y' = 10x$$

$$= m$$

equation of a tangent which passes through the point (0,3)

$$y - y_1 = m(x - x_1)$$

$$y - 3 = m(x - 0)$$

$$y - 3 = mx$$

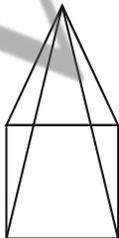
$$y - 3 = 0$$

$$y = 3 \quad (1)$$

This is the equation of the tangent and it is parallel to the x axis because $y = \text{constant} =$ parallel the to x - axis.

14.(2) If the price is x (at 20% discount) , then $(x) \cdot .8 = 192$; so $x = 192 / .8 = 240$;

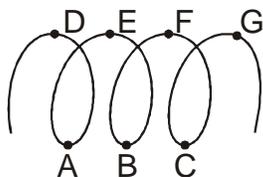
If the full price is Y then $Y \cdot .8 = 240$; $Y = 240 / .8 = 300$



15.(3)

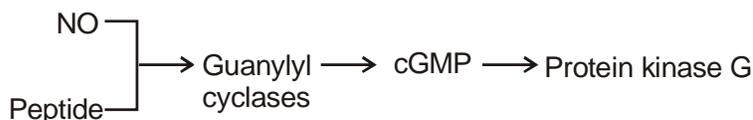
Pyramid have total 8 edge.

As we want 8 strands so by keeping wire like



A, B, C put in one time and D, E, F, G in next time.

- 16.(1)** The hydrophobic effect is due to non-polar groups interacting with water. When mixed with water, small amounts of non-polar substances coalesce into droplets. This process results from hydrophobic interactions.
- 17.(2)** Histidine is the amino acid with pKa closest to physiological pH. It has pKa of 6.8 and that is why it is found at the active site of enzymes.
- 18.(3)** One form of glycogen synthetase has a requirement for glucose-6-phosphate. It is an example of allosteric activation.
- 19.(4)** Acyl carrier proteins are involved in fatty acid synthesis. ACP is a small protein which consists of a single polypeptide chain to which phosphopantetheine group is covalently bound.
- 20.(2)** Specificity of transcription by RNA polymerases holoenzyme in E. coli is altered by changing the sigma subunit. The σ subunit is concerned specifically with promoter recognition.
- 21.(3)** Gene C1 from the lambda phage chromosome encodes lambda repressor; which represses the lytic cycle.
- 22.(1)** Ion channels are the channel proteins concerned specifically with inorganic ions transport. They are opened either by binding of ligands or by changes in electric potential across the membrane.
- 23.(4)** Nitric oxide (NO) is a paracrine signaling molecule as well as neurotransmitter. It regulates vasodilation and is synthesized from L-arginine by NO synthase.



- 24.(4)** Cell cycle is controlled by certain cyclins, cyclin-dependent protein kinases, inhibitory proteins and phosphatases.
- 25.(4)** Primary and secondary antibody responses differ in the predominant isotype generated, the number of lymphocytes responding to antigen and the speed at which antibodies appear in the serum.
- 26.(1)** Mendel could not find recombination and crossing over as traits he chose were either present on different chromosomes or were far apart.
- 27.(1)** Aneuploidy involves changes in chromosome number by additions or deletions of less than a whole set. In this case organism gains or loses one or more chromosomes but not a complete set.
- 28.(3)** Most commonly, agar (A polysaccharide obtained from a seaweed, i.e., a red alga, *Galidium amansii*) is used as solidifying or gelling agent. Agar gels do not react with constituents of media and not digested by plant enzymes. Generally, 0.5–1% agar is used to form gel. Before use of agar, gelatin (10%) had been used as gelling agent. Demerit of gelatin is that it melts at low temperatures (25°C).
- 29.(4)** Blue-white selection is used to test for the presence of a cloned insert in a plasmid.
- 30.(2)** DNA microarray would give the most precise and accurate information about where and when a given gene is expressed.
- 31.(2)** Reporter gene is a gene which can be used to measure the activity of a promoter and to determine when and where a promoter is active. It replaces the coding region of a gene of interest with a coding region that is easily assayed.

- 32.(2)** Three-dimensional images of the surface of the cells and tissues could be visualized through scanning electron microscope. Transmission electron microscope produces two-dimensional image.
- 33.(3)** An ion exchanger is usually a three - dimensional network or matrix that contains covalently linked charged groups.
- 34.(3)** Bacteria that are resistant to penicillin and related antibiotics produce an enzyme that breaks the beta-lactam ring in these antibiotics.
- 35.(4)** Mesodiploid is a bacterial cell that is mostly haploid, but is diploid for some regions of the genome. It is also known as partial diploid.

36.(1) Mean = $\frac{10 + 8 + 20 + 22 + 39 + 18}{6} = 19.5$

Median = $\left(\frac{n+1}{2}\right)^{\text{th}}$ item = $\frac{6+1}{2} = 3.5^{\text{th}}$ item

Thus median lies in between 3rd and 4th item

$$= \frac{18 + 20}{2} = 19$$

- 37.(1)** Tropical wet evergreen forest [with rain fall exceeds 250 cm] are found in Andaman, Mysore, Tamil Nadu, western Ghats.
These forests are climatic climax forests with very dense growth of tall trees (more than 45 meter high).
The shrubs, lianas, climbers and epiphytes are abundant, however grasses and herbs are rare on the forest floor.
- 38.(3)** Niche is a specific physical space occupied by an organism as well as its functional role in ecosystem. It includes the behavioral characteristics of organisms. The fundamental niche is always larger than realized niche.
- 39.(4)** Cytochromes are heme-proteins which serve as electron carrier in both respiration and photosynthesis

Cytochrome b and cytochrome c_1 (cytochrome bc_1) cytochrome a and cytochrome a_3 (cytochrome oxidase) and cytochrome c etc. are electron carriers.

- 40.(1)** The intermediates in the citric acid cycle provide precursors for many biosynthetic pathways for example

Amino acid synthesis following transamination of α -ketoglutarate.

Synthesis of fatty acids from citrate

Synthesis of purine and pyrimidine nucleotides from α -ketoglutarate and oxaloacetate.

- 41.(3)** Transpiration pull is a suction which is created in the xylem vessels. It depends on the very negative water potential of the atmosphere.

- 42.(4)** In some flowering plants, the requirement of long day-length or low temperature treatment for flowering can be effectively substituted by Gibberellins, while in short-day plants, they inhibit flowering.

Abscisic acid sometimes promotes flowering in short-day plants while inhibit in long-day plants (antagonistic to gibberellin).

2,4-D (2, 4 dichlorophenoxyacetic acid) are used as selective weed killers. They inhibit sprouting of potatoes. It also prevents premature fruit drop.

- 43.(4)** During water stress, the ABA level of the leaf can increase 50-fold.

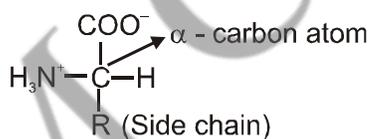
In addition to closing stomata, ABA increases the hydraulic conductivity of the root and increases the root: shoot ratio at low water potentials, (drought tolerance). During water stress ABA is synthesized continuously at a low rate in mesophyll and tends to accumulate mostly in chloroplasts.

- 44.(1)** In female gametophyte, the egg apparatus is attached to the wall of embryo sac only at the micropylar end and it is surrounded by the central cell.

The egg apparatus is comprised of an egg cell and two synergids.

Cells of the egg apparatus and the antipodal cells are uninucleate and haploid whereas the central cell is binucleate or diploid.

- 45.(4) Biosynthetic routes from cholesterol to steroid hormones
cholesterol → Pregnenlone → Progesterone → Testosterone (androgen) → Estradiol (estrogen).
- 46.(4) The perineurium is the connective tissue layer surrounding fascicles of axons in the peripheral nervous system.
- 47.(2) Amount of hemoglobin in the blood has the greatest effect on the ability of blood to transport oxygen.
- 48.(1) The rate of water reabsorption from the proximal tubule is determined primarily by the rate of dissolved particle (solute) reabsorption from the proximal tubule.
- 49.(3) The type of cleavage in the mammalian embryo is rotational cleavage.
- 50.(4) The evolution of similar characters in genetically unrelated species, mostly because they have been subjected to similar environmental selection pressures; is known as convergent evolution. Australian marsupials and placental mammals; the flippers in fish, penguins, and dolphins; the wings in birds, bats, and insects are all examples of convergent evolution.
- 51.(1) Amino acids always have at least one amino group and at least one carboxyl group in its



structure.

- 52.(4) Double bonds in unsaturated fatty acids are generally in cis configuration. In polyunsaturated fatty acid, double bonds are almost never conjugated. Sphingolipids are involved in biological recognition. Prostaglandins contain a five membered ring of carbon atoms and regulates the synthesis of cAMP.

53.(1)
$$[\text{Ex}] = \frac{6.85 \times 10^{-1} \text{g/liter}}{12800 \text{g/mol}} = 5.35 \times 10^{-5} \text{mol/lit}$$

$$K_{\text{cat}} = \frac{V_{\text{max}}}{[\text{Ex}]} = \frac{3.47 \text{ moles/lit/min}}{5.35 \times 10^{-5} \text{ mol/lit}}$$

$$K_{\text{cat}} = 6.48 \times 10^4 \text{ min}^{-1}$$

- 54.(4)** DNA - dependent RNA polymerase of E. coli requires a DNA template, Mg^{2+} , and all four ribonucleoside triphosphates and forms a phosphodiester bond and pyrophosphate. It is a polymeric protein which requires a protein factor (σ factors) for initiation of transcription.
- 55.(1)** Archaeobacterial operons are similar to those of eubacteria; and archaeobacterial RNA polymerase have a large number of subunits similar to eukaryotic polymerases; some of their subunits have homology to each other.
- 56.(1)** G- proteins \rightarrow transduces hormone stimulus from an activated 7 Tm membrane receptor to adenylate cyclase.
Adenylate cyclase \rightarrow is activated by G_{α} - GTP
IP3 \rightarrow is a second messenger arising from PIP2
DAG \rightarrow activates protein kinase C
Ras \rightarrow is a small G - protein GTP ase
 β - adrenergic receptor \rightarrow binds epinephrine.
- 57.(2)** The difference between a benign and a malignant tumor is that a malignant tumor has the ability to spread to other tissues and to initiate tumors at secondary sites, whereas benign tumours do not spread.
- 58.(4)** When B cells switch from producing IgM or IgD to IgG immunoglobulins, the change occurs in the genome as the genes encoding the constant regions for Igm and IgD are deleted independently of the RAG proteins.
- 59.(1)** Down's syndrome \rightarrow presence of an extra chromosome
Cri - du - chat syndrome \rightarrow loss of a part of chromosome
Klinefelter's syndrome \rightarrow an additional sex chromosome
Turner 's syndrome \rightarrow absence of sex chromosome
- 60.(2)** Phage DNA integration is accomplished by site - specific (reciprocal) recombination between the phage att P and the bacterial att B sequences (staggered cleavage at the att

B) and att P sites provides complementary single - stranded ends which can form a holliday junction).

- 61.(3)** Restriction endonucleases are enzymes that make sequence specific cuts in both strands of duplex DNA molecules generating 3' - hydroxyl and 5' - phosphate ends in the cut DNA strands.
- 62.(3)** Fluorescence recovery after photobleaching (FRAP) is typically used to measure lateral diffusion of membrane lipids and proteins. it involves fluorescent labeling of cell - surface molecules and demonstrates that lipids diffuse freely over short distances, but generally not over longer distances, in fibroblast membranes.
- 63.(2)** Totipotency is the ability of a plant/ animal cell that is not committed to a single developmental pathway, to form all types of differentiated cells. Totipotent plant cell can regenerate an entire plant when cultured in a suitable medium.
- 64.(4)** B - cell, T- cell, macrophage are the major population of cells present in petriplate, nylon wool adhered and nylon wool column flow through respectively.
- 65.(3)** Photochemical oxidant pollution is also known as photochemical smog.
Three major photochemical oxidant pollutants are Ozone (O_3), NO_2 and PAN (peroxyacetyl nitrate).
photochemical smog is produced as a result of photochemical reaction among nitrogen oxides (NO_x), hydrocarbons and oxygen in the air, exposed to intense solar radiation (UV radiations)
- 66.(3)** Epidermal growth factor - dependent tyrosine phosphorylation will be detected in only the membrane fraction of both cell lines.
- 67.(3)** Epidermal growth factor - dependent serine phosphorylation will be detected in only the membrane fraction of cell line B.
- 68.(4)** The mechanical work done by a chemical system during any change at constant temperature is equal to the decrease in its free energy.

In thermodynamics, free energy represent the potential to do work. The potential energy of water is referred to as water potential.

In the case of imbibition , as water continues to move into the imbinant , the water potential of the water in the imbibnant becomes less negative.

Osmotic pressure can also be defined as pressure built by a solution to increase its chemical potential to that of pure water. The osmotic pressure is a colligative property of a solution; it is directly related to the number of solute molecules in a Solution.

- 69.(2)** Double fixation of CO_2 takes place both in C_4 and CAM plants. CO_2 fixation in C_4 plants is separated by space whereas in CAM plants, it is separated by time.
- 70.(3)** Cytokinins make dormant buds active. Gibberellins are involved in the breaking of seed dormancy. Cytokinins are generally found in higher concentrations in meristematic regions and growing tissues.
- 71.(2)** Fritillairia type: After the nuclear fusion, both nuclei of the coenomegaspore (one haploid and one triploid) divide twice forming four nuclei at each pole. The mature embryo sac comprises an egg apparatus of three haploid cells, three triploid antipodal cells and central cell with two polar nuclei one haploid and one triploid.
- 72.(3)** Chloride shift involves the passage of chloride ions from the plasma to RBC to balance the bicarbonate ions which have passed out from RBC to Plasma.
- 73.(3)** There are several ventricles in the brain and some of these ventricles are connected by foreman of monro. This foramen connects lateral ventricles and third ventricle in cerebral hemispheres which are located in the diencephalon of the brain.
- 74.(2)** A new species is formed when genotypic changes accumulate in a population resulting in its reproductive isolation
- 75.(3)** irradiation treatment of seeds with X - rays would be most effective in producing mutations for plant breeding experiments. It aims at improving the genetic makeup of the crop plants.