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**NEET
2019**

**Paper &
Solution
Code : S2**

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1. From evolutionary point of view, retention of the female gametophyte with development young embryo on the parent sporophyte for some time, is first observed in :
(1) Pteridophytes (2) Gymnosperms (3) Liverworts (4) Mosses

Sol. 1

2. Extrusion of second polar body from egg nucleus occurs :
(1) before entry of sperm into ovum
(2) simultaneously with first cleavage
(3) after entry of sperm but before fertilization
(4) after fertilization

Sol. 3

3. DNA precipitation of a mixture of biomolecules can be achieved by treatment with
(1) Methanol at room temperature
(2) Chilled chloroform
(3) Isopropanol
(4) Chilled ethanol

Sol. 4

4. Due to increasing air borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to :-
(1) Proliferation of fibrous tissues and damage of the alveolar walls
(2) reduction in the secretion of surfactants by pneumocytes
(3) benign growth on mucous lining of nasal cavity
(4) inflammation of bronchi and bronchioles

Sol. 4

5. The Earth summit held in Rio de Janeiro in 1992 was called :
(1) to assess threat posed to native species by invasive weed species
(2) for immediate steps to discontinue use of CFCs that were damaging the ozone layer
(3) to reduce CO₂ emissions and global warming.
(4) for conservation of biodiversity and sustainable utilization of its benefits.

Sol. 4

6. Match the hominids with their **correct** brain size.
(a) Homo habilis (i) 900cc
(b) Homo neanderthalensis (ii) 1350cc
(c) Homo erectus (iii) 650-800 cc
(d) Homo sapiens (iv) 1400 cc

Select the correct option.

- | | | | | |
|-----|-------|-------|------|------|
| | (a) | (b) | (c) | (d) |
| (1) | (iii) | (iv) | (i) | (ii) |
| (2) | (iv) | (iii) | (i) | (ii) |
| (3) | (iii) | (i) | (iv) | (ii) |
| (4) | (iii) | (ii) | (i) | (iv) |

Sol. 4

7. How does steroid hormone influence the cellular activities ?
(1) Activating cyclic AMP located on the cell membrane
(2) Using aquaporin channels as second messenger
(3) Changing the permeability of the cell membrane
(4) Binding to DNA and forming a gene-hormone complex
Sol. 4
8. Expressed Sequence Tags (ESTs) refers to :
(1) DNA polymorphism (2) Novel DNA sequence
(3) Genes expressed as RNA (4) Polypeptide expression
Sol. 3
9. It takes very long time for pineapple plants to produce flowers. Which combination of hormones can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield ?
(1) Gibberellin and Abscisic acid (2) Cytokinin and Abscisic acid
(3) Auxin and Ethylene (4) Gibberellin and Cytokinin
Sol. 3
10. Which of the following ecological pyramids is generally inverted ?
(1) Pyramid of biomass in a forest (2) Pyramid of biomass in a sea
(3) Pyramid of numbers in grassland (4) Pyramid of energy
Sol. 2
11. Which of the following pair or organelles does not contain DNA ?
(1) Lysosomes and Vacuoles
(2) Nuclear envelope and Mitochondria
(3) Mitochondria and Lysosomes
(4) Chloroplast and Vacuoles
Sol. 1
12. Select the correct sequence for transport of sperm cells in male reproductive system.
(1) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra
(2) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus
(3) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra
(4) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vasdeferens → Ejaculatory duct → Urethra → Urethral meatus
Sol. 4

13. Match the following hormones with the respective disease :

- | | |
|--------------------|-------------------------|
| (1) Insulin | (i) Addison's disease |
| (2) Thyroxin | (ii) Diabetes insipidus |
| (3) Corticoids | (iii) Acromegaly |
| (4) Growth Hormone | (iv) Goitre |
| | (v) Diabetes mellitus |

Select the correct option.

- | | (a) | (b) | (c) | (d) |
|-----|------|------|-------|-------|
| (1) | (v) | (iv) | (i) | (iii) |
| (2) | (ii) | (iv) | (i) | (iii) |
| (3) | (v) | (i) | (ii) | (iii) |
| (4) | (ii) | (iv) | (iii) | (i) |

Sol. 1

14. Persistent nucellus in the seed is known as :

- (1) Hilum (2) Tegmen (3) Chalaza (4) Perisperm

Sol. 4

15. Pinus seed cannot germinate and establish without fungal association. This is because :

- (1) It has very hard seed coat
 (2) Its seeds contain inhibitors that prevent germination.
 (3) Its embryo is immature.
 (4) It has obligate association with mycorrhizae.

Sol. 4

16. Cells in G₀ phase :

- (1) suspend the cell cycle
 (2) terminate the cell cycle
 (3) exit the cell cycle
 (4) enter the cell cycle

Sol. 3

17. Match the following structures with their respective location in organs :

- | | |
|--------------------------|-----------------------|
| (a) Crypts of Lieberkuhn | (i) Pancreas |
| (b) Glisson's Capsule | (ii) Duodenum |
| (c) Islets of Langerhans | (iii) Small intestine |
| (d) Brunner's Glands | (iv) Liver |

Select the correct option from the following :

- | | (a) | (b) | (c) | (d) |
|-----|-------|------|------|------|
| (1) | (iii) | (iv) | (i) | (ii) |
| (2) | (iii) | (ii) | (i) | (iv) |
| (3) | (iii) | (i) | (ii) | (iv) |
| (4) | (ii) | (iv) | (i) | (ii) |

Sol. 1

18. Grass leaves curl inwards during very dry weather. select the most appropriate reason from the following :

- (1) Shrinkage of air spaces in spongy mesophyll
 (2) Yyloses in vessels
 (3) Closure of stomata
 (4) Flaccidity of bulliform cells

Sol. 4

- 19.** Consider the following statements :
(A) Conzyme or metal ion that is tightly bound to enzyme protein is called prosthetic group.
(B) A complete catalytic active enzyme with its bound prosthetic group is called apoenzyme.
Select the correct option.
(1) Both (A) and (B) is false.
(2) (A) is false but (B) is true
(3) Both (A) and (B) are true
(4) (A) is true but (B) is false.
- Sol. **1**
- 20.** Respiratory quotient (RQ) value of triplamitin is:
(1) 0.07 (2) 0.09 (3) 0.9 (4) 0.7
- Sol. **4**
- 21.** Which of the following statements is incorrect ?
(1) Infective constituent in viruses is the protein coat.
(2) Prions consist of abnormally folded proteins
(3) Viroids lack a protein coat.
(4) Viruses are obligate parasites.
- Sol. **1**
- 22.** Phloem in gymnosperm lacks :
(1) Companion cells only
(2) Both sieve tubes and companion cells
(3) Albuminous cells and sieve cells
(4) Sieve tubes only
- Sol. **2**
- 23.** Under which of the following conditions will there be no change in the reading frame of following mRNA ?
5'AAGAGCGGUGCUAAU3'
(1) Insertion of A and G at 4th and 5th positions respectively
(2) Deletion of GGU from 7th, 8th and 9th position
(3) Insertion of G at 5th position
(4) Deletion of G from 5th position
- Sol. **2**
- 24.** Identify the cells whose secretion protects the lining of gastro-intestinal tract from various enzymes.
(1) Oxyntic Cells
(2) Duodenal cells
(3) Chief cells
(4) Goblet cells
- Sol. **4**
- 25.** What is the site of perception of photoperiod necessary for induction of flowering in plants ?
(1) Shoot apex
(2) Leaves
(3) Lateral buds
(4) Pulvinus
- Sol. **2**

- 26.** What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of diastole is 100 mL and at the end of ventricular systole is 50 mL ?
 (1) 100 beats per minute
 (2) 125 beats per minute
 (3) 50 beats per minutes
 (4) 75 beats per minutes
- Sol. **1**
- 27.** Tidal volume and expiratory reserve volume of an athlete is 500 mL and 1000 mL respectively what will be his expiratory capacity if the residual volume is 1200 mL ?
 (1) 2200 mL
 (2) 2700 mL
 (3) 1500 mL
 (4) 1700 mL
- Sol. **3**
- 28.** Placentation, in which ovules develop on the inner wall of the ovary or in peripheral part is :
 (1) Parietal
 (2) Free central
 (3) Basal
 (4) Axile
- Sol. **3**
- 29.** Which of these following methods is the most suitable for disposal of nuclear waste ?
 (1) Dump the waste within rocks under deep ocean
 (2) Bury the waste within rocks deep below the Earth's surface
 (3) Shoot the waste into space
 (4) Bury the waste under antarctic ice-over
- Sol. **2**
- 30.** Which of the following statements is incorrect ?
 (1) Conidia are produced exogenously and ascospores endogenously
 (2) Yeasts have filamentous bodies with long thread like hyphae
 (3) Morels and truffles are edible delicacies
 (4) *Claviceps* is a source of many alkaloids and LSD.
- Sol. **2**
- 31.** Which one of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes?
 (1) Industrial oven (2) Bioreactor (3) BOD incubator (4) Sludge digester
- Sol. **2**
- 32.** Match the following organisms with the products they produce :
 (a) *Lactobacillus* (i) Cheese
 (b) *Saccharomyces cerevisiae* (ii) Curd
 (c) *Aspergillus niger* (iii) Citric acid
 (d) *Acetobacter aceti* (iv) Bread
 (v) Acetic acid
- Select the correct option.
- | | | | | |
|-----|-------|------|-------|-------|
| | (a) | (b) | (c) | (d) |
| (1) | (iii) | (iv) | (v) | (i) |
| (2) | (ii) | (i) | (iii) | (v) |
| (3) | (ii) | (iv) | (v) | (iii) |
| (4) | (ii) | (iv) | (iii) | (v) |
- Sol. **4**

- 33.** Select the incorrect statement.
(1) Inbreeding selects harmful recessive genes that reduce fertility and productivity.
(2) Inbreeding helps in accumulation of superior genes and elimination of undesirable genes.
(3) Inbreeding increases homozygosity.
(4) Inbreeding is essential to evolve purelines in any animal.
Sol. 1
- 34.** Which of the following immune responses is responsible for rejection of kidney graft?
(1) Inflammatory immune response
(2) Cell-mediated immune response
(3) Auto-immune response
(4) Humoral immune response.
Sol. 2
- 35.** Which the statements given below is not true about formation of annual rings in trees?
(1) Activity of cambium depends upon variation in climate.
(2) Annual rings are not prominent in trees of temperate region.
(3) Annual ring is combination of spring wood and autumn wood produced in a year.
(4) Differential activity of cambium causes light and dark bands of tissue - early and late wood respectively.
Sol. 2
- 36.** Which of the following is true for golden rice?
(1) It is drought tolerant, developed using Agrobacterium vector.
(2) It has yellow grains, because of a gene introduced from a primitive variety of rice.
(3) It is vitamin A enriched, with a gene from daffodil.
(4) It is pest resistant, with a gene from Bacillus thuringiensis.
Sol. 2
- 37.** What is the genetic disorder in which an individual has an overall masculine development gynaecomastia, and is sterile
(1) Edward syndrome
(2) Down's syndrome
(3) Turner's syndrome
(4) Klinefelter's syndrome
Sol. 4
- 38.** Which of the following statements regarding post fertilization development in flowering plants is incorrect?
(1) Central cell develops into endosperm
(2) Ovules develop into embryo sac
(3) Ovary develops into fruit.
(4) Zygote develops into embryo.
Sol. 2
- 39.** Which of the following is the most important cause for, animals and plants being driven to extinction?
(1) Economic exploitation
(2) Alien species invasion
(3) Habitat loss and fragmentation
(4) Drought and floods.
Sol. 3

40. Which of the following contraceptive methods do involve a role of hormone?

- (1) Cut, Pills, Emergency contraceptives
- (2) Pills, Emergency contraceptives, Barrier methods
- (3) Lactational amenorrhea, Pills, Emergency contraceptives
- (4) Barrier method, Lactational amenorrhea, Pills

Sol. 3

41. Consider following features :

- (1) Organ system level of organisation
- (2) Bilateral symmetry
- (3) True coelomates with segmentation of body

Select the correct option of animal groups which possess all the above characteristics.

- (1) Arthropoda, Mollusca and Chordata
- (2) Annelida, mollusca and Chordata
- (3) Annelida, Arthropoda and Chordata
- (4) Annelida, Arthropoda and Mollusca

Sol. 3

42. Which of the following factors is responsible for the formation of concentrated urine ?

- (1) Secretion of erythropoietin juxtaglomerular complex.
- (2) Hydrostatic pressure during glomerular filtration.
- (3) Low levels of antidiuretic hormone.
- (4) Maintaining hyperosmolarity towards inner medullary interstitium in the kidneys.

Sol. 4

43. Match the following organisms with their respective characteristics :

- | | |
|-------------------|-------------------------|
| (a) Pila | (i) Flame cells |
| (b) Bombyx | (ii) Comb plates |
| (c) Pleurobrachia | (iii) Radula |
| (d) Taenia | (iv) Malpighian tubules |

Select the correct option from the following :

- | | (1) | (2) | (3) | (4) |
|-----|-------|------|-------|------|
| (1) | (ii) | (iv) | (iii) | (i) |
| (2) | (iii) | (ii) | (iv) | (i) |
| (3) | (iii) | (ii) | (i) | (iv) |
| (4) | (iii) | (iv) | (ii) | (i) |

Sol. 4

44. Xylem translocates :

- (1) Water mineral salts and some organic nitrogen only
- (2) Water mineral salts some organic nitrogen and hormones
- (3) Water only
- (4) Water and mineral salts only

Sol. 2

45. What is the direction of movement of sugars in phloem?

- (1) Downward
- (2) Bi-directional
- (3) Non-multidirectional
- (4) Upward

Sol. 2

46. The correct sequence of phases of cell cycle is:

- (1) $S \rightarrow G_1 \rightarrow G_2 \rightarrow M$
- (2) $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$
- (3) $M \rightarrow G_1 \rightarrow G_2 \rightarrow S$
- (4) $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$

Sol. 2

47. The shorter and longer arms of a submetacentric chromosome are referred to as:

- (1) q-arm and p-arm respectively
- (2) m-arm and n-arm respectively
- (3) s-arm and l-arm respectively
- (4) p-arm and q-arm respectively

Sol. 4

48. Which of the following can be used as a biocontrol agent in the treatment of plant diseases?

- (1) Anabaena
- (2) Lactobacillus
- (3) Trichoderma
- (4) Chlorella

Sol. 3

49. Which of the following glucose transporters is insulin-dependent?

- (1) GLUT III
- (2) GLUT IV
- (3) GLUT I
- (4) GLUT II

Sol. 2

50. Purines found both in DNA and RNA are:

- (1) Guanine and cytosine
- (2) Cytosine and thymine
- (3) Adenine and thymine
- (4) Adenine and guanine

Sol. 4

51. Drug called 'Heroin' is synthesized by:

- (1) glycosylation of morphine
- (2) nitration of morphine
- (3) methylation of morphine
- (4) acetylation of morphine.

Sol. 4

52. Select the correct option.

- (1) Each rib is a flat thin bone and all the ribs are connected dorsally to the thoracic vertebrae and ventrally to the sternum.
- (2) There are seven pairs of vertebrosteral, three pairs of vertebrochondral and two pairs of vertebral ribs.
- (3) 8th, 9th and 10th pairs of ribs articulate directly with the sternum.
- (4) 11th, and 12th pairs of ribs are connected to the sternum with the help of hyaline cartilage.

Sol. 2

53. A gene locus has two alleles A, a. If the frequency of dominant allele A is 0.4, then what will be the frequency of homozygous dominant, heterozygous and homozygous recessive individuals in the population?

- (1) 0.16(AA); 0.48(Aa); 0.36(aa)
- (2) 0.16(AA); 0.36(Aa); 0.48(aa)
- (3) 0.36(AA); 0.48(Aa); 0.16(aa)
- (4) 0.16(AA); 0.24(Aa); 0.36(aa)

Sol. 1

54. Which of the following statements regarding mitochondria is incorrect?

- (1) Inner membrane is convoluted with infoldings.
- (2) Mitochondrial matrix contains single circular DNA molecule and ribosomes.
- (3) Outer membrane is permeable to monomers of carbohydrates, fats and proteins.
- (4) Enzymes of electron transport are embedded in outer membrane.

Sol. 4

55. Variations caused by mutation, as proposed by Hugo de Vries, are:

- (1) small and directional
- (2) small and directionless
- (3) random and directional
- (4) random and directionless

Sol. 4

56. Following statements describe the characteristics of the enzyme, Restriction, Endonuclease, Identify the incorrect statements.

- (1) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.
- (2) The enzyme recognizes a specific palindromic nucleotide sequence in the DNA.
- (3) The enzyme cuts, DNA molecule at identified position within the DNA.
- (4) The enzyme binds DNA at specific sites and cuts only one of the two strands.

Sol. 4

57. Which part of the brain is responsible for thermoregulation?

- (1) Corpus callosum
- (2) Medulla oblongata
- (3) Cerebrum
- (4) Hypothalamus

Sol. 4

58. Use of an artificial kidney during hemodialysis may result in:

- (a) Nitrogenous waste build-up in the body
- (b) Non-elimination of excess potassium ions
- (c) Reduced absorption of calcium ions from gastro-intestinal tract
- (d) Reduced RBC production

Which of the following options is the most appropriate?

- (1) (c) and (d) are correct
- (2) (a) and (d) are correct
- (3) (a) and (b) are correct
- (4) (b) and (c) are correct

Sol. 1

- 59.** What triggers activation of protoxin to active bt toxin of Bacillus thuringiensis in boll worm?
(1) Alkaline pH of gut
(2) Acidic pH of stomach
(3) Body temperature
(4) Moist surface of midgut
Sol. 1
- 60.** Which fo the following protocols did aim for reducing emission of chlorofluorocarbons into the atmosphere?
(1) Gothenburg Protocol
(2) Geneva protocol
(3) Montreal Protocol
(4) Kyoto Protocol
Sol. 3
- 61.** Which of the following sexually transmitted diseases is not completely curable?
(1) Genital herpes
(2) Chlamydiasis
(3) Gonorrhoea
(4) Genital warts.
Sol. 1
- 62.** Thiobasillus is a group of bacteria helpful in carrying out:
(1) Nitrification
(2) Denitrification
(3) Nitrogen fixation
(4) Chemoautotrophic fixation
Sol. 2
- 63.** In Antirrhinum (Snapdragon), a red flower was crossed with a white flower and in F₁ generation, pink flowers were obtained. When pink flowers were selfed, the F₂ generation showed white red and pink flowers. Choose the incorrect statement from the following:
(1) Ratio of F₂ is $\frac{1}{4}$ (Red): $\frac{2}{4}$ (Pink): $\frac{1}{4}$ (white)
(2) Law of segregation does dont apply in the experiment.
(3) This experimnet does not follow the principle of Dominance.
(4) Pink colour in F₁ is due to incomplete dominance.
Sol. 2
- 64.** In a species the weight of newborn ranges from 2 to 5 kg. 97% of the newborn with weight from 2 to 2.5 kg or 4.5 to 5 kg die. Which type of selection process is taking place?
(1) Disruptive Selection
(2) Cyclical Selection
(3) Directional Selection
(4) Stablizing Selection
Sol. 4
- 65.** Concanavalin A is :
(1) a lectin (2) a pigment (3) an alkaloid (4) an essention oil
Sol. 1

66. Match the column - I with Column-II:

Column-I

- (a) P-wave
(b) QRS complex
(c) T-wave
(d) reduction in the size of T-wave

Column-II

- (i) Depolarisation of ventricles
(ii) Repolarisation of ventricles
(iii) coronary ischemia
(iv) Depolarisation of atria
(v) Repolarisation of atria

select the correct options:

- | | | | | |
|-----|------|-------|------|-------|
| | (a) | (b) | (c) | (d) |
| (1) | (ii) | (i) | (v) | (iii) |
| (2) | (ii) | (iii) | (v) | (iv) |
| (3) | (iv) | (i) | (ii) | (iii) |
| (4) | (iv) | (i) | (ii) | (v) |

Sol.

3

67. Match following genes of the Lac operon with their respective products:

- | | |
|------------|---------------------|
| (a) i gene | (i) b-galactosidase |
| (b) z gene | (ii) Permease |
| (c) a gene | (iii) Repressor |
| (d) y gene | (iv) Transcetylase |

select the correct options:

- | | | | | |
|-----|-------|-------|------|------|
| | (a) | (b) | (c) | (d) |
| (1) | (iii) | (i) | (iv) | (ii) |
| (2) | (iii) | (iv) | (i) | (ii) |
| (3) | (i) | (iii) | (ii) | (iv) |
| (4) | (iii) | (i) | (ii) | (iv) |

Sol.

1

68. Which of the following statement is not correct?

- (1) Lysosomes are membrane bound structures.
(2) Lysosomes are formed by the process of packaging in the endoplasmic reticulum
(3) Lysosomes have numerous hydrolytic enzymes.
(4) The hydrolytic enzymes of lysosomes are active under acidic pH

Sol.

2

69. In some plants the female gamete develops into embryo without fertilization. This phenomenon is known as:

- (1) Syngamy
(2) Parthenogenesis
(3) Autogamy
(4) Parthenocarpy

Sol.

2

70. Match the column -I with Column-II

Column-I

(a) Saprophyte

(b) Parasite

(c) Lichens

(d) mycorrhiza

Column-II

(i) Symbiotic association of fungi with plant roots

(ii) Decomposition of dead organic materials

(iii) Living on living plants or animals

(iv) Symbiotic association of algae and fungi

Choose the correct answer form the givin below:

- | | | | | |
|-----|-------|-------|-------|------|
| | (a) | (b) | (c) | (d) |
| (1) | (ii) | (i) | (iii) | (iv) |
| (2) | (ii) | (iii) | (iv) | (i) |
| (3) | (i) | (ii) | (iii) | (iv) |
| (4) | (iii) | (ii) | (i) | (iv) |

Sol.

2

71. Which of the following is a commercial blood cholestrol lowering agent?

(1) Streptokinase

(2) Lipase

(3) Cyclosporin A

(4) Statin

Sol.

4

72. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology?

(1) Genetic code is nearly universal

(2) Genetic code is specific

(3) Genetic code is not ambiguous

(4) Genetic code is redundant

Sol.

1

73. The ciliated epithelial cell are reuired to move particles or mucus in a specific direction. In humans, these cells are mainly present in:

(1) Eustachian tube and Salivary duct

(2) Bronchioles and Fallopian tubes

(3) Bile duct and Bronchioles

(4) Fallopian tube and Pancreatic duct

Sol.

2

74. Conversion of glucose -6-phosphate the first irreversible reaction of glycolysis, is catalyzed by :

(1) Enolase

(2) Phosphofructokinase

(3) Aldolase

(4) Hexokinase

Sol.

4

75. Which one of the following is not a method of in situ conservation of biodiversity?

(1) Botanical Garden

(2) Sacred Grove

(3) Biosphere Reserve

(4) Wildlife Sanctuary

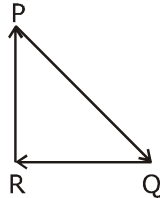
Sol.

1

- 76.** The concept of "Omnis cellula-e cellula" regarding cell division was first proposed by:
 (1) Schleiden
 (2) Arustotle
 (3) Rudolf Virchow
 (4) Theodore Schwann
 Sol. 3
- 77.** Select the correct group of biocontrol agents:
 (1) Oscillatoria, Rhizobium, Trichoderma
 (2) Nostoc, Azospirillum, Nucleopolyhedrovirus
 (3) Bacillus thuringiensis, Tobacco mosaic virus, Aphids
 (4) Trichoderma, Baculovirus, Bacillus thuringiensis
 Sol. 4
- 78.** Identify the correct pair of representing the causative agent of typhoid fever and the confirmatory test for typhoid.
 (1) Salmonella typhi / Anthrone test
 (2) Salmonella typhi / Widal test
 (3) Plasmodium vivax / UTI test
 (4) Streptococcus pneumoniae/ Widal test
 Sol. 2
- 79.** Select the incorrect Statement.
 (1) In domesticated fowls, sex of progeny depends on the type of sperm rather than egg.
 (2) Human males have one of their sex-chromosome much shorter than the other.
 (3) male fruit fly is heterogametic.
 (4) In male grasshopper, 50% of sperms have no sex-chromosome.
 Sol. 1
- 80.** Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth:
 (1) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum
 (2) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum
 (3) Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
 (4) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon → Rectum
 Sol. 3
- 81.** Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the newborn infants because it contains:
 (1) Macrophages
 (2) Immunoglobulin A
 (3) Natural killer cells
 (4) Monocytes
 Sol. 2
- 82.** What is the fate of the male gametes discharged in the synergid ?
 (1) One fuses with the egg, other (s) fuse(s) with synergid nucleus.
 (2) One fuses with the egg and other fuses with central cell nuclei.
 (3) One fuses with the egg. other(s) degenerate (s) in the synergid.
 (4) All fuse with the egg.
 Sol. 2
- 83.** What map unit (centimorgan) is adopted in the construction of genetic maps ?
 (1) A unit of distance between genes on chromosomes, representing 1% cross over.
 (2) A unit of distance between genes on chromosomes, representing 50% cross over.
 (3) A unit of distance between two expressed genes, representing 10% cross over.
 (4) A unit of distance between two expressed genes, representing 100% cross over.
 Sol. 1

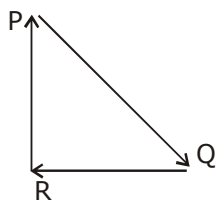
- 84.** Select the hormone-releasing intra-uterine devices.
(1) Progestasert, LNG-20
(2) Lippes Loop, Multiload 375
(3) Vaults, LNG-20
(4) Multiload 375, Progestasert
Sol. 1
- 85.** Select the correctly written scientific name of mango which was first described by Carlous Linnaeus:
(1) *Mangifera Indica*
(2) *Mangifera Indica*
(3) *Mangifera Indica Car Linn.*
(4) *Magifera Indica Linn*
Sol. 4
- 86.** Which of the following pairs of gases is mainly responsible for green house effect.
(1) Nitrogen and Sulphur dioxide
(2) Carbon dioxide and Methane
(3) Ozone and Ammonia
(4) Oxygen and Nitrogen
Sol. 2
- 87.** The frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes was explained by:
(1) Alfred Sturtevant
(2) Sutton Boveri
(3) T.H. Morgan
(4) Gregor J. Mendel
Sol. 1
- 88.** Which of the following statements is correct ?
(1) Cornea is convex, transparent layer which is highly vascularised
(2) Cornea consists of dense matrix of collagen and is the most sensitive portion of the eye.
(3) Cornea is an external, transparent and protective proteinaceous covering of the eye-ball
(4) Cornea consists of dense connective tissue of elastin and can repair itself.
Sol. 3
- 89.** Which of the following muscular disorders is inherited ?
(1) Myasthenia gravis
(2) Botulism
(3) Tetany
(4) Muscular dystrophy
Sol. 4
- 90.** Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for
(1) Construction of roads
(2) making tubes and pipes
(3) making plastic sacks
(4) use as a fertilizer
Sol. 1

- 93.** A particle moving with velocity \vec{V} is acted by three forces shown by the vector triangle PQR. The velocity of the particle will :



- (1) remain constant
(2) change according to the smallest force \overline{QR}
(3) increase
(4) decrease

Sol. 1



Closed triangle means net force = 0

$$\therefore F_{\text{net}} = 0$$

Hence $v = \text{constant}$

- 94.** Ionized hydrogen atoms and α -particles with same momenta enters perpendicular to a constant magnetic field B. The ratio of their radii of their paths $r_H : r_\alpha$ will be :

- (1) 4 : 1 (2) 1 : 4 (3) 2 : 1 (4) 1 : 2

Sol. 3

$$r = \frac{mv}{qB}$$

$$r \propto \frac{1}{q}$$

$$\therefore r_H = \frac{1}{e}$$

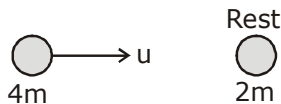
$$r_\alpha = \frac{1}{2e}$$

$$\therefore \frac{r_H}{r_\alpha} = \frac{2e}{e} = 2 : 1$$

- 95.** Body A of mass $4m$ moving with speed u collides with another body B of mass $2m$, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is :

- (1) $\frac{4}{9}$ (2) $\frac{5}{9}$ (3) $\frac{1}{9}$ (4) $\frac{8}{9}$

Sol. 4



$$E_i = \frac{1}{2} (4m) u^2 = 2mu^2$$

$$p_i = p_f$$

$$4mu = 4mv_1 + 2mv_2$$

$$e = \frac{v_2 - v_1}{u_1 - u_2} = 1$$

$$\Rightarrow v_2 - v_1 = u$$

$$\Rightarrow v_2 = u + v_1$$

$$\therefore 4mu = 4mv_1 + 2mu + 2mv_1$$

$$\Rightarrow 2mu = 6mv_1$$

$$\Rightarrow v_1 = \frac{1}{3} u$$

$$\therefore E_f = \frac{1}{2} \times 4m \times \frac{u^2}{9}$$

$$= \frac{2mu^2}{9}$$

$$\therefore \text{Energy lost} = \frac{E_i - E_f}{E_i} = \frac{2mu^2 - \frac{2}{9}mu^2}{2mu^2}$$

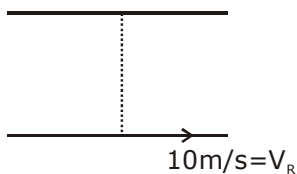
$$= \frac{8}{9}$$

- 96.** The speed of a swimmer in still water is 20 m/s . The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by :

- (1) 60° west (2) 45° west (3) 30° west (4) 0°

Sol. 3

$$V_{BR} = 20 \text{ m/s}$$

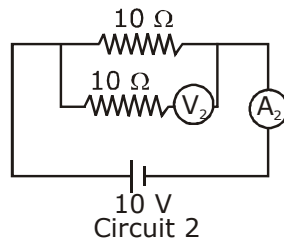
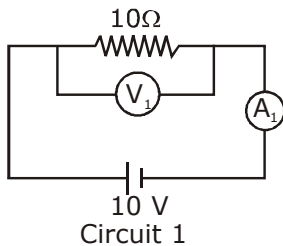


$$\sin \theta = \frac{V_r}{V_{BR}} = \frac{10}{20} = \frac{1}{2}$$

$$\Rightarrow \theta = 30^\circ$$

$$\therefore 30^\circ \text{ west}$$

97. In the circuits shown below, the readings of the voltmeters and the ammeters will be :



(1) $V_1 = V_2$ and $i_1 = i_2$
 (3) $V_2 > V_1$ and $i_1 = i_2$

(2) $V_2 > V_1$ and $i_1 > i_2$
 (4) $V_1 = V_2$ and $i_1 > i_2$

Sol. 1

Considering ideal (V) and (A)

$$\therefore V_1 = V_2$$

$$i_1 = i_2$$

98. A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field $5 \times 10^{-5} \text{ T}$. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s , the emf induced in the coil will be :

- (1) $2 \times 10^{-3} \text{ V}$ (2) 0.02 V (3) 2 V (4) 0.2 V

Sol. 2

$$N = 800$$

$$A = 0.05 \text{ m}^2$$

$$B = 5 \times 10^{-5} \text{ T}$$

$$\phi = NBA$$

$$= 800 \times 0.05 \times 5 \times 10^{-5}$$

$$= 200 \times 10^{-5} \text{ Wb}$$

$$\therefore e = \frac{d\phi}{dt} = \frac{200 \times 10^{-5}}{0.1}$$

$$= 0.02 \text{ v}$$

99. At a point A on the earth's surface the angle of dip, $\delta = +25^\circ$. At a point B on the earth's surface the angle of dip, $\delta = -25^\circ$. We can interpret that :

- (1) A is located in the northern hemisphere and B is located in the southern hemisphere
 (2) A and B are both located in the southern hemisphere.
 (3) A and B are both located in the northern hemisphere.
 (4) A is located in the southern hemisphere and B is located in the northern hemisphere.

Sol. 1

From sign convention →

Positive sign is chosen if magnetic needle points towards surface of earth

100. An electron is accelerated through a potential difference of 10,000V. its de Broglie wavelength is, (nearly) : ($m_e = 9 \times 10^{-31}$ kg)

(1) 12.2×10^{-14} m

(2) 12.2 nm

(3) 12.2×10^{-13} m

(4) 12.2×10^{-12} m

Sol. 4

$$\lambda = \frac{\sqrt{150}}{\sqrt{v}}$$

$$= \frac{12.27}{\sqrt{10000}} = 12.2 \times 10^{-12} \text{m}$$

101. The displacement of a particle executing simple harmonic motion is given by $y = A_0 + A \sin \omega t + B \cos \omega t$. Then the amplitude of its oscillation is given by :

(1) $\sqrt{A_0^2 + (A+B)^2}$

(2) $A + B$

(3) $A_0 + \sqrt{A^2 + B^2}$

(4) $\sqrt{A^2 + B^2}$

Sol. 4

given : $y = A_0 + A \sin \omega t + B \cos \omega t$

$(y - A_0) = A \sin \omega t + B \cos \omega t$

So resultant Amplitude

$$\Rightarrow \sqrt{A^2 + B^2 + 2AB \cos \frac{\pi}{2}} \left(\because \Delta \phi = \frac{\pi}{2} \right)$$

$$\Rightarrow \sqrt{A^2 + B^2}$$

102. α - particle consists of :

(1) 2 electrons and 4 protons only

(2) 2 protons only

(3) 2 protons and 2 neutrons only

(4) 2 electrons, 2 protons and 2 neutrons

Sol. 3

By theory

α particle $\rightarrow {}_2\text{He}^4$

No. of protons $\rightarrow 2$

No. of neutrons $\rightarrow 4 - 2 = 2$

103. A hollow metal sphere of radius R is uniformly charged, The electric field due to the sphere at a distance r from the centre :

(1) Zero as r increases from $r < R$ increases as r increases for $r > R$

(2) decreases as r increases for $r < R$ and for $r > R$

(3) increases as r increases for $r < R$ and for $r > R$

(4) zero as r increases for $r < R$, decreases as r increases for $r > R$

Sol. 4

For hollow sphere

⇒ inside sphere no chargedistributed so electric fiendl inside sphere is zero.
and outside sphere electric field

$$E = \frac{kQ}{r^2} \Rightarrow E \propto \frac{1}{r^2}$$

$r \downarrow, E \downarrow$

104. In an experiment the percentage of error ocured in the measurement of physical quantities A,B,C, and D are 1%, 2%, 3% and 4% respectively, Then the maximum percentage of error in the measurement X, where $X = \frac{A^2B^{1/2}}{C^{1/3}D^3}$, will be :

- (1) -10% (2) 10% (3) $\left(\frac{3}{13}\right)\%$ (4) 16%

Sol. 4

$$\% \text{ error in } x = 2 \frac{\Delta A}{A} \times 100 + \frac{1}{2} \frac{\Delta B}{B} \times 100 + \frac{1}{3} \frac{\Delta C}{C} \times 100 + 3 \frac{\Delta D}{D} \times 100$$

$$\Rightarrow 2 \times 1 + \frac{1}{2}(2) + \frac{1}{3}(3) + 3 \times 4$$

$$\Rightarrow 2 + 1 + 1 + 12 \Rightarrow 16\%$$

105. A force $F = 20 + 10y$ acts on a particle in y - direction where F is in newton and y in meter. Work done by this force to move the particle from $y = 0$ to $y = 1$ m is
(1) 25 J (2) 20 J (3) 30 J (4) 5 J

Sol. 1

$$w = \int F_y \cdot dy$$

$$w = \int_0^1 (20 + 10y) dy$$

$$w = 20[y]_0^1 + \frac{10}{2}[y^2]_0^1$$

$$\Rightarrow 20(1 - 0) + 5(1 - 0)$$

$$\Rightarrow 20 + 5 = 25 \text{ Joule}$$

- 106.** In Which of the following processes, heat is neither absorbed nor released by a system ?
(1) isobaric (2) isochoric (3) isothermal (4) adiabatic

Sol. 4

By Theory

For adiabatic process - Heat not absorbed and heat not released by a system

- 107.** In which of the following devices the eddy current effect is not used ?

(1) electromagnet (2) electric heater (3) induction furnace (4) magnetic braking in train.

Sol. 2

By Theory

Electric heater is a device in which eddy current effect is not used

- 108.** The unit of thermal conductivity is :

(1) $W m K^{-1}$ (2) $W m^{-1} K^{-1}$ (3) $J m K^{-1}$ (4) $J m^{-1} K^{-1}$

Sol. 2

$$\text{As we know } \frac{d\theta}{dt} = \frac{Ka(T_2 - T_1)}{l}$$

$$k = \frac{\left(\frac{d\theta}{dt} \times \Delta l\right)}{A \times \Delta T} \Rightarrow \frac{\text{Watt}}{l \times k}$$

$$k = \text{watt } m^{-1} k^{-1}$$

- 109.** A body weighs 200 N on the surface of the earth. How much will it weigh half way down to the centre of the earth?

(1) 250 N (2) 100 N (3) 150 N (4) 200 N

Sol. 2

As we know

$$g_d = g \left(1 - \frac{d}{R}\right)$$

$$\text{Given: For half depth } d = \frac{R}{2}$$

$$g_d = g \left(1 - \frac{R}{2R}\right)$$

$$g_d = \frac{g}{2}$$

$$\text{Weight} = mg_d$$

$$\Rightarrow \frac{mg}{2}$$

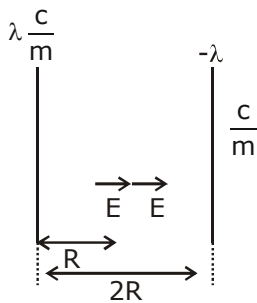
$$\text{So final weight at half depth} = \frac{200}{2}$$

$$= 100 \text{ N}$$

110. Two parallel infinite line charges with linear charge densities $+\lambda$ C/m and $-\lambda$ C/m are placed at a distance of $2R$ in free space. What is the electric field mid-way between the two line charges ?

- (1) $\frac{\lambda}{\pi \epsilon_0 R}$ N/C (2) $\frac{\lambda}{2\pi \epsilon_0 R}$ N/C (3) zero (4) $\frac{2\lambda}{\pi \epsilon_0 R}$ N/C

Sol. 1



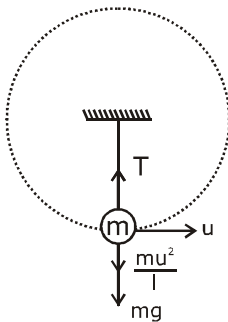
Electric field mid-way between the two line charges = $\frac{\lambda}{\pi \epsilon_0 R}$

$$\begin{aligned} E_{\text{net}} &= 2E \\ &= 2 \times \lambda \frac{2k\lambda}{R} \\ &= 4 \times \frac{\lambda}{4\pi \epsilon_0 R} \\ &= \frac{\lambda}{\pi \epsilon_0 R} \end{aligned}$$

111. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when:

- (1) the mass is at the lowest point (2) inclined at an angle of 60° from vertical
(3) the mass is at the highest point (4) the wire is horizontal

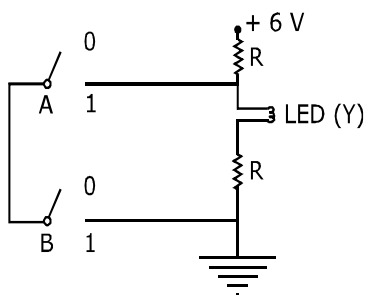
Sol. 1



At lowest point

$$T_{\max} = \frac{mu^2}{\ell} + mg$$

112.

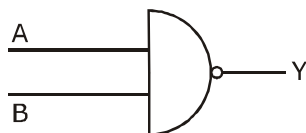


The correct Boolean operation represented by the circuit diagram drawn is:

- (1) NAND (2) NOR (3) AND (4) OR

Sol. 1

NAND Gate



Output of the circuit

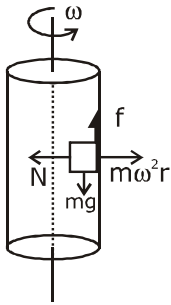
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

A	B	Y'	Y
0	0	0	1
1	0	0	1
0	1	0	1
1	1	1	0

113. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1m. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be :
($g = 10 \text{ m/s}^2$)

- (1) 10 rad/s (2) 10π rad/s (3) $\sqrt{10}$ rad/s (4) $\frac{10}{2\pi}$ rad/s

Sol. 1



$$m = 10 \text{ kg}$$

$$\mu = 0.1$$

$$r = 1 \text{ m}$$

$$f = mg$$

$$\mu N = mg$$

$$\mu m \omega^2 r = mg$$

$$\omega = \sqrt{\frac{g}{\mu r}} = \sqrt{\frac{10}{0.1 \times 1}} = 10 \text{ rad/s}$$

114. A small hole of area of cross-section 2 mm^2 is present near the bottom of a fully filled open tank of height 2 m . Taking $g = 10 \text{ m/s}^2$, the rate of flow of water through the open hole would be nearly:

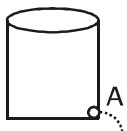
(1) $2.23 \times 10^{-6} \text{ m}^3/\text{s}$

(2) $6.4 \times 10^{-6} \text{ m}^3/\text{s}$

(3) $12.6 \times 10^{-6} \text{ m}^3/\text{s}$

(4) $8.9 \times 10^{-6} \text{ m}^3/\text{s}$

Sol. 3



$$v = \sqrt{2gh}$$

$$\text{volume flow rate} = A \times v$$

$$= 2 \times (10^{-3})^2 \times \sqrt{2 \times 10 \times 2} = 12.6 \times 10^{-6} \text{ m}^3/\text{sec}$$

115. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be:

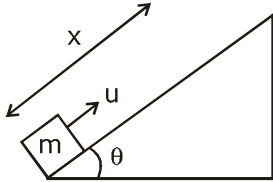
(1) $1:\sqrt{3}$

(2) $1:2\sqrt{3}$

(3) $1:\sqrt{2}$

(4) $\sqrt{2}:1$

Sol. 1



$$a = g \sin \theta$$

$$0 = u^2 - 2g \sin \theta \times X$$

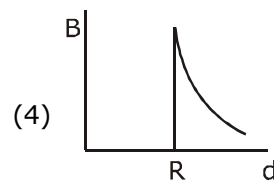
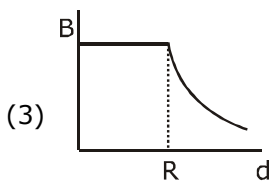
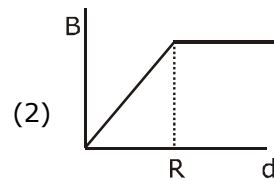
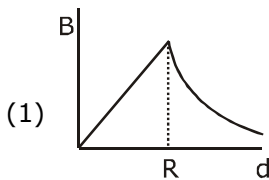
$$X = \frac{u^2}{2g \sin \theta}$$

$$X \propto \frac{1}{\sin \theta}$$

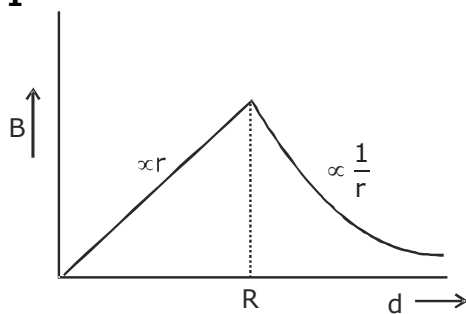
$$\frac{x_1}{x_2} = \frac{\sin \theta_2}{\sin \theta_1} = \frac{\sin 30}{\sin 60}$$

$$\frac{x_1}{x_2} = \frac{1}{\sqrt{3}}$$

116. A cylindrical conductor of radius R is carrying a constant current. The plot of the magnitude of the magnetic field, B with the distance, d, from the centre of the conductor, is correctly represented by the figure :



Sol. 1



- 117.** A soap bubble, having radius of 1 mm, is blown from a detergent solution having a surface tension of 2.5×10^{-2} N/m. The pressure inside the bubble equals at a point Z_0 below the free surface of water in a container. Taking $g = 10$ m/s², density of water = 10^3 kg/m³, the value of Z_0 is -

(A) 1 cm (B) 0.5 cm (C) 100 cm (D) 10 cm

Sol. 1

$$r = 1 \text{ mm}$$

$$T = 2.5 \times 10^{-2}$$

$$Z_0 Sg = \frac{4T}{r}$$

$$Z_0 = \frac{4T}{rSg} = \frac{4(2.5 \times 10^{-2})}{(10^{-3})(10^3)(10)}$$

$$Z_0 = \frac{10}{10} \times 10^{-2} = \frac{1}{100} \text{ m} = 1 \text{ cm}$$

- 118.** The work done to raise a mass m from the surface of the earth to a height h , which is equal to the radius of the earth, is -

(1) $\frac{1}{2} mgR$ (2) $\frac{3}{2} mgR$ (C) mgR (D) $2mgR$

Sol. 1

$$\Delta V = \frac{mgh}{1 + \frac{h}{R}} = \frac{mgh}{2} \quad (\because h = R)$$

- 119.** Which of the following acts as a circuit protection device ?

(1) switch (2) fuse (3) conductor (4) inductor

Sol. 2

Fuse

- 120.** Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed V_A and V_B respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be :

(1) $r_B : r_A$ (2) 1 : 1 (3) $r_A : r_B$ (4) $v_A : v_B$

Sol. 2

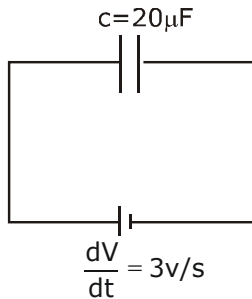
$$T_A = T_B$$

$$\therefore \omega_A = \omega_B = 1 : 1$$

- 121.** A parallel plate capacitor of capacitance $20\mu\text{F}$ is being charged by a voltage source whose potential is changing at the rate of 3 V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively :

(1) $60 \mu\text{A}$, zero (2) zero, zero (3) zero, $60 \mu\text{A}$ (4) $60 \mu\text{A}$, $60 \mu\text{A}$

Sol. 4



$$q = CV$$

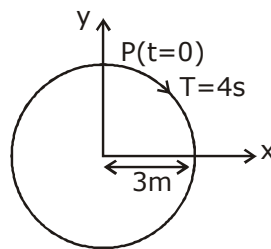
$$\frac{dq}{dt} = C \frac{dv}{dt}$$

$$= (20\mu\text{F}) \cdot (3)$$

$$= 60 \mu\text{A}$$

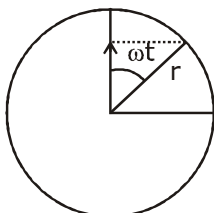
$$i_c = i_d = 60 \mu\text{A}$$

- 122.** The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.
y - projection of the radius vector of rotating particle P is -



- (1) $y(t) = 3 \cos\left(\frac{3\pi t}{2}\right)$, where y in m (2) $y(t) = 3 \cos\left(\frac{\pi t}{2}\right)$, where y in m
- (3) $y(t) = -3 \cos 2\pi t$, where y in m (4) $y(t) = 4 \sin\left(\frac{\pi t}{2}\right)$, where y in m

Sol. 2



$$y = r \cos \omega t$$

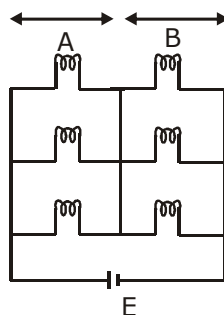
$$= 3 \cos \left(\frac{2\pi}{4} \right) t$$

$$y = 3 \cos \left(\frac{\pi}{2} \right) t$$

- 123.** For a p-type semiconductor, which of the following statements is true ?
 (1) Holes are the majority carriers and pentavalent atoms are the dopants.
 (2) Electrons are the majority carriers and pentavalent atoms are the dopants.
 (3) Electrons are the majority carriers and trivalent atoms are the dopants.
 (4) Holes are the majority carriers and trivalent atoms are the dopants.

Sol. 4

- 124.** Six similar bulbs are connected as shown in the figure with a DC source of emf E , and zero internal resistance.
 The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing will be :



- Sol. 4** (1) 1:2 (2) 2:1 (3) 4:9 (4) 9:4

$$P_1 = \frac{E^2}{\left(\frac{2R}{3}\right)}$$

$$P_2 = \frac{E^2}{\left(\frac{3}{2}R\right)}$$

$$\frac{P_1}{P_2} = \frac{\frac{3}{2}}{\frac{2}{3}} = \frac{9}{4}$$

125. Increase in temperature of a gas filled in a container would lead to :

- (1) decrease in its pressure
- (2) decrease in intermolecular distance
- (3) increase in its mass
- (4) increase in its kinetic energy

Sol. 4

$$PV = nRT$$

$$P \propto T$$

and increase in K.E.

126. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2° . What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water? ($\mu_{\text{water}} = 4/3$)

- (1) 0.05°
- (2) 0.1°
- (3) 0.266°
- (4) 0.15°

Sol. 4

$$\frac{\beta}{D} = \frac{\lambda}{D}$$

$$0.2^\circ = \frac{\lambda}{D} \quad \dots(i)$$

Now immersed in water

$$\lambda' = \frac{\lambda}{\mu}$$

$$= \frac{3}{4} \lambda$$

$$\therefore d = 1\text{m}$$

$$= 0.2^\circ \times \frac{3}{4}$$

$$= 0.2^\circ \times 0.75$$

$$0.15^\circ$$

127. The total energy of an electron in an atom in an orbit is -3.4eV . Its kinetic and potential energies are, respectively:

- (1) 3.4eV , -6.8eV
- (2) 3.4eV , 3.4eV
- (3) -3.4eV , -3.4eV
- (4) -3.4eV , -6.8eV

Sol. 4

$$\text{T.E.} = U/2 = -\text{K.E.} = -3.4$$

$$\text{K.E.} = 3.4 \text{ eV and } U = -6.8 \text{ eV}$$

128. Which colour of the light has the longest wavelength?

- (1) green
- (2) violet
- (3) red
- (4) blue

Sol. 3

$$\begin{array}{c} \text{V I B G Y O R} \\ \xrightarrow{\lambda \uparrow} \end{array}$$

Red

- 129.** In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction ?
 (1) equal to angle of incidence (2) 90°
 (3) 180° (4) 0°

Sol. 2

$$\angle i = \angle C \text{ so } \angle r = 90^\circ$$

- 130.** A disc of radius 2m. and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20cm/s. How much work is needed to stop it ?
 (1) 2J (2) 1J (3) 3J (4) 30kJ

Sol. 3

$$K_i = \frac{1}{2} mv^2 \left(1 + \frac{K^2}{R^2} \right) = \frac{1}{2} (100) (0.2)^2 \left(1 + \frac{1}{2} \right)$$

$$K_i = \frac{3}{4} (100) \left(\frac{4}{100} \right) = 3 \text{ J}$$

- 131.** When a block of mass M is suspended by a long wire of length L, the length of the wire becomes (L+l). The elastic potential energy stored in the extended wire is :

- (1) $\frac{1}{2} Mgl$ (2) $\frac{1}{2} MgL$ (3) Mgl (4) MgL

Sol. 1

$$kl = mg$$

$$\text{and } U = \frac{1}{2} kx^2$$

$$U = \frac{1}{2} \left(\frac{mg}{l} \right) l^2$$

$$U = \frac{mgl^2}{2l} = \frac{mgl}{2}$$

- 132.** A solid cylinder of mass 2kg and radius 4cm is rotating about its axis at the rate of 3rpm. The torque required to stop after 2π revolutions is :

- (1) $12 \times 10^{-4} \text{ N m}$ (2) $2 \times 10^6 \text{ N m}$
 (3) $2 \times 10^{-6} \text{ N m}$ (4) $2 \times 10^{-3} \text{ N m}$

Sol. 3

$$\omega_i = \frac{6\pi}{60} = \frac{\pi}{10} \text{ rad/s}$$

$$i = \frac{mr^2}{2} = 2 \times \frac{\left(\frac{4}{100} \right)^2}{2}$$

$$= 16 \times 10^{-4} \text{ kg.m}^2$$

$$\text{and } 0 = \omega_f^2 - 2\alpha\theta$$

$$\alpha = \frac{\omega_1^2}{2\theta} = \frac{\pi^2 / 100}{2 \cdot 4\pi^2} = \frac{100}{800} \text{ rad/s}$$

$$\tau = I \alpha = 16 \times 10^{-4} \times \frac{100}{800}$$

$$= 2 \times 10^{-6} \text{ N.m}$$

- 133.** Two point charges A and B, having charges +Q and -Q respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then force between the charges becomes:

(1) $\frac{16F}{9}$ (2) $\frac{4F}{3}$ (3) F (4) $\frac{9F}{16}$

Sol. 4

$$\frac{+Q \quad \quad \quad -Q}{d}$$

$$F = \frac{kQ^2}{d^2}$$

and $\frac{3}{4}Q$ _____ $\frac{-3}{4}Q$

$$F' = \frac{k \cdot \left(\frac{9}{16} Q^2\right)}{d^2} = \frac{9}{16} F$$

- 134.** Pick the wrong answer is the context with rainbow.

- (1) An observer can see a rainbow when his front is towards the sun
 (2) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.
 (3) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.
 (4) The order of colours is reversed in the secondary rainbow.

Sol. 1

Rainbow is formed on the opposite side of sun's position

- 135.** A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is :

$$(\alpha_{Cu} = 1.7 \times 10^{-5} \text{ K}^{-1} \text{ and } \alpha_{Al} = 2.2 \times 10^{-5} \text{ K}^{-1})$$

- (1) 88cm (2) 68cm (3) 6.8cm (4) 113.9cm

Sol. 2

Cu rod 88 cm

Al Rod l

$$\alpha_1 (88) = \alpha_2 (l)$$

$$(1.7 \times 10^{-5}) (88) = (2.2 \times 10^{-5}) l$$

$$l = \frac{1.7(88)}{(2.2)} = 68 \text{ cm}$$

136. In which case change in entropy is negative ?

- (1) Sublimation of solid to gas
- (2) $2\text{H(g)} \rightarrow \text{H}_2\text{(g)}$
- (3) Evaporation of water
- (4) Expansion of a gas at constant temperature

136. (2)



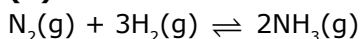
No. of particle decreases from reactant to product side

137. For the chemical reaction $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons 2\text{NH}_3\text{(g)}$ the correct option is :

$$(1) -\frac{d[\text{N}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt} \qquad (2) 3 \frac{d[\text{H}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$$

$$(3) -\frac{1}{3} \frac{d[\text{H}_2]}{dt} = -\frac{1}{2} \frac{d[\text{NH}_3]}{dt} \qquad (4) -\frac{d[\text{N}_2]}{dt} = 2 \frac{d[\text{NH}_3]}{dt}$$

137. (1)



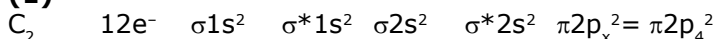
$$r = -\frac{1}{1} \frac{d[\text{N}_2]}{dt} = \frac{1}{3} \frac{d[\text{H}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$$

$$\therefore -\frac{d[\text{N}_2]}{dt} = \frac{1}{2} \frac{d[\text{NH}_3]}{dt}$$

138. Which of the following diatomic molecular species has only π bonds according to molecular Orbital Theory ?

- (1) C_2
- (2) Be_2
- (3) O_2
- (4) N_2

138. (1)



$$B_o = \frac{8-4}{2} = 2 \quad (\text{where last } 4 e^- \text{ present in } \pi 2p_x^2 = \pi 2p_y^2)$$

139. Which of the following is incorrect statement?

- (1) GeX_4 ($x = \text{F, Cl, Br, I}$) is more stable than GeX_2
- (2) SnF_4 is ionic in nature
- (3) PbF_4 is covalent in nature
- (4) SiCl_4 is easily hydrolysed

139. (3)

Order of stability of OS

IV A	due to inert pair effect		due to pseudo inert gas configuration
Ge	Ge^{2+}	<	Ge^{4+}
	^		
Sn	Sn^{2+}	<	Sn^{4+}
	^		
Pb	Pb^{2+}	>	Pb^4

140. Under isothermal condition a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is :

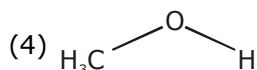
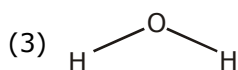
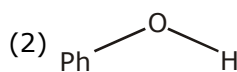
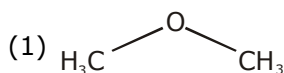
[Given that 1 L bar = 100J]

- (1) 25 J (2) 30 J (3) -30 J (4) 5KJ

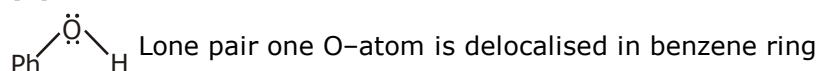
140. (3)

$$\begin{aligned} w &= -p_{\text{ext}} (V_2 - V_1) && \text{irreversible} \\ &= -2(0.25 - 0.1) && \text{isothermal} \\ &= -2 (0.15) && \text{expansion} \\ &= -0.3 \text{ lt - bar} \\ &= -0.3 \times 100 \text{ J} \\ &= -30 \text{ J} \end{aligned}$$

141. The compound that is most difficult to protonate is :



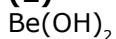
141. (2)



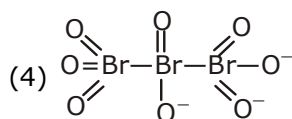
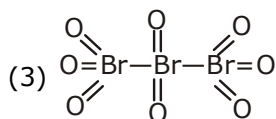
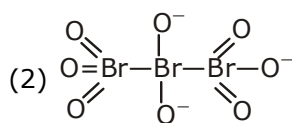
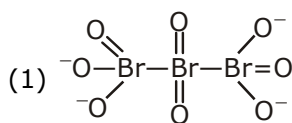
142. Which of the following is an amphoteric hydroxide ?

- (1) Mg(OH)₂ (2) Be(OH)₂
(3) Sr(OH)₂ (4) Ca(OH)₂

142. (2)



143. The correct structure of tribromooctaoxide is :



143. (3)

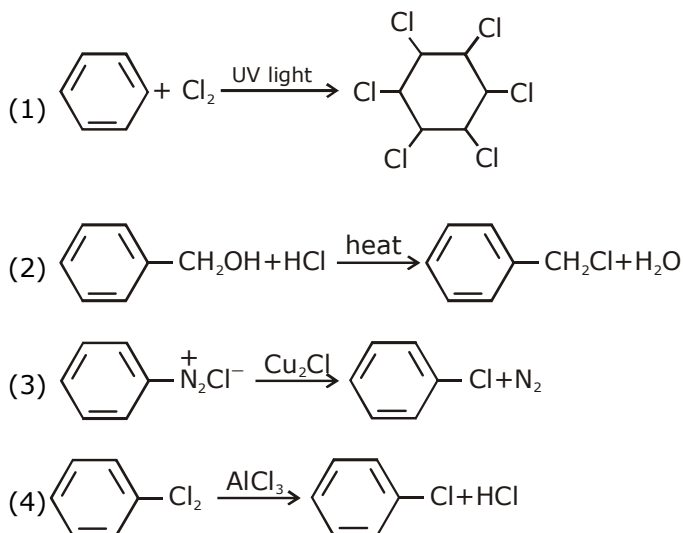
144. The biodegradable polymer is :

- (1) nylon-6 (2) Buna-S (3) nylon-6,6 (4) nylon 2-nylon 6

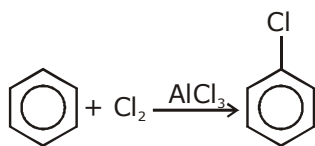
144. (4)

Nylon-2-Nylon - 6 is a biodegradable polymer

145. Among the following, the reaction that proceeds through an electrophilic substitution is :



145. (4)



Electrophilic substitution reaction

146. Match the following :

- | | |
|----------------------|-----------------------------------|
| (a) Pure nitrogen | (i) Chlorine |
| (b) Haber process | (ii) Sulphuric acid |
| (c) Contact process | (iii) Ammonia |
| (d) Deacon's process | (iv) Sodium azide or Barium azide |

Which of the following is the correct option ?

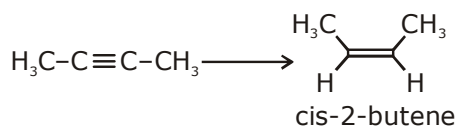
- | | (a) | (b) | (c) | (d) |
|-----|-------|-------|-------|-------|
| (1) | (iii) | (iv) | (ii) | (i) |
| (2) | (iv) | (iii) | (ii) | (i) |
| (3) | (i) | (ii) | (iii) | (iv) |
| (4) | (ii) | (iv) | (i) | (iii) |

146. (2)

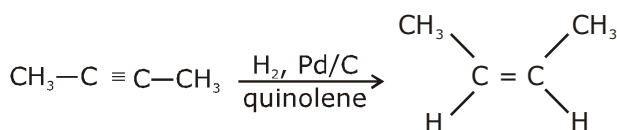
147. The number of sigma (σ) and pi (π) bonds in pent-2-en-4-yne is :

- (1) 11 σ bonds and 2 π -bonds
- (2) 13 σ bonds and no π bond
- (3) 10 σ bonds and 3 π bonds
- (4) 8 σ bonds and 5 π bonds

151. The most suitable reagent for the following conversion, is :



151. (4) (1) Zn/HCl (2) $\text{Hg}^{2+}/\text{H}^+, \text{H}_2\text{O}$ (3) Na/liquid NH_3 (4) $\text{H}_2, \text{Pd/C}$, quinoline

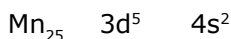
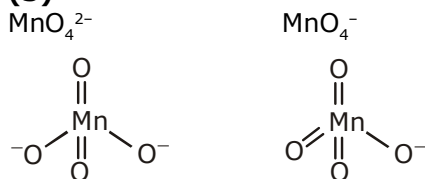


hindlar's Catalyst give Cis-product (syn addition)

152. The manganate and permanganate ions are tetrahedral, due to:

- (1) The π -bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese
 (2) The π -bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese
 (3) The π -bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese
 (4) There is no π -bonding

152. (3)



If bonding takes place by overlap of p orbital of oxygen & d orbital of mn.

153. For a cell involving one electron $E_{\text{cell}}^{\ominus} = 0.59 \text{ V}$ at 298K, the equilibrium constant for the cell reaction is:

[Given that $\frac{2.303 RT}{F} = 0.059 \text{ V}$ at $T=298 \text{ K}$]

153. (1) (1) 1.0×10^{10} (2) 1.0×10^{30} (3) 1.0×10^2 (4) 1.0×10^5

$$\Delta G = -nF E_{\text{cell}}^{\ominus} = -RT \ln k$$

$$\Rightarrow E_{\text{cell}}^{\ominus} = \frac{RT}{F} \times 2.303 \times \frac{1}{n} \log k$$

$$\Rightarrow 0.59 = 0.059 \times \frac{1}{1} \log k$$

$$\Rightarrow \log k = \frac{0.59}{0.059}$$

$$\Rightarrow \log k = 10$$

$$\Rightarrow k = 1 \times 10^{10}$$

154. pH of a saturated solution of Ca(OH)_2 is 9. The solubility product (K_{sp}) of Ca(OH)_2 is :

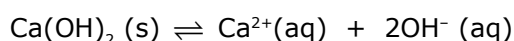
- (1) 0.125×10^{-15} (2) 0.5×10^{-10} (3) 0.5×10^{-15} (4) 0.25×10^{-15}

154. (3)

$$\text{pH} = 9$$

$$\therefore \text{pOH} = 14 - 9 = 5$$

$$[\text{OH}^-] = 10^{-5}$$



$$S \qquad 2S = 10^{-5}$$

$$\therefore K_{sp} = [\text{Ca}^{2+}] [\text{OH}^-]^2$$

$$= S \times (2S)^2$$

$$= \frac{10^{-5}}{2} \times (10^{-5})^2$$

$$= 0.5 \times 10^{-15}$$

155. For an ideal solution the correct option is :

- (1) $\Delta_{\text{mix}} H = 0$ at constant T and P (2) $\Delta_{\text{mix}} G = 0$ at constant T and P
(3) $\Delta_{\text{mix}} S = 0$ at constant T and P (4) $\Delta_{\text{mix}} V \neq 0$ at constant T and P

155. (1)

factual

156. A gas at 350 K and 15 bar has molar volume 20 percent smaller than that for an ideal gas under the same conditions. The correct option about the gas and its compressibility factor (Z) is:

- (1) $Z < 1$ and attractive forces are dominant
(2) $Z < 1$ and repulsive forces are dominant
(3) $Z > 1$ and attractive forces are dominant
(4) $Z > 1$ and repulsive forces are dominant

156. (1)

$$Z = \frac{(PV)_{\text{real}}}{(PV)_{\text{ideal}}}$$

as real volume is lesser than an ideal gas volume

$$\therefore Z < 1$$

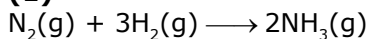
and for $Z < 1$, attractive forces dominant

- 157.** The correct order of the basic strength of methyl substituted amines in aqueous solution is :
- (1) $(\text{CH}_3)_3\text{N} > (\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2$
 - (2) $\text{CH}_3\text{NH}_2 > (\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N}$
 - (3) $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N}$
 - (4) $(\text{CH}_3)_3\text{N} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_2\text{NH}$
- 157. (3)**
Correct order of basic strength of methyl substituted amines is
 $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N}$ ($2^\circ > 1^\circ > 3^\circ$)
- 158.** For the second period elements the correct increasing order of first ionisation enthalpy is:
- (1) $\text{Li} < \text{B} < \text{Be} < \text{C} < \text{N} < \text{O} < \text{F} < \text{Ne}$
 - (2) $\text{Li} < \text{Be} < \text{B} < \text{C} < \text{O} < \text{N} < \text{F} < \text{Ne}$
 - (3) $\text{Li} < \text{Be} < \text{B} < \text{C} < \text{N} < \text{O} < \text{F} < \text{Ne}$
 - (4) $\text{Li} < \text{B} < \text{Be} < \text{C} < \text{O} < \text{N} < \text{F} < \text{Ne}$
- 158. (4)**
- 159.** Which mixture of the solutions will lead to the formation of negatively charged colloidal $[\text{AgI}]\text{I}^-$ sol.?
- (1) 50 mL of 2 M AgNO_3 + 50 mL of 1.5 M KI
 - (2) 50 mL of 0.12 M AgNO_3 + 50 mL of 0.1 M KI
 - (3) 50 mL of 1 M AgNO_3 + 50 mL of 1.5 M KI
 - (4) 50 mL of 1 M AgNO_3 + 50 mL of 2M KI
- 159. (3,4)**
If in KI solution AgNO_3 is added than it will form -vely charged $[\text{AgI}]\text{I}^-$ colloid. If in AgNO_3 solution KI is added it will form AgI/Ag^+ (positively charged) colloid.
- 160.** For the cell reaction $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^-(\text{aq}) \longrightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{aq})$
 $E_{\text{cell}}^\circ = 0.24\text{V}$ at 298K. The standard Gibbs energy ($\Delta_r G^\circ$) of the cell reaction is:
(Given that Faraday constant $F = 96500 \text{ C mol}^{-1}$)
- (1) $46.32 \text{ kJ mol}^{-1}$
 - (2) $23.16 \text{ kJ mol}^{-1}$
 - (3) $-46.32 \text{ kJ mol}^{-1}$
 - (4) $-23.16 \text{ kJ mol}^{-1}$
- 160. (3)**
 $\Delta G_{\text{cell}}^\circ = -nFE_{\text{cell}}^\circ$
 $= -2 \times 96500 \times 0.24 = -46320 \text{ J/Mol} = -46.32 \text{ J/Mol}$
- 161.** Which is the correct thermal stability order for H_2E (E = O, S, Se, Te and Po)?
- (1) $\text{H}_2\text{Po} < \text{H}_2\text{Te} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{O}$
 - (2) $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po} < \text{H}_2\text{O} < \text{H}_2\text{S}$
 - (3) $\text{H}_2\text{S} < \text{H}_2\text{O} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$
 - (4) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$
- 161. (1)**

162. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is:

- (1) 30 (2) 40 (3) 10 (4) 20

162. (1)



$$\frac{n_{\text{H}_2}}{3} = \frac{n_{\text{NH}_3}}{2}$$

$$\Rightarrow n_{\text{H}_2} = \frac{3}{2} \times 20 \Rightarrow n_{\text{H}_2} = 30 \text{ moles}$$

163. Which of the following series of transitions in the spectrum of hydrogen atom falls in visible region?

- (1) Paschen series (2) Brackett series (3) Lyman series (4) Balmer series

163. (4)

Factual

164. A compound is formed by cation C and anion A. The anions form hexagonal close packed (hcp) lattice and the cations occupy 75% of octahedral voids. The formula of the compound is:

- (1) C₃A₄ (2) C₄A₃ (3) C₂A₃ (4) C₃A₂

164. (1)

(c) OV : hcp(A)

$$6 \times \frac{75}{100} : 6$$

$$\frac{3}{4} : 1$$

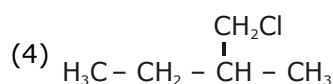
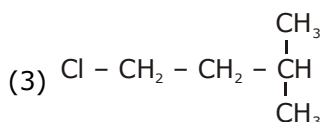
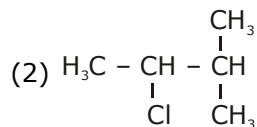
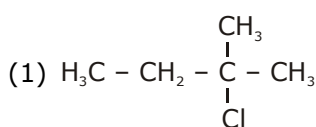
$$3 : 4$$

165. The non-essential amino acid among the following is:

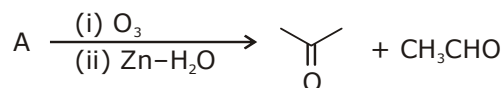
- (1) alanine (2) lysine (3) valine (4) leucine


165. (1)

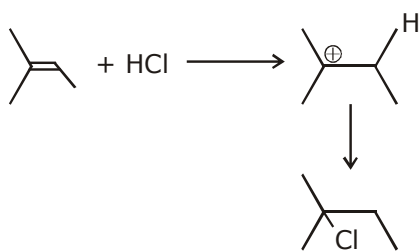
166. An alkene "A" on reaction with O₃ and Zn – H₂O gives propanone and ethanal in equimolar ratio. Addition of HCl to alkene "A" gives "B" as the major product. The structure of product "B" is:



166. (1)



So, (A) should be 



167. Which of the following species is not stable?

- (1) $[\text{Sn}(\text{OH})_6]^{2-}$ (2) $[\text{SiCl}_6]^{2-}$ (3) $[\text{SiF}_6]^{2-}$ (4) $[\text{GeCl}_6]^{2-}$

167. (2)

168. Match the Xenon compounds in Column-I with its structure in Column-II and assign the correct code :

Column - I

- (a) XeF_4
(b) XeF_6
(c) XeOF_4
(d) XeO_3

Code :

- | | | | | | | | | | |
|-----|------|-------|-------|------|-----|-------|-------|------|------|
| | (a) | (b) | (c) | (d) | | (a) | (b) | (c) | (d) |
| (1) | (ii) | (iii) | (i) | (iv) | (2) | (iii) | (iv) | (i) | (ii) |
| (3) | (i) | (ii) | (iii) | (iv) | (4) | (ii) | (iii) | (iv) | (i) |

Column - II

- (i) Pyramidal
(ii) square planar
(iii) Distorted octahedral
(iv) Square Pyramidal

168. (4)

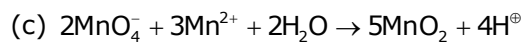
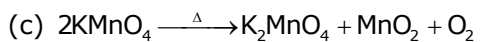
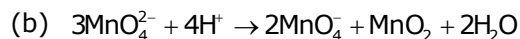
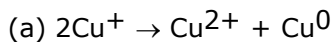
169. Among the following, the one that is not a green house gas is :

- (1) ozone (2) sulphur dioxide (3) nitrous oxide (4) methane

169. (2)



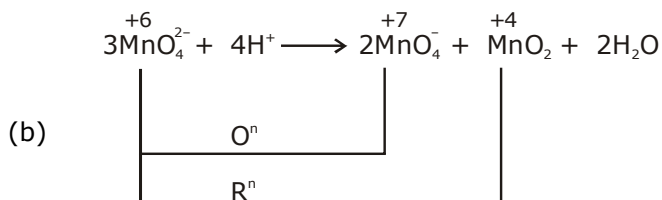
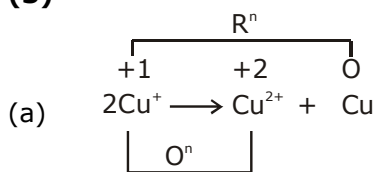
170. Which of the following reactions are disproportionation reaction ?



Select the **correct** option from the following :

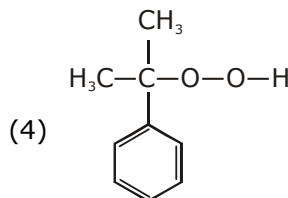
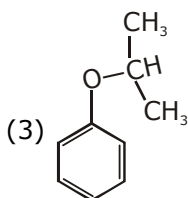
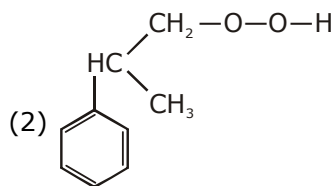
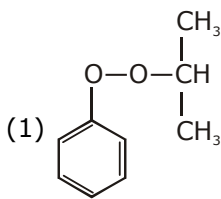
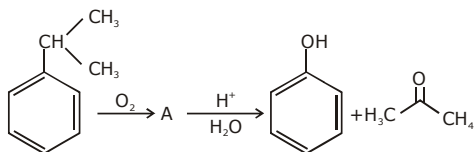
(1) (a), (c) and (d) (2) (a) and (d) only (3) (a) and (b) only (4) (a), (b) and (c)

170. (3)

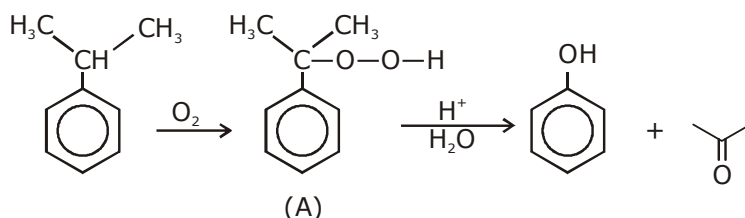


∴ (a) & (b) are disproportionation reaction

171. The structure of intermediate A in the following reaction, is :



171. (4)



172. The mixture that forms maximum, boiling azeotrope is :

- (1) Acetone + Carbon disulphide (2) Heptane + Octane
(3) Water + Nitric acid (4) Ethanol + Water

172. (3)

factual

Water + Nitric Acid

173. What is the correct electronic configuration of the central atom in $K_4 [Fe(CN)_6]$ based on crystal field theory?

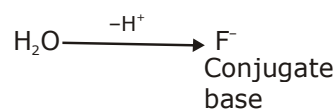
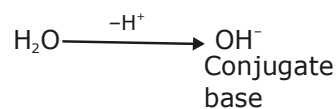
- (1) $e^3 t_2^3$ (2) $e^4 t_2^2$ (3) $t_{2g}^4 e_g^2$ (4) $t_{2g}^6 e_g^0$

173. (4)

174. Conjugate base for Bronsted acids H_2O and HF are :

- (1) OH^- and F^- , respectively (2) H_3O^+ and H_2F^+ , respectively
(3) OH^- and H_2F^+ , respectively (4) H_3O^+ and F^- , respectively

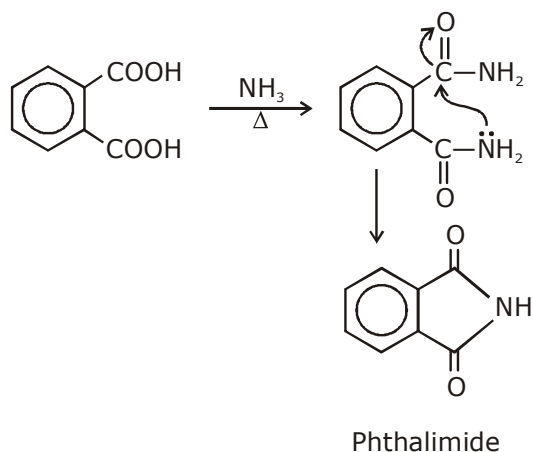
174. (1)



175. Which will make basic buffer?

- (1) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH
(2) 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH
(3) 50 mL of 0.1 M NaOH + 25 mL of 0.1 M CH_3COOH
(4) 100 mL of 0.1 M CH_3COOH + 100 mL of 0.1 M NaOH

178. 4



179. The method used to remove temporary hardness of water is :

- (1) Ion - exchange method (2) Synthetic resins method
(3) Calgon's method (4) Clark's method

179. (4)

180. Which one is malachite from the following?

- (1) Fe_3O_4 (2) $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$
(3) CuFeS_2 (4) $\text{Cu}(\text{OH})_2$

180. (2)

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	(After Scholarship)
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100-150	₹ 74,900
50-100	₹ 85,600

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