## NEET 2019

## Question Paper

## with Solutions

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1. What map unit (Centimorgan) is adopted in the construction of genetic maps?
A. A unit of distance between two expressed genes representing 100\% cross over.
B. A unit of distance between genes on chromosomes, representing $1 \%$ cross over.
C. A unit of distance between genes on chromosomes, representing 50\% cross over.
D. A unit of distance between two expressed genes representing $10 \%$ cross over.
Ans. B
Sol. • Gene mapping is used to define the locus of genes as well as to determine the distance between the genes.

- The distance between two positions along a chromosome that results in one recombinant individual in 100 progeny is defined as one genetic map unit.
- Distance respective to this one percent recombination frequency is called a centimorgan.
- 1 map unit represent $1 \%$ cross over and it is used to measure genetic distance.
- This genetic distance is based on average number of cross over frequency.

2. Select the correct group of biocontrol agents.
A. Trichoderma, Baculovirus, Bacillus thuringiensis
B. Oscillatoria, Rhizobium, Trichoderma
C. Nostoc, Azospirillium, Nucleopolyhedrovirus
D. Bacillus thuringiensis, Tobacco mosaic virus, Aphids
Ans. A
Sol. - The natural predators or enemies of the pests, weeds, etc are referred to as biocontrol agents.

- Fungus Trichoderma, Baculoviruses (NPV) and Bacillus thuringiensis are used as biocontrol agents.
- Trichoderma is mainly used for soilborne disease and is effective against many pathogenic fungi like phytopthara etc.
- The majority of Baculoviruses are included in the genus Nucleopolyhedrovirus and are effective against many insects and arthropods.
- Bacillus thuringiensis is used as a biopesticide in mosquito control.
- Rhizobium, Nostoc, Azospirillum, and Oscillatoria are used as biofertilizers, whereas TMV is a pathogen.
- Aphids are pests that harm crop plants.

3. The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in
A. Fallopian tubes and Pancreatic duct
B. Eustachian tube and Salivary duct
C. Bronchioles and Fallopian tubes D. Bile duct and Bronchioles

Ans. C
Sol. Bronchioles and Fallopian tubes are lined with ciliated epithelium.
It helps in moving the particles or mucus in a specific direction.
In fallopian tubes ciliated columnar epithelium is present.
In bronchioles pseudostratified ciliated glandular epithelium is present.
Simple columnar epithelium is present in the bile duct.
4. 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?
A. 0.16(AA); 0.24(Aa); 0.36(aa)
B. 0.16(AA); 0.48(Aa); 0.36(aa)
C. $0.16(\mathrm{AA}) ; 0.36(\mathrm{Aa}) ; 0.48(\mathrm{aa})$
D. $0.36(\mathrm{AA}) ; 0.48(\mathrm{Aa}) ; 0.16(\mathrm{aa})$

Ans. B
Sol. • Frequency of dominant allele (say $p)=0.4$

- Frequency of recessive allele (say q) $=1-0.4=0.6$

Frequency of homozygous dominant individuals $(A A)=p^{2}=(0.4)^{2}=0.16$ Frequency of heterozygous individuals $(\mathrm{Aa})=2 \mathrm{pq}=2(0.4)(0.6)$ $=0.48$
Frequency of homozygous recessive individuals $(a a)=q^{2}=(0.6)^{2}=0.36$
5. Select the incorrect statement.
A. Inbreeding is essential to evolve purelines in any animal.
B. Inbreeding selects harmful recessive genes that reduce fertility and productivity
C. Inbreeding helps in accumulation of superior genes and elimination of undesirable genes
D. Inbreeding increases
homozygosity
Ans. B
Sol. • Inbreeding refers to breeding between closely related animals for many generations.

- Inbreeding is generally employed to increase the number of homozygotic individuals in a population.
- Harmful recessive genes exposed by inbreeding can be removed by selection.
- It also helps in accumulation of superior genes and elimination of less desirable genes.
- Therefore this is the selection at each step which results in the increase in the productivity of the inbred population.
- Close and continued inbreeding usually reduces fertility and even productivity often termed as inbreeding depression.

6. Which of the following factors is responsible for the formation of concentrated urine?
A. Maintaining hyperosmolarity towards inner medullary interstitium in the kidneys.
B. Secretion of erythropoietin by Juxtaglomerular complex
C. Hydrostatic pressure during glomerular filtration
D. Low levels of antidiuretic hormone Ans. A
Sol. • The proximity between the loop of Henle and vasa recta as well as counter-current in them helps in maintaining an increasing osmolarity towards the inner medullary interstitium.

- This mechanism helps to maintain a concentration gradient in medullary interstitium so human urine is nearly four times concentrated than the initial filtrate formed.
- The secretion of erythropoietin by the Juxtaglomerular complex is responsible for the production of RBCs.
- The antidiuretic hormone is responsible for the less secretion of urine.

7. Match Column - I with Column - II

| Column - I | Column - II |
| :--- | :--- |
| (a) Saprophyte | (i) Symbiotic association of fungi with plant roots |
| (b) Parasite | (ii) Decomposition of dead organic materials |
| (c) Lichens | (iii) Living on living plants or animals |
| (d) Mycorrhiza | (iv) Symbiotic association of algae and fungi |

Choose the correct answer from the option given below
A. (a)-(iii) (b)-(ii) (c)-(i) (d)-(iv)
B. (a)-(ii) (b)-(i) (c)-(iii) (d)-(iv)
C. (a)-(ii) (b)-(iii) (c)-(iv) (d)-(i)
D. (a)-(i) (b)-(ii) (c)-(iii) (d)-(iv)

Ans. C
Sol. - Saprophytes are the plants, fungus, or microorganisms that live on dead or decaying organic matter.

- Lichens are the mutual relationship between fungi and photosynthetic green algae or cyanobacteria. Algae produced food through photosynthesis and fungi absorbs nutrients from the soil.
- Mycorrhizae - This is a mutual relationship between fungi and roots of higher plants. Role of fungi is to absorb essential nutrients from the soil whereas plant in turn provide energy yielding carbohydrates to fungi.
- A parasite is an organism which lives as a host on other plants and animals.

8. Which of the following glucose transporters is insulin-dependent?
A. GLUT II
B. GLUT III
C. GLUT IV
D. GLUT I

Ans. C
Sol. • GLUT - IV is insulin-dependent glucose transporter.

- It is present in adipose tissues and skeletal and cardiac muscles and responsible for the majority of glucose transport to these sites under anabolic conditions.
- GLUT - I is present in erythrocytes and also serve as the main transporter of glucose across the blood-brain barrier.
- GLUT - II is insulin-independent and is present in the plasma
membrane of the liver, pancreatic, intestinal and kidney cells.
- GLUT - III facilitates the transport of glucose in neurons, sperms, WBCs etc.

9. Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following
A. Flaccidity of bulliform cells
B. Shrinkage of air spaces in spongy mesophyll
C. Tyloses in vessels
D. Closure of stomata

Ans. A
Sol. During the time of insufficient water supply or dry season, the bulliform cells lose the water and became flaccid due to water loss.

- When they are flaccid during the water stress, bulliform cells make the leaves curl inward so that the leaf surface is not exposed. The curling of leaves minimises the water loss. Hence, the bulliform cell minimise the loss of water during the condition of water loss

10. Concanavalin A is
A. an essential oil
B. a lectin
C. a pigment
D. an alkaloid

Ans. B
Sol. - Concanavalin A is a lectin extracted from Canavalia ensiformis.

- It is a lectin (carbohydrate - binding protein ).
- It is a secondary metabolite.
- It has the property to agglutinates RBCs.
- Alkaloid is a nitrogenous organic compounds of plant origin.

11. Select the incorrect statement.
A. In male grasshoppers $50 \%$ of sperms have no sex-chromosome B. In domesticated fowls, sex of progeny depends on the type of sperm rather than egg C. Human males have one of their sex chromosome much shorter than the other
D. Male fruit fly is heterogametic Ans. B
Sol. •In birds, female heterogamety is present. So sex of the progeny is decided by the egg and not by the sperms in the domesticated fowls.

- Birds have a ZW system of sex determination.
- In this system, female has a pair of dissimilar ZW chromosome and male has two similar ZZ chromosome.
- Human males have two types of sex chromosome - $X$ and $Y$.
- The Y chromosome is shorter and smaller overall than the $X$ chromosome.
- In male grasshoppers, $50 \%$ of sperms have no sex-chromosome i.e. they have X0 condition.
- The male fruit fly has XY set of sex chromosomes and produces two types of gametes. Hence, it is called heterogametic.

12. Which one of the following is not a method of in situ conservation of biodiversity?
A. Wildlife Sanctuary
B. Botanical Garden
C. Sacred Grove
D. Biosphere Reserve

Ans. B
Sol. •In-situ conservation is the approach in which endangered species of either plant or animal is provided protection along with its natural environment.

- While ex-situ conservation is a type of off-site conservation in which endangered species are protected in an artificially provided environment by man which is almost similar to their natural habitat.
- Examples of in-situ conservation Wildlife Sanctuary, Biosphere Reserve, Sacred grooves, etc.
- Examples of ex-situ conservation Botanical Garden, zoological parks, cryopreservation, etc.

13. Which of the following statements is incorrect?
A. Claviceps is a source of many alkaloids and LSD
B. Conidia are produced exogenously and ascospores endogenously.
C. Yeasts have filamentous bodies with long thread-like hyphae.
D. Morels and truffles are edible delicacies.
Ans. C
Sol. - The fungi are filamentous in nature (consists of hyphae - long, slender thread-like structure) except yeast.

- Yeast is a unicellular sac fungus.
- However, yeast contains Pseudohyphae. It is distinguished from true hyphae by their method of growth, relative frailty and lack of cytoplasmic connection between the cells.
- Claviceps purpurea is the main source of ergot alkaloids (nitrogenous organic compounds of plant origin having pronounced physiological actions on humans).
- LSD or lysergic acid diethylamide is the most notorious ergot alkaloid and is responsible for hallucinations.
- Morels and truffles are edible delicacies as they are rarely found edible fungi and are not available as mushrooms are so that is why they are considered delicacies (expensive food).
- Conidia are the asexual spores produced exogenously on the special mycelium called conidiophores (eg. in penicillium).
- Whereas sexual spores are called ascospores which are produced endogenously in sac like asci.

14. Which of the following contraceptive methods do involve a role of hormone?
A. Barrier method, Lactational amenorrhea, Pills.
B. CuT, Pills, Emergency contraceptives.
C. Pills, Emergency contraceptives, Barrier methods.
D. Lactational amenorrhea, Pills Emergency contraceptives.
Ans. D
Sol. • Lactational amenorrhea, Pills, Emergency contraceptives involve the use of hormones to prevent pregnancy.

- Lactational amenorrhoea is a natural method of contraception. It is generally effective for a period of 6 months after parturition. Due to high levels of prolactin in a breastfeeding mother, gonadotropin level decreases.
- Oral pills are the combinations of either progestogens or progestogenestrogen used by the females.
- Emergency contraceptives have to be taken within a period of 72 hours of coitus. It includes the
administration of progestogens or a progestogen-estrogen combination.
- Barrier methods include physical devices that prevent the meeting os sperm and ovum. For eg. Condoms used by males and diaphragm, vaults, etc. are used by females.
- CuT are the type of copper releasing IUDs which is inserted into the uterus and it results in the decrease of motility and fertilising capoacity of sperms.

15. 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 :
A. (a)- (iii) (b)- (iv) (c)- (ii) (d)- (i)
B. (a)- (ii) (b)- (iv) (c)- (iii) (d)- (i)
C. (a)- (iii) (b)- (ii) (c)- (iv) (d)- (i)
D. (a)- (iii) (b)- (ii) (c)- (i) (d)- (iv)

Ans. A
Sol. • Pila is a mollusc. The radula is a filelike rasping organ used for feeding present in the mouth.

- Bombyx is an arthropod. Malpighian tubules are excretory tubules of the bombyx.
- Pleurobrachia comes under ctenophore. For the purpose of locomotion eight external rows of ciliated comb plates are present.
- Flame cells are used for osmoregulation and excretion in the taenia which is a Platyhelminth.

16. Drug called 'Heroin' is synthesized by
A. acetylation of morphine
B. glycosylation of morphine
C. nitration of morphine
D. methylation of morphine

Ans. A
Sol. - Heroin is an opioid which binds to specific receptors in CNS and GIT and relieves pain.

- It is obtained from the acetylation of morphine (diacetylmorphine).
- It is white, odourless and bitter crystalline compound.
- It is a depressant and results in the slowing down of body functions.
- It is generally taken by snorting or by injection.

17. Match the following organisms with the products they produce

| (a) Lactobacillus | (i) Cheese |
| :--- | :--- |
| (b) Saccharomyces | (ii) Curd cerevisiae |
| (c) Aspergillus niger | (iii) Citric Acid |
| (d) Acetobacter aceti | (iv) Bread |
|  | (v) Acetic Acid |

Select the correct option.
A. (a)-(ii) (b)-(iv) (c)-(iii) (d)-(v)
B. (a)-(iii) (b)-(iv) (c)-(v) (d)-(i)
C. (a)-(ii) (b)-(i) (c)-(iii) (d)-(v)
D. (a)-(ii) (b)-(iv) (c)-(v) (d)-(iii)

Ans. A
Sol. • Various micro-organisms are used to produce several household and industrial products For E.g.,-

- Lactobacillus or LAB is used in the production of curd from milk.
- Saccharomyces cerevisiae is used in the process of bread making.
- Aspergillus niger and Acetobacter aceti are employed in the production of citric acid and acetic acid respectively.

18. What is the site of perception of photoperiod necessary for induction of flowering in plants?
A. Pulvinus
B. Shoot apex
C. Leaves
D. Lateral buds

Ans. C
Sol. The length of the light period is called Photoperiod and the response is shown by the plant to change the relative length of Dark and light period is called as Photoperiodism.

- Bofore flowering the shoot apices modify themselves into floerin apices. Shoot Apices of Plants themselves cannot perceive photoperiods
- The site of perceptios of light/dark is the levaes of te pplanst

19. 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 ?
A. 1700 mL
B. 2200 mL
C. 2700 mL
D. 1500 mL

Ans. D
Sol. • Tidal Volume (TV) - Volume of air inspired or expired during normal respiration. It is approximately 500 ml per breath.

- Expiratory Reserve Volume (ERV) It is the additional volume of air that
a person can expire by a forcible expiration ( 1000 ml to 1100 ml ).
- Residual Volume (RV) - It is the volume of air that would remain in the lungs even after the forcible expiration ( 1100 to 1200 ml ).
- Expiratory Capacity (EC) - Total volume of air which a person can expire after a normal inspiration. Expiratory capacity $=$ TV + ERV.
- Here, $E C=500+1000=1500 \mathrm{ml}$.

20. Thiobacillus is a group of bacteria helpful in carrying out
A. Chemoautotrophic fixation
B. Nitrification
C. Denitrification
D. Nitrogen fixation

Ans. C
Sol. • A thiobacillus is a group of bacteria helpful in carrying out Denitrification.

- In the atmosphere, there is $79 \%$ of nitrogen is present but in the form of gas and it cannot be directly used by the plants.
- In order to use the nitrogen by the plants it has to be converted in to combined form like Nitrates $\left(\mathrm{NO}_{3}\right)$ or Ammonium ( $\mathrm{NH}_{4}$ ) and this process of conversion of nitrogen gas to nitrates and ammonium form is called as Nitrogen Fixation.
- A part of nitrates in the soil is converted into free nitrogen by denitrifying bacteria and this process is known as denitrification.

21. In a species, the weight of newborn ranges from 2 to $5 \mathrm{~kg} .97 \%$ of the newborn with an average weight between 3 to 3.3 kg survive whereas $99 \%$ of the infants born with weights from 2 to 2.5 kg or 4.5 to 5 kg die. Which type of selection process is taking place?
A. Stabilizing Selection
B. Disruptive Selection
C. Cyclical Selection
D. Directional Selection

Ans. A
Sol. • It is an example of Stabilizing Selection.

- In this case, nature favours or selects the individuals in the population possessing mean character value.
- In other words, it is said that natural selection leads to the stabilisation of the traits.
- In the above question, the survival rate of new-born babies having average weight in the range of 3-3.3 is more in comparison to those newborn babies having either more or less weight.

22. In Antirrhinum (Snapdragon), a red flower was crossed with a white flower and in $F_{1}$ generation pink flowers were obtained. When pink flowers were selfed, the $F_{2}$ generation showed white, red and pink flowers. Choose the incorrect statement from the following :
A. Pink colour in $F_{1}$ is due to incomplete dominance.
B. Ratio of $F_{2}$ is $1 / 4$ (Red) : $2 / 4$ (Pink) :1/4 (White)
C. Law of Segregation does not apply in this experiment
D. This experiment does not follow the Principle of Dominance.
Ans. C
Sol. • Incomplete dominance is an exception to Mendel's law.

- In incomplete dominance, the dominant allele is not completely expressed over its paired allele. This results in a third phenotype in which the expressed physical trait is a combination of the phenotypes of both alleles.
- For eg. Flower colour in Snapdragon.
- In case of Snapdragon when we cross red colour flowers (RR) with white colour flowers (rr), we get all pink flowers ( Rr ) due to incomplete dominance.
- When we make a selfing of pink flowers i.e. Rr X Rr we get Red : Pink : White flowers in the ratio of $1: 2: 1$.
- This experiment does not follow the law of dominance but follows the law of segregation which is a universal law.

23. Expressed Sequence Tags (ESTs) refers to :
A. Polypeptide expression
B. DNA polymorphism
C. Novel DNA sequences
D. Genes expressed as RNA

Ans. D
Sol. •Expressed Sequence Tags (ESTs) are DNA sequences (genes) that are expressed as mRNA for protein synthesis.

- The term expressed sequence tags (ESTs) was coined by Anthony Kerlavage.
- Expressed Sequence Tags (ESTs) are used in gene discovery and Human Genome Project.
- ESTs are usually 200 to 500 nucleotides long and are generated by sequencing the ends of DNA.

24. Identify the cells whose secretion protects the lining of gastrointestinal tract from various enzymes.
A. Goblet Cells
B. Oxyntic Cells
C. Duodenal Cells
D. Chief Cells

Ans. A
Sol. • Goblet cells are present in the mucosal epithelium of the intestine and stomach.

- Goblet cells secrete mucus and bicarbonates which protect the lining of the stomach from the deteriorating effects of acid as well as from the enzymes too.
- Mucus also aids in lubricating the ingested food material to facilitate their digestion and absorption.
- Chief cells are also known as peptic cells and they secrete the enzyme pepsinogen which is a proenzyme i.e. inactive form.
- Parietal or oxyntic cells are involved in secreting the HCl as well as an intrinsic factor which is essential for the absorption of the vitamin B12.

25. Extrusion of second polar body from egg nucleus occurs :
A. after fertilization
B. before entry of sperm into ovum
C. simultaneously with first cleavage
D. after entry of sperm but before fertilization
Ans. D
Sol. • Extrusion of the second polar body from egg nucleus occurs after entry of sperm but before fertilization.

- The secondary oocyte completes its second meiotic division after the entry of sperm.
- The completion of meiosis-II is promoted by the breakdown of metaphase promoting factor or MPF (due to entry of sperm) and turning on of anaphase promoting complex.
- As a result of second meiosis which is also an unequal division, secondary oocyte forms an ovum and a second polar body.

26. Match the hominids with their correct brain size :

| (a) Homo habilis | (i) 900 cc |
| :--- | :--- |
| (b) Homo neanderthalensis | (ii) 1350 cc |
| (c) Homo erectus | (iii) $650-800 \mathrm{cc}$ |
| (d) Homo sapiens | (iv) 1400 cc |

Select the correct option.
A. (a)- (iii) (b)- (ii) (c)- (i) (d)- (iv)
B. (a)- (iii) (b)- (iv) (c)- (i) (d)- (ii)
C. (a)- (iv) (b)- (iii) (c)- (i) (d)- (ii)
D. (a)- (iii) (b)- (i) (c)- (iv) (d)- (ii)

Ans. B
Sol. • Homo habilis is considered as the first human being like hominid.

- They were about 1.2-1.5 metres tall and moved erect.
- They have a brain capacity of about 650-800 cc.
- Homo neanderthalensis had a cranial capacity of about 1300 to 1600 cubic centimetres. It is believed that they buried their dead with flowers and tools and they also had a religion.
- Homo erectus probably ate meat and they had a cranial capacity of about 900 cc.
- Homo sapiens are also regarded as the modern humans and had a cranial capacity of about 1350 cc.

27. Which of the following statements is not correct?
A. The hydrolytic enzymes of lysosomes are active under acidic pH B. Lysosomes are membrane bound structures
C. Lysosomes are formed by the process of packaging in the endoplasmic reticulum
D. Lysosomes have numerous hydrolytic enzymes
Ans. C
Sol. - Lysosomes are membrane -bound organelles which are also known as suicidal bags of the cell.

- Lysosomes consists of many hydrolytic enzymes and they digest excess or worn-out organelles, food particles, and engulfed viruses or bacteria.
- Lysosomes are formed from the fusion of vesicles from the Golgi
complex with endosomes (vesicles formed by endocytosis from the plasma membrane).
- Endosomes fuse with transport vesicles from the Golgi that contain acid hydrolases. Once fused, these endosomes finally develop into lysosomes.
- Lysosomes bud off from trans face of Golgi bodies.

28. Select the hormone-releasing IntraUterine Devices.
A. Multiload 375, Progestasert
B. Progestasert, LNG-20
C. Lippes Loop, Multiload 375
D. Vaults, LNG-20

Ans. B
Sol.•Intrauterine devices are inserted into the uterus through the vagina.

- Progestasert, LNG-20 are the hormone releasing IUDs.
- Hormone releasing IUDs make the uterus unsuitable for implantation and the cervix hostile to the sperms.
- Multiload 375 is a copper releasing IUD.
- Lippes loop is a non-medicated IUD.
- Vaults come under the category of barrier methods used by females.

29. Respiratory Quotient (RQ) value of tripalmitin is
A. 0.7
B. 0.07
C. 0.09
D. 0.9

Ans. A
Sol. The respiratory quotient $(R Q)$ is the ratio of $\mathrm{CO}_{2}$ produced to $\mathrm{O}_{2}$ consumed while food is being metabolized.

30. Pinus seed cannot germinate and establish without fungal association. This is because :
A. it has obligate association with mycorrhizae.
B. it has very hard seed coat.
C. its seeds contain inhibitors that prevent germination.
D. its embryo is immature.

Ans. A

Sol. • Mycorrhiza is the mutual relationship that exists between the root of the Pine tree and the fungal species.

- Colder areas are the natural habitat of pinus trees where the source of water is snow rather than rain.
- Water is required for the germination of seeds.
- In order to fulfill its water requirements, the pinus tree is found in association with fungi.
- Fungus increases minerals \& water absorption for the plant by increasing surface area.
- Fungus in turn gets food and minerals required for its growth and development.

31. Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth
A. Pharynx $\rightarrow$ Oesophagus $\rightarrow$ Gizzard
$\rightarrow$ Crop $\rightarrow$ Ileum $\rightarrow$ Colon $\rightarrow$ Rectum
B. Pharynx $\rightarrow$ Oesophagus $\rightarrow$ Gizzard
$\rightarrow$ Ileum $\rightarrow$ Crop $\rightarrow$ Colon $\rightarrow$ Rectum
C. Pharynx $\rightarrow$ Oesophagus $\rightarrow$ Ileum
$\rightarrow$ Crop $\rightarrow$ Gizzard $\rightarrow$ Colon $\rightarrow$ Rectum
D. Pharynx $\rightarrow$ Oesophagus $\rightarrow$ Crop $\rightarrow$ Gizzard $\rightarrow$ Ileum $\rightarrow$ Colon $\rightarrow$ Rectum Ans. D
Sol. • The alimentary canal of cockroach is divided into three parts - foregut, midgut, and hindgut.

- The mouth opens into pharynx which leads to oesophagus.
- The oesophagus leads to crop (a sac-like structure used to store food).
- The crop is followed by gizzard which helps in the grinding of food particles.
- After gizzard ileum, colon and rectum are present in sequence (all are the parts of hindgut).
- The rectum opens out through anus.

32. Under which of the following conditions will there be no change in the reading frame of following mRNA?
5'AACAGCGGUGCUAUU3'
A. Deletion of $G$ from 5 th position $B$. Insertion of $A$ and $G$ at 4th and 5th positions respectively
C. Deletion of GGU from 7th, 8th and $9^{\text {th }}$ positions
D. Insertion of G at 5th position

Ans. C
Sol.


- On deleting the GGU from 7th, 8th and $9^{\text {th }}$ positions respectively, the triplet codon sequence of mRNA strand will not get disturbed.
- While on the addition and deletion of single or double nitrogenous base will disturb the reading sequence of codon triplet.

33. From evolutionary point of view, retention of the female gametophyte with developing young embryo on the parent sporophyte for some time, is first observed in
A. Mosses
B. Pteridophytes
C. Gymnosperms
D. Liverworts

Ans. B
Sol. • Pteridophytes are the first terrestrial plants to poses vascular tissue; xylem and phloem where xylem transport water and minerals while phloem conducts organic food.

- In heterosporous species, the female gametophyte remains on parents sporophyte for variable periods. The development of zygotes into young embryo takes place within the female gametophyte. This event is a precursor to the seed habit and thus considered an important step in evolution.

34. Match the following hormones with the respective disease

| (a) Insulin | (i) Addison's disease |
| :--- | :--- |
| (b) Thyroxin | (ii) Diabetes insipidus |
| (c) Corticoids | (iii) Acromegaly |
| (d) Growth Hormone | (iv) Goitre |
|  | (v) Diabetes mellitus |

Select the correct option.
A. (a)- (ii) (b)- (iv) (c)- (iii) (d)- (i)
B. (a)- (v) (b)- (iv) (c)- (i) (d)- (iii)
C. (a)- (ii) (b)- (iv) (c)- (i) (d)- (iii)
D. (a)- (v) (b)- (i) (c)- (ii) (d)- (iii)

Ans. B

Sol. • Defects in insulin secretion, insulin action, or both lead to Diabetes mellitus.

- It is a group of metabolic diseases characterized by hyperglycemia.
- Iodine is essential for the normal functioning of the thyroid gland.
- The deficiency of iodine in the diet leads to hypothyroidism and results in the enlargement of the thyroid gland known as simple goitre.
- Adrenal cortex is involved in the secretion of glucocorticoids and mineralocorticoids, deficiency of which leads to Addison's disease.
- Symptoms of Addison's disease include bronze-like pigmentation of the skin, low blood sugar, nausea, vomiting, etc.
- Acromegaly is caused due to oversecretion of growth hormone after puberty.

35. The concept of "Omnis cellula-e cellula" regarding cell division was first proposed by
A. Theodore Schwann
B. Schleiden
C. Aristotle
D. Rudolf Virchow

Ans. D
Sol.•Rudolf Virchow stated the postulate, "Omnis cellula-e cellula".

- It means that a cell arises from the pre-existing cell.
- Theodore Schwann and Schleiden together gave the cell theory.
- Aristotle is known as the Father of biology.

36. Colostrum the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains
A. Monocytes
B. Macrophages
C. Immunoglobulin A
D. Natural killer cells

Ans. C
Sol. • Colostrum is the first milk secreted by a mother after parturition.

- Colostrum is rich in antibody IgA.
- Newborn infants get this antibody as an immunity when their mother breastfeed them.
- This type of immunity is a type of passive immunity.
- Monocytes, macrophages and natural killer T cells are not present in the colostrum.

37. Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for
A. Use as a fertilizer
B. Construction of roads
C. Making tubes and pipes
D. Making plastic sacks

Ans. B
Sol. • Polyblend is a fine powder of recycled modified plastic.

- Polyblend is mixed with bitumen and then used to lay roads.
- The mixture of polyblend and bitumen, when used to lay roads enhanced the bitumen's water repellant property which in turn increases the life of roads by a factor of three.
- Any plastic film waste can be used to prepare polyblend.

38. 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?
A. Gibberellin and Cytokinin
B. Gibberellin and Abscisic acid
C. Cytokinin and Abscisic acid
D. Auxin and Ethylene

Ans. D
Sol. Auxin and Ethylene can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield

- Auxin such as NAA and 2, 4 -D are sprayed on pineapple, which induces flowering.
- Flowering and fruit set up are also synchronised by etylene in pineapple.

39. Which part of the brain is responsible for thermoregulation?
A. Hypothalamus
B. Corpus callosum
C. Medulla oblongata
D. Cerebrum

Ans. A
Sol. - Hypothalamus of the forebrain is responsible for temperature regulation or thermoregulation.

- Corpus callosum is a band of nerve fibres which connect both the
cerebral hemispheres i.e. right and left cerebral hemispheres.
- The cerebrum is the part of forebrain which is involved in various complex functions like memory, learning, regulation of voluntary functions etc.
- Medulla oblongata is the part of the hind brain which contains various centres that control respiration, cardiovascular reflexes and gastric secretions.

40. Which of the following pairs of gases is mainly responsible for green house effect?
A. Oxygen and Nitrogen
B. Nitrogen and Sulphur dioxide
C. Carbon dioxide and Methane
D. Ozone and Ammonia

Ans. C
Sol. •The greenhouse effect is a warming of Earth's surface and the air above it.

- It is caused by gases in the air that trap energy from the Sun.
- These heat-trapping gases are called greenhouse gases.
- The relative contribution of greenhouse gases is as follows -
- Carbon dioxide - 60\%
- Methane - 20\%
- CFCs - $14 \%$
- $\mathrm{N}_{2} \mathrm{O}-6 \%$
- Therefore carbon dioxide and methane are the major gases responsible for greenhouse effect.

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

| (a) i gene | (i) $\beta$-galactosidase |
| :--- | :--- |
| (b) z gene | (ii) Permease |
| (c) a gene | (iii) Repressor |
| (d) y gene | (iv) Transacetylase |

Select the correct option.
A. (a)- (iii) (b)- (i) (c)- (ii) (d)- (iv)
B. (a)- (iii) (b)- (i) (c)- (iv) (d)- (ii)
C. (a)- (iii) (b)- (iv) (c)-(i) (d)- (ii)
D. (a)- (i) (b)- (iii) (c)- (ii) (d)- (iv) D. (a)- (i) (b)- (iii) (c)- (ii) (d)- (iv) Ans. B
Sol.•Regulator gene(i): The gene codes for proteins known as repressor protein, it is synthesised all the time from the i gene, that's why it is a constitutive gene which is always functional

- lac Z gene codes for betagalactosidase which is primarily responsible for the hydrolysis of disaccharides, lactose into its monomeric units of galactose and glucose
- lac a: The a gene codes for transacetylase which can transfer cetyl group to beta-galactosidase
- lac y gene: It codes for permease, which increases the permeability of the cell

42. DNA precipitation out of a mixture of biomolecules can be achieved by treatment with
A. Chilled ethanol
B. Methanol at room temperature
C. Chilled chloroform
D. Isopropanol

Ans. A
Sol. The procedure of total DNA preparation from a culture of bacterial cells can be divided into four stages:

1. A culture of bacteria is grown and then harvested
2. The cell is broken to release its content like bacteria by lysozyme, Fungal by Chitinase, and plant cell by Cellulase
3. The cell is extracted to treated to remove all component except the DNA. RNA s removed by ribonuclese whereas, protein by protease 4. The Resulting DNA Solution is concentrated.
Other molecules can be removed by appropriate treatment and purified DNA ultimately precipitated out after the addition of chilled ethanol. This is further seen as a collection of fine threads in the suspension.
4. The correct sequence of phases of cell cycle is
A. $\mathrm{G}_{1} \rightarrow \mathrm{G}_{2} \rightarrow \mathrm{~S} \rightarrow \mathrm{M}$
B. $\mathrm{S} \rightarrow \mathrm{G}_{1} \rightarrow \mathrm{G}_{2} \rightarrow \mathrm{M}$
C. $\mathrm{G}_{1} \rightarrow \mathrm{~S} \rightarrow \mathrm{G}_{2} \rightarrow \mathrm{M}$
D. $\mathrm{M} \rightarrow \mathrm{G}_{1} \rightarrow \mathrm{G}_{2} \rightarrow \mathrm{~S}$

Ans. C
Sol. •The cell cycle is the sequence of events of a cell division.

- The cell cycle is divided into two phases - Interphase and $M$ phase.
- Interphase is divided into 3 phases that occur in sequence namely $\mathrm{G}_{1}$, S and $\mathrm{G}_{2}$.
- After interphase, M phase or the actual cell division takes place.
- During $\mathrm{G}_{1}$ phase the cell is metabolically active and continously grows but does not replicate its DNA. - S phase or the synthesis phase is the phase during which the cell doubles the amount of DNA but the chromosome number will remain the same.
- During $G_{2}$ phase, proteins are synthesized for the purpose of mitosis while cell growth continues.
- M phase is the phase during which actual cell division occurs.
- It is divided into two phases, first is karyokinesis and second is cytokinesis.

44. Which of the following statements regarding mitochondria is incorrect?
A. Enzymes of electron transport are embedded in outer membrane. B. Inner membrane is convoluted with infoldings.
C. Mitochondrial matrix contains single circular DNA molecule and ribosomes.
D. Outer membrane is permeable to monomers of carbohydrates, fats and proteins.
Ans. A
Sol. •Mitochondria is a double membrane-bound organelle - outer membrane and inner membrane.

- The enzymes and electron carriers for formation of ATP are present only in the inner membrane.
- The cristae are the infoldings of the inner membrane towards the matrix and increases the surface area for enzyme action.
- Mitochondrial matrix contains its own single circular DNA molecule and ribosomes.
- It is known as the powerhouse of the cell.

45. The frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes was explained by :
A. Gregor J. Mendel
B. Alfred Sturtevant
C. Sutton Boveri
D. T.H. Morgan

Ans. B

Sol. - The frequency of recombination between linked genes on the same chromosome can be used as a measure of the distance between genes.

- It was explained by Alfred Sturtevant.
- The frequency of recombination increases with the increase in distance between the two genes on the same chromosome as larger the distance more will be the chances of number of cross over between them.
- Gregor Mendel conducted the experiments on pea plant and discovered the fundamental laws of inheritance. He is also known as the Father of Genetics.
-T.H. Morgan is known for his experimental research with the fruit fly (Drosophila) with the help of which he established the chromosome theory of heredity.
- Sutton and Boveri together gave the chromosomal theory of inheritance.

46. Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.
A. Streptococcus pneumoniae /

Widal test
B. Salmonella typhi / Anthrone test
C. Salmonella typhi / Widal test
D. Plasmodium vivax / UTI test

Ans. C
Sol. •Typhoid is a bacterial disease which is caused by bacterium Salmonella typhi.

- These pathogens generally enter into the small intestine through contaminated food and water.
- Sustained high fever, stomach ache, headache, and loss of appetite are common symptoms.
- Widal test is used as a confirmation test for typhoid.
- The anthrone test is used for the determination of carbohydrates, either free or present in polysaccharides.
- Plasmodium vivax causes malaria.
- Streptococcus pneumoniae is responsible for causing pneumonia.
- UTI test is used for the diagnosis of urinary tract infections.

47. The Earth Summit held in Rio de Janeiro in 1992 was called
A. for conservation of biodiversity and sustainable utilization of its benefits
B. to assess threat posed to native species by invasive weed species C. for immediate steps to discontinue use of CFCs that were damaging the ozone layer
D. to reduce $\mathrm{CO}_{2}$ emissions and global warming
Ans. A
Sol. - The Earth Summit was held in Rio de Janeiro, Brazil.

- Appropriate measures for the conservation of biodiversity and sustainable utilization of its benefits were taken during this summit.

48. Variations caused by mutation, as proposed by Hugo de Vries are
A. random and directionless
B. small and directional
C. small and directionless
D. random and directional

Ans. A
Sol. • Hugo de Vries stated that a large mutation can occur in a single step.

- According to him, mutations are random and directionless.
- He called it as saltation.
- He believed that mutation is responsible for speciation.

49. Which of the following can be used as a biocontrol agent in the treatment of plant disease?
A. Chlorella
B. Anabaena
C. Lactobacillus
D. Trichoderma

Ans. D
Sol. • The natural predators or enemies of the pests, weeds, etc are referred to as biocontrol agents.

- Trichoderma is used as a biocontrol agent.
- Trichodermais mainly used for soilborne disease and is effective against many pathogenic fungi like phytopthara etc.
- Lactobacillus is a bacteria that coagulates and partially digests the milk proteins and convert it into curd. - Anabaena is a nitrogen-fixing bacteria and forms a symbiotic relationship with certain plants such as mosquito fern.
- Chlorella is an algae and is a good source of several vitamins, minerals and antioxidants.

50. Which of the following immune responses is responsible for rejection of kidney graft?
A. Humoral immune response
B. Inflammatory immune response
C. Cell-mediated immune response
D. Auto-immune response

Ans. C
Sol. • A graft is defined as the organ or tissue used for transplantation.

- Tissue matching, blood group matching are essential for an organ transplant.
- Cell-mediated immunity is responsible for the rejection of transplanted tissue or organ.
- Because the immune system recognizes the protein in the transplanted tissue or organs as foreign and as a result initiate cellular immunity.

51. Cells in $\mathrm{G}_{0}$ phase :
A. enter the cell cycle
B. suspend the cell cycle
C. terminate the cell cycle
D. exit the cell cycle

Ans. D
Sol. • Cells in $G_{0}$ phase will exit the cell cycle.

- cells that do not divide further exit the $\mathrm{G}_{1}$ phase and enter into an inactive stage Go phase or Quiescent stage.
- Cells in this stage do not divide unless called on to do so as per the requirement of the organism.
- But the cell is metabolically active during this stage.

52. Which of the following is a commercial blood cholesterol lowering agent?
A. Statin
B. Streptokinase
C. Lipases
D. Cyclosporin A
Ans. A

Sol. • Statin is used as a blood cholesterol-lowering agent.

- Statins are produced by the yeast Monascus purpureus.
- It acts by competitively inhibiting the enzyme responsible for the synthesis of cholesterol.
- Streptokinase is produced by the bacterium Streptococcus and is used
as a clot bluster for removing clots from the blood vessel.
- Cyclosporin A is obtained from the fungi Trichoderma polysporum and is used as an immunosuppressive agent.
- Lipases are obtained from Candida lipolytica and are used in detergent formulations to remove oily strains.

53. Which of the following muscular disorders is inherited?
A. Muscular dystrophy
B. Myasthenia gravis
C. Botulism
D. Tetany

Ans. A
Sol. • Muscular dystrophy is an inherited $X$ - linked recessive disease.

- In this disease progressive degeneration and loss of muscle mass occur.
- Some mutations causes the production of abnormal gene which further interferes with the production of proteins which are required for the formation of healthy muscle.
- Due to deficiency of calcium, spasms occur in the muscles at irregular intervals. This condition is known as tetany.
- Myasthenia gravis is an autoimmune disease.
- It is a chronic neuromuscular disease that results in the weakness in the skeletal muscles.
- Botulism is a serious illness caused by bacterium Clostridium Botulinum.
- Botulinum toxin released causes paralysis which starts from the face and spreads to the limbs and it may reaches to the breathing muscles resulting in the respiratory failure.

54. Select the correct option.
A. 11th and 12th pairs of ribs are connected to the sternum with the help of hyaline cartilage.
B. Each rib is a flat thin bone and all the ribs are connected dorsally to the thoracic vertebrae and ventrally to the sternum.
C. There are seven pairs of vertebrosternal, three pairs of vertebrochondral and two pairs of vertebral ribs.
D. 8th, 9th and 10th pairs of ribs articulate directly with the sternum. Ans. C

Sol. •There are total 12 pairs of ribs present in humans.

- The first seven pairs of ribs are called as vertebrosternal ribs or true ribs.
- They are dorsally attached to thoracic vertebrae and ventrally connected to the sternum via hyaline cartilage.
- Next 3 pair of ribs are called as vertebrochondral or false ribs. They attached dorslly to vertebral column but does not attach to the sternum directly. They join the 7th rib with the help of hyaline cartilage.
- The 11th and 12th pair of ribs are not connected ventrally and hence they are called as floating ribs.

55. Which of the following statements is correct?
A. Cornea consists of dense connective tissue of elastin and can repair itself.
B. Cornea is convex, transparent layer which is highly vascularised.
C. Cornea consists of dense matrix of collagen and is the most sensitive portion the eye.
D. Cornea is an external, transparent and protective proteinacious covering of the eye-ball.
Ans. C
Sol. - The cornea is derived from the sclera and is located in front of the eye.

- The cornea is a curved surface and it acts like a convex lens.
- The cornea is avascular.
- Cornea consists of dense matrix of collagen and corneal epithelium.
- It is the most sensitive part of eye.

56. Following statements describe the characteristics of the enzyme Restriction Endonuclease. Identify the incorrect statement.
A. The enzyme binds DNA at specific sites and cuts only one of the two strands.
B. The enzyme cuts the sugarphosphate backbone at specific sites on each strand.
C. The enzyme recognizes a specific palindromic nucleotide sequence in the DNA.
D. The enzyme cuts DNA molecule at identified position within the DNA.
Ans. A

Sol.•Restriction Endonuclease is an enzyme that cuts the DNA into pieces after recognizing the specific sequence or sites known as restriction sites.

- Once the enzyme identifies its particular site of cutting, it gets binds to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbone.
- This enzyme also recognizes a specific palindromic nucleotide sequence ( sequence which reads same in both the direction ) in the DNA.
- Examples of restriction endonuclease enzymes are EcoRI, EcoRII, BamHI, HindIII, etc.

57. Phloem in gymnosperms lacks:
A. Sieve tubes only
B. Companion cells only
C. Both sieve tubes and companion cells
D. Albuminous cells and sieve cells

Ans. C
Sol. • Sieve tube element is long, a tublike structure which is arranged longitudinally. They are absent in Pteriodophytes and Gymnosperm. These plants have sieve cells in place of a seive tube, which is not arranged distinctly in a linear row.

- Companion cells are specialised parenchymatous cells which are closely associated with a seive tube, due to which they are called companion cells. Gymnosperm and pteridophytes lack these cells. Gymnosperm possed albuminus cells, in placed of companion cells, which is associated with seive cells in them
Thus, Phloem in gymnosperms lacks Both sieve tubes and companion cells.

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?
A. (b) and (c) are correct
B. (c) and (d) are correct
C. (a) and (d) are correct
D. (a) and (b) are correct

Ans. B
Sol. - Optin $a$ and $b$ are incorrect as dialysis is done in order to remove nitrogenous waste and excess potassium from the body.

- Option c and d are correct.
- Erythropoietin hormone is released by the Juxtaglomerular cells of the kidney. In artificial, there are no such cells so RBC production will be reduced, due to reduced erythropoietin hormone.
- Kidney disease causes imbalances in bone metabolism.
- As phosphate ions are eliminated during dialysis, along with that calcium ions are also eliminated. So, there will be reduced absorption of calcium ions from gastrointestinal tract.

59. Which of the following statements is incorrect?
A. Viruses are obligate parasites. B. Infective constituent in viruses is the protein coat.
C. Prions consist of abnormally folded proteins. D. Viroids lack a protein coat.

Ans. B
Sol. • Viruses consist of either DNA or RNA along with protein.

- The DNA or RNA is infective material in the viruses and not protein.
- Viruses are obligate parasites i.e. they depend completely on the host to carry out their metabolic functions.
- Viroids are the smallest infectious pathogens known.
- They consist of circular singlestranded RNA.
- The protein coat is absent in them.
- Prions consist of abnormally folded proteins.

60. Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to
A. inflammation of bronchi and bronchioles
B. proliferation of fibrous tissues and damage of the alveolar walls
C. reduction in the secretion of surfactants by pneumocytes D. benign growth on mucous lining of nasal cavity
Ans. A
Sol.•Difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles is known as asthma.

- Air-borne allergens and pollutants leads to the inflammation of bronchi and bronchioles is known as asthma.
- Asthma is an allergic condition faced by many people in urban areas due to the increasing rate of pollution.
- The proliferation of fibrous tissues and damage to the alveolar walls refers to fibrosis.

61. Which of the following sexually transmitted diseases is not completely curable?
A. Genital warts
B. Genital herpes
C. Chlamydiasis
D. Gonorrhoea

Ans. B
Sol. • Genital Herpes is caused by Type II herpes simplex virus.

- Symptoms include painful genital blisters on the prepuce, glans penis in males and on the vulva and in the vagina in females.
- There is no cure of genital herpes at present.
- Other noncurable STDs are hepatitis-B and HIV.
- Genital Warts is a viral disease caused by the Human Papilloma Virus (HPV).
- Gonorrhoea is caused by bacterium Neisseria gonorrhoeae.
- Chlamydiasis is caused by bacterium Chlamydia trachomatis.

62. How does steroid hormone influence the cellular activities?
A. Binding to DNA and forming a genehormone complex
B. Activating cyclic AMP located on the cell membrane
C. Using aquaporin channels as second Messenger
D. Changing the permeability of the cell membrane
Ans. A
Sol. • Steroidal or lipid-soluble hormones interact with the intracellular
receptors located inside the nucleus and regulate gene expression (i.e. by modifying mRNA sequence and thus the protein) by the interaction of hormone-receptor complex.

- Steroid Hormones bind to the DNA and forms a gene hormone complex to regulate cellular activity.
- Examples of steroidal hormones androgens, estrogens, progestogens, mineralocorticoids, and glucocorticoids.

63. Which of the statements given below is not true about formation of Annual Rings in trees?
A. Differential activity of cambium causes light and dark bands of tissue early and late wood respectively. B. Activity of cambium depends upon variation in climate.
C. Annual rings are not prominent in trees of temperate region. D. Annual ring is a combination of spring wood and autumn wood produced in a year
Ans. C
Sol. Growth Rings are unformed by the seasonal activity of cambium. In temperate region, cambium is more active in spring and less active in the autumn season

- The activity of Cambium ring is not uniform throughout the entire year but markedly affected by variation in the external environment, i.e. climate as well as the internal environment of the plant.
- The climatic condition is not uniform through the entire year and different season show different climates. The secondary xylem or the wood produced is different in the different season due to differential activity of cambium.
- One annual ring includes one circle of springwood and one of autumn wood. thus, is the combination of springwood and autumn wood produced in a year

64. What is the direction of movement of sugars in phloem?
A. Upward
B. Downward
C. Bi-directional
D. Non-multidirectional

Ans. C

Sol. - The vascular system in plants is used to translocate substances from one place to another.

- Xylem and phloem are the components of the vascular system.
- Xylem conducts water and mineral salts whereas phloem is involved in the translocation of food substances like sugars across various parts of the plants.
- Transport via phloem is bidirectional i.e. both upwards and downwards.
- Phloem transports food material synthesized in the leaves to different parts of the plant.

65. The shorter and longer arms of a submetacentric chromosome are referred to as
A. p -arm and q -arm respectively
B. $q$-arm and p -arm respectively
C. m-arm and $n$-arm respectively
D. s-arm and l-arm respectively

Ans. A
Sol. - The centromere in the submetacentric chromosome is situated slightly away from the middle of the chromosome which results into one longer arm and one shorter arm.

- Therefore the submetacentric chromosome is heterobrachial.
- Short arm is designated as ' $p$ ' arm.
- Long arm is designated as 'q' arm.

66. Which of these following methods is the most suitable for disposal of nuclear waste?
A. Bury the waste under Antarctic ice-cover
B. Dump the waste within rocks under deep ocean
C. Bury the waste within rocks deep below the Earth's surface D. Shoot the waste into space

Ans. C
Sol. • Nuclear waste can't be released into open environment as radiations released have devastating effects on the health of living organisms.

- So nuclear waste is generally buried below the rock deep inside the earth's surface after packing it in suitably closed containers to avoid its leakage.

67. Match the Column-I with Column-II


Select the correct option.
A. (a)- (iv) (b)- (i) (c)- (ii) (d)- (v)
B. (a)- (ii (b)- (i) (c)- (v) (d)- (iii)
C. (a)- (ii) (b)- (iii) (c)- (v) (d)- (iv)
D. (a)- (iv) (b)- (i) (c)- (ii) (d)- (iii)

Ans. D
Sol. •ECG or electrocardiograph is the graphical representation of the electrical activity of the heart during a cardiac cycle.

- The $P$ wave in the ECG represents the electrical excitation or depolarization of the atria.
- The QRS complex represents the depolarization of ventricles.
- Repolarisation of ventricles or returning of ventricles from excited to the normal state is depicted by T wave.
- Coronary ischemia is a medical term for not having enough blood through the coronary arteries.
- A decrease in the size of $T$ wave represents the condition of cardiac ischemia.

68. Which one of the following statements regarding postfertilization development in flowering plants is incorrect?
A. Zygote develops into embryo
B. Central cell develops into endosperm
C. Ovules develop into embryo sac
D. Ovary develops into fruit

Ans. C
Sol.•Double fertilization is seen in flowering plants - Syngmay and Triple fusion.

- In syngamy, the male gamete from anther fuses with the nucleus of the egg cell to form a diploid zygote which develops into an embryo.
- In a Triple fusion, another male gamete fuses with two polar nuclei located in the central cell and forms a triploid primary endosperm nucleus.
- Ovules develop into seed. In fact, a seed is known as a fertilized ovule.
- The fruit is developed from the ovary and is called as a ripened ovary.
- Embryo Sac is the female gametophyte of flowering plants which is formed by the division of haploid megaspore nucleus.

69. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus
A. Mangifera indica Linn.
B. Mangifera ndica
C. Mangifera Indica
D. Mangifera indica Car. Linn.

Ans. A
Sol. • Biological names are generally written in Latin language and are always written in italics and are also separately underlined.

- The first name in the biological name indicates the name of genus (starting with the capital letter) and the second letter represents the species (starting with the small letter).
- The name of the author appears after the specific epithet.
- On the basis of the above rules, the right name of mango given by Carolus Linnaeus is Mangifera indica Linn.

70. What is the fate of the male gametes discharged in the synergid?
A. All fuse with the egg. B. One fuses with the egg, other(s) fuse(s) with synergid nucleus. C. One fuses with the egg and other fuses with central cell nuclei. D. One fuses with egg other(s) degenerate(s) in the synergid.
Ans. C
Sol. After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.
Syngamy: One of the male gametes moves towards the egg cell and fuses with its nucleus. Thus, resulting in the formation of a diploid cell, the zygote.
71. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology?
A. Genetic code is redundant
B. Genetic code is nearly universal
C. Genetic code is specific
D. Genetic code is not ambiguous

Ans. B

Sol. •The genetic code is universal in nature.

- It means that a particular sequence of the nitrogenous base in the form of triplet or codon will code for a particular amino acid in nearly all organisms.
- This property of genetic code allows bacteria to produce human insulin by recombinant DNA technology.
- The genetic code is redundant means that one amino acid can be coded by many codons.
- The genetic code is not ambiguous means that a particular codon will code only for a particular amino acid.

72. Which of the following pair of organelles does not contain DNA?
A. Chloroplast and Vacuoles
B. Lysosomes and Vacuoles
C. Nuclear envelope and

Mitochondria
D. Mitochondria and Lysosomes

Ans. B
Sol. •Lysosomes and vacuoles do not contain their own DNA.

- Lysosomes are present in eukaryotes and are involved in the phagocytosis of foreign material and therefore called as suicidal bags.
- Vacuoles are present in the plant cells and they contain water, sap, excretory product, and other materials not useful for the cell.
- Mitochondria and chloroplast contain their own DNA.
- Mitochondria are known as the powerhouse of the cells.
- Chloroplasts are the plastids present in plant cells and contain green colouring pigment called chlorophyll.
- The envelope surrounding the nucleus is called as nuclear envelope.

73. In some plants, the female gamete develops into embryo without fertilization. This phenomenon is known as
A. Parthenocarpy
B. Syngamy
C. Parthenogenesis
D. Autogamy

Ans. C
Sol. - In parthenogenesis, the female gamete undergoes development to form new organisms without fertilisation.

- For example, some rotifers, honeybees, and in some lizards and birds (turkey).
- Parthenocarpy is a situation in which fruits develop without fertilization. Eg. Banana.
- Autogamy - In this, the pollen grains from the anther transfer to the stigma of the same flower.
- Syngamy refers to the fusion of male and female gametes.

74. Consider the following statement :
(A) Coenzyme 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.
A. (A) is true but (B) is false.
B. Both (A) and (B) are false.
C. (A) is false but (B) is true.
D. Both (A) and (B) are true.

Ans. A
Sol. • Coenzyme or metal ion that is tightly bound to enzyme protein is called prosthetic group.

- It is a tightly bound, specific nonpolypeptide unit required for the biological function of some proteins.
- It may be organic (such as a vitamin, sugar, or lipid) or inorganic (such as a metal ion), but never be an amino acid.
- A complete catalytic active enzyme with its bound prosthetic group is called holoenzyme.
- An apoenzyme is an inactive enzyme, activation of the enzyme occurs upon binding of an organic or inorganic cofactor.

75. Conversion of glucose to glucose-6phosphate, the first irreversible reaction of glycolysis, is catalyzed by
A. Hexokinase
B. Enolase
C. Phosphofructokinase
D. Aldolase

Ans. A
Sol. Glycolysis is the process of partial oxidation of glucose to form pyruvic acid .The Process of Gycloysis involves various steps:

- Glucose is phosphorylated to glucose 6 phosphate by ATP on the presence of Hexokinase, the first irreversible reaction of glycolysis
- Enolase acts on 2phosphoglycerate and converts into Phosphoenolpyruvate
- The Fructose 1-6-bisphosphate splits into dihydroxyacetone phosphate and 3 phosphoglyceraldehyde
- Fructose 6 phosphate is phosphorylated to form-1-6 bisphophate. the enzyme which helps in transfer of phosphate from ATP to fructose 6 phosphate is phosphofructokinase

76. Which of the following ecological pyramids is generally inverted?
A. Pyramid of energy
B. Pyramid of biomass in a forest
C. Pyramid of biomass in a sea
D. Pyramid of numbers in grassland Ans. C
Sol. - Pyramid of biomass in sea is generally inverted.

- Although the number of producers are much more in number than the primary and secondary consumers
- But due to small size of producers the amount of biomass produced is not in huge amount.
- Being less in number but larger in size the amount of biomass is more than the producers.
- Therefore the pyramid of biomass is inverted for biomass in sea.
- The pyramid of energy is always upright and can never be inverted.
- Pyramids of number in grassland is upright as producers are more in number than members at next trophic level.
- Pyramid of biomass in forest is also not inverted.

77. Consider following features
(a) Organ system level of organization
(b) Bilateral symmetry
(c) True coelomates with segmentation of body
Select the correct option of animal groups which possess all the above characteristics
A. Annelida, Arthropoda and Mollusca
B. Arthropoda, Mollusca and Chordata
C. Annelida, Mollusca and Chordata D. Annelida, Arthropoda and Chordata
Ans. D

Sol. • Annelida and Arthropoda are nonchordates.

- Annelida, Arthropoda and chordates all three possess organ system level of organisation with true segmentation and bilateral symmetry.
- They all are true coelomates (have a body cavity called a coelom with a complete lining called peritoneum derived from mesoderm).
- Bilateral symmetry means that a body is divided into two equal and identical halves when divided along a particular plane (sagittal plane).

78. What is the genetic disorder in which an individual has an overall masculine development gynaecomastia, and is sterile ?
A. Klinefelter's syndrome
B. Edward syndrome
C. Down's syndrome
D. Turner's syndrome

Ans. A
Sol. • Overall masculine development along with gynaecomastia and sterility is observed in an individual suffering from genetic disorder Klinefelter's syndrome.

- This syndrome is characterized by an additional copy of $X$ chromosome resulting into a karyotype of $47, \mathrm{XXY}$. - Edwards syndrome is a genetic disorder caused by a third copy of all or part of chromosome 18.
- Many parts of the body are affected in this disorder.
- Babies are often born small and have heart defects. This disorder is also known as trisomy 18.
- Turner's syndrome - It is characterized by X0 i.e. absence of one of the $X$ chromosome.
- Such females lack secondary sexual characters and are sterile as ovaries are rudimentary in them.
- Down's syndrome - It is also known as trisomy of 21 i.e. an additional copy of chromosome number 21 is present. Physical, mental and psycomotor development is retarded in this case.

79. Which of the following is the most important cause for animals and plants being driven to extinction?
A. Drought and floods
B. Economic exploitation
C. Alien species invasion
D. Habitat loss and fragmentation

Ans. D
Sol. • There are 4 major causes ( known as Evil Quartet ) of the biodiversity loss.

- Habitat loss and fragmentation, over-exploitation, Alien species invasions, and co-extinctions.
- Among all these the habitat loss and fragmentation is the major cause of biodiversity loss.
- Habitat loss refers to the loss of natural home or living conditions of an organism due to pollution, human interference, etc.
- Alien species invasion is also responsible for the loss of many native species.

80. What triggers activation of protoxin to active Bt toxin of Bacillus thuringiensis in boll worm?
A. Moist surface of midgut
B. Alkaline pH of gut
C. Acidic pH of stomach
D. Body temperature

Ans. B
Sol. • Bacillus thuringiensis during sporulation forms intracellular crystalline bodies that contain an insecticidal protein endotoxin.

- This endotoxin is an inactive precursor.
- When insect ingested the bacteria, this protoxin is cleaved by proteases in the alkaline conditions in the gut.
- It results in the shorter versions of the protein which is responsible for the toxic activity which results in the death of insect.

81. Select the correct sequence for transport of sperm cells in male reproductive system.
A. Seminiferous tubules $\rightarrow$ Rete testis $\rightarrow$ Vasa efferentia $\rightarrow$ Epididymis $\rightarrow$ Vas deferens $\rightarrow$ Ejaculatory duct $\rightarrow$ Urethra $\rightarrow$ Urethral meatus
B. Seminiferous tubules $\rightarrow$ Vasa efferentia $\rightarrow$ Epididymis $\rightarrow$ Inguinal canal $\rightarrow$ Urethra
C. Testis $\rightarrow$ Epididymis $\rightarrow$ Vasa efferentia $\rightarrow$ Vas deferens $\rightarrow$ Ejaculatory duct $\rightarrow$ Inguinal canal $\rightarrow$ Urethra $\rightarrow$ Urethral meatus
D. Testis $\rightarrow$ Epididymis $\rightarrow$ Vasa efferentia $\rightarrow$ Rete testis $\rightarrow$ Inguinal canal $\rightarrow$ Urethra
Ans. A
Sol. - Sperms are produced in the seminiferous tubules.

- Seminiferous tubules unite to form several straight tube-like structures called as tubuli recti which further opens into rete testis.
- Several rete testis unites to form vasa efferentia which transports sperm from rete testis to epididymis.
- Sperms undergo maturation in the epididymis.
- Epididymis leads to vas deferens.
- Vas deferens along with the duct from seminal vesicle forms the ejaculatory duct.
- sperm from the ejaculatory duct pass into the urethra and then into the urethral meatus.

82. Persistent nucellus in the seed is known as
A. Perisperm
B. Hilum
C. Tegmen
D. Chalaza
Ans. A

Sol. Seeds in which remains of nucellus is seen is called Perispermic Seeds. The Residual, persistent nucellus is called
Perisperm. Example: Black Pepper, Beet

- The hilum is the junction between ovule and funicle or the point of attachment of funicle to the body of the ovule
- Chalaza is opposite to micropyle end representing the basal part of the ovule
- The outer layer of the seed coat is called testa and the inner one is called Tegmen

83. Which one of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes?
A. Sludge digester
B. Industrial oven
C. Bioreactor
D. BOD incubator

Ans. C
Sol. - In order to produce large volumes of the desired culture like of enzymes etc. bioreactors are used for the purpose.

- A bioreactor provides the best suitable conditions for achieving the desired growth of the product by providing optimum growth conditions like temperature, pH , substrate, salts, vitamins, oxygen, etc.
- Stirring type bioreactor is the most commonly used bioreactor.
- BOD Incubator (Bio-Oxygen Demand) is used in maintaining the temperature for test tissue culture growth, storage of bacterial cultures and incubation where constant high temperature is necessary for the growth of microbes in a test culture.

84. 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. (a)- (ii) (b)- (iv) (c)- (i) (d)- (iii)
B. (a)- (iii) (b)- (iv) (c)- (i) (d)- (ii)
C. (a)- (iii) (b)- (ii) (c)- (i) (d)- (iv)
D. (a)- (iii) (b)- (i) (c)- (ii) (d)- (iv)

Ans. B
Sol. • Mucosa forms crypts in between the base of the villi in the intestine known as crypts of Leiberkuhn

- The liver consists of hepatic globules which are the structural and functional units of the liver and contain hepatic cells.
- Each hepatic lobule is covered by a thin connective tissue sheath called as Glisson's capsule.
- Islets of Langerhans are present in the pancreas. Beta cells of Islets of Langerhans are responsible for the secretion of insulin.
- Brunner's gland are present in the duodenum. Their secretion is alkaline in nature and protects the wall of the intestine from gastric juices.

85. 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 ?
A. 75 beats per minute
B. 100 beats per minute
C. 125 beats per minute
D. 50 beats per minute

Ans. B

Sol. $\cdot$ Cardiac output $=$ Stroke Volume X Heart Rate.

- Stroke Volume is the volume of blood pumps out by ventricle during a cardiac cycle.
- Therefore, Stroke volume $=$ Blood volume in ventricles at the end of diastole (relaxation) - Blood volume in ventricles at the end of systole (after contraction) $=100 \mathrm{ml}-50 \mathrm{ml}=$ 50 ml .
- So, Heart Rate = cardiac output / stroke volume $=5000 / 50=100$ beats per minute.

86. Xylem translocates
A. Water and mineral salts only
B. Water, mineral salts and some organic nitrogen only
C. Water, mineral salts, some organic nitrogen and hormones
D. Water only

Ans. C
Sol. • Translocation means the movement of substances over long distances.

- In plants, translocation is done by the vascular system which consists of xylem and phloem.
- Xylem is involved in the translocation of water, mineral salts, some organic nitrogen, and hormones.
- Transport in the xylem is unidirectional i.e. from roots to other parts of the plant.
- Phloem translocates organic compounds and other food material and the transport is bidirectional.

87. Which of the following is true for Golden rice?
A. It is pest resistant, with a gene from Bacillus thuringiensis
B. It is drought tolerant, developed using Agrobacterium vector
C. It has yellow grains, because of a gene introduced from a primitive variety of rice
D. It is Vitamin A enriched, with a gene from daffodil
Ans. D
Sol. • Golden rice is vitamin A enriched rice, with a gene from daffodil.

- Golden rice is developed to combat the deficiency of Vitamin A.
- Genetic modification is done in rice in order to produce beta carotene which is not produced in normal rice.
- Beta carotene is converted into VitA when metabolized in the human body.
- Vitamin A is necessary for maintaining healthier skin, immune system, and vision.

88. Purines found both in DNA and RNA are
A. Adenine and guanine
B. Guanine and cytosine
C. Cytosine and thymine
D. Adenine and thymine

Ans. A
Sol. • Nitrogenous bases are of two types

- Purines and Pyrimidines.
- Purines consist of adenine and guanine.
- Pyrimidines consist of cytosine. uracil and thymine.
- In DNA and RNA both the purines
i.e. adenine and guanine are present.
- In case of pyrimidines, DNA consist of cytosine and thymine while RNA consist of cytosine and uracil and not thymine.

89. Which of the following protocols did aim for reducing emission of chlorofluorocarbons into the atmosphere?
A. Kyoto Protocol
B. Gothenburg Protocol
C. Geneva Protocol
D. Montreal Protocol

Ans. D
Sol. •Montreal Protocol was signed in Montreal, Canada in 1987.

- Many steps were decided in order to reduce the emission of CFCs and other ozone-depleting chemicals, separately for developing and developed countries.
- This protocol becomes effective in 1989.

90. Placentation in which ovules develop on the inner wall of the ovary or in peripheral part, is
A. Axile
B. Parietal
C. Free central
D. Basal

Ans. B
Sol. The arrangement of ovules on placenta within the ovary is known as Placentation.

- Parietal Placentation: The ovary is one chambered but becomes twochambered due to the formation of false septum. The ovary develops on the inner wall of the ovary or in the
peripheral part. Example: Mustard, Agremone
- Basal: The placenta develops at the base of the ovary. Example: Sunflower, Marigold
- Free central: The ovule is borne on the central axis and septa are absent in the ovary. Example: Primose and Dianthus
- Axile: The placenta is present in axial position and the ovule is attached to it in a multilocular ovary. Example: China Rose, Tomato and Lemon

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

A. $\mathrm{H}_{2}, \mathrm{Pd} / \mathrm{C}$, quinoline
B. $\mathrm{Zn} / \mathrm{HCl}$
C. $\mathrm{Hg}^{2+} / \mathrm{H}^{+}, \mathrm{H}_{2} \mathrm{O}$
D. Na /liquid $\mathrm{NH}_{3}$

Ans. A
Sol.

92. The correct structure of tribromooctaoxide is





Ans. D
Sol.

93. For a cell involving one electron $\mathrm{E}^{\circ}$ cell $=0.59 \mathrm{~V}$ at 298 K , the equilibrium constant for the cell reaction is :[Given that $\frac{2.303 R T}{F}=0.059 \mathrm{~V}$ at $T$ $=298 \mathrm{~K}]$
$1.0 \times 10^{5}$ B. $1.0 \times 10^{10}$
C. $1.0 \times 10^{30}$ D. $1.0 \times 10^{2}$

Ans. B
Sol. $E_{\text {cell }}=E_{\text {cell }}^{o}-\frac{0.059}{n} \log Q$

At equilibrium, $\mathrm{Q}=\mathrm{K}_{\text {eq }}$ and $\mathrm{E}_{\text {cell }}=0$
So, $0=E_{\text {cell }}^{o}-\frac{0.059}{n} \log K_{e q}$
$\log K_{e q}=\frac{E^{o}{ }_{\text {cell }} \times n}{0.059}$ As n
electrons is 1 so $\mathrm{n}=1$ and E
(given) $\log K_{\text {eq }}=0.59 * 1 / 0.059$
$\log K_{\text {eq }}=10 K_{\text {eq }}=10^{10}$
94. The structure of intermediate $A$ in the following reaction, is

A.

B.

C.

D.


Ans. A
Sol.


95. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is :
A. 20
B. 30
C. 40
D. 10

Ans. B
Sol. Haber's Process
$\mathrm{N}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g}) \rightleftharpoons 2 \mathrm{NH}_{3}$ 20 moles need to be produced 2 moles of $\mathrm{NH}_{3} \rightarrow 3$ moles of $\mathrm{H}_{2}$ Hence, 20 moles of $\mathrm{NH}_{3} \rightarrow 3 * 20 / 2$ moles of $\mathrm{H}_{2}$
30 moles of $\mathrm{H}_{2}$
96. The non-essential amino acid among the following is:
A. Leucine
B. Alanine
C. Lysine
D. Valine

Ans. B
Sol. There are 11 nonessential amino acids: alanine, arginine, asparagine, aspartic acid,

## cysteine, glutamic acid, glutamine, glycine, proline, serine, and tyrosine.

97. 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 :
A. $Z>1$ and repulsive forces are dominant
B. $Z<1$ and attractive forces are dominant
C. $Z<1$ and repulsive forces are dominant
D. $\mathrm{Z}>1$ and attractive forces are dominant
Ans. B
Sol. Compressibility factor $(Z)=\frac{V_{\text {real }}}{V_{\text {ideal }}}$
for $V_{\text {real }}<V_{\text {ideal, }} \quad \mathrm{Z}<1$ If $\mathrm{Z}<1$, attractive forces are dominant among gaseous molecules and liquefaction of gas will be easy
98. Which of the following reactions are disproportionation reaction?
(a) $2 \mathrm{Cu}^{+} \rightarrow \mathrm{Cu}^{2+}+\mathrm{Cu}^{0}$
(b) $3 \mathrm{MnO}^{2-} 4+4 \mathrm{H}^{+} \rightarrow 2 \mathrm{MnO}_{4}^{-}+\mathrm{MnO}_{2}$
$+2 \mathrm{H}_{2} \mathrm{O}$
(c) $2 \mathrm{KMnO}_{4} \xrightarrow{\Delta} \mathrm{~K}_{2} \mathrm{MnO}_{4}+\mathrm{MnO}_{2}+\mathrm{O}_{2}$
(d) $2 \mathrm{MnO}_{4}^{-}+3 \mathrm{Mn}^{2+}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow 5 \mathrm{MnO}_{2}+4 \mathrm{H}^{+}$

Select the correct option from the following
A. (a), (b) and (c)
B. (a), (c) and (d)
C. (a) and (d) only
D. (a) and (b) only

Ans. D
Sol. Disproportionation reactions are reactions in which the same species undergo for both oxidisation and reduction.

1. $2 \mathrm{Cu}^{+} \rightarrow \mathrm{Cu}^{2+}+\mathrm{Cu}^{0}$
(Disproportionation reaction) (+1) (+2) (0)
2. $3 \mathrm{MnO}^{2-}{ }_{4}+4 \mathrm{H}^{+} \rightarrow 2 \mathrm{MnO}_{4}^{-}+\mathrm{MnO}_{2}$
$+2 \mathrm{H}_{2} \mathrm{O}$ (Disproportionation reaction) $(+6)(+7)(+4)$
3. $2 \mathrm{KMnO}_{4} \xrightarrow{\Delta} \mathrm{~K}_{2} \mathrm{MnO}_{4}+\mathrm{MnO}_{2}+\mathrm{O}_{2}$ (Not Disproportionation reaction)
$(+7)(+6)(+4)$
4. $2 \mathrm{MnO}_{4}^{-}+3 \mathrm{Mn}^{2+}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow 5 \mathrm{MnO}_{2}+4 \mathrm{H}^{+}$
(Not Disproportionation reaction) $(+7)(+2)(+4)$
5. Which is the correct thermal stability order for $\mathrm{H}_{2} \mathrm{E}$ ( $\mathrm{E}=\mathrm{O}, \mathrm{S}, \mathrm{Se}, \mathrm{Te}$ and Po)?
A. $\mathrm{H}_{2} \mathrm{O}<\mathrm{H}_{2} \mathrm{~S}<\mathrm{H}_{2} \mathrm{Se}<\mathrm{H}_{2} \mathrm{Te}<\mathrm{H}_{2} \mathrm{Po}$
B. $\mathrm{H}_{2} \mathrm{Po}<\mathrm{H}_{2} \mathrm{Te}<\mathrm{H}_{2} \mathrm{Se}<\mathrm{H}_{2} \mathrm{~S}<\mathrm{H}_{2} \mathrm{O}$
C. $\mathrm{H}_{2} \mathrm{Se}<\mathrm{H}_{2} \mathrm{Te}<\mathrm{H}_{2} \mathrm{Po}<\mathrm{H}_{2} \mathrm{O}<\mathrm{H}_{2} \mathrm{~S}$
D. $\mathrm{H}_{2} \mathrm{~S}<\mathrm{H}_{2} \mathrm{O}<\mathrm{H}_{2} \mathrm{Se}<\mathrm{H}_{2} \mathrm{Te}<\mathrm{H}_{2} \mathrm{Po}$ Ans. B
Sol. On going down the group thermal stability order for $\mathrm{H}_{2} \mathrm{E}$ decreases because of $\mathrm{H}-\mathrm{E}$ bond energy decreases. $\mathrm{H}_{2} \mathrm{Po}<\mathrm{H}_{2} \mathrm{Te}<\mathrm{H}_{2} \mathrm{Se}<\mathrm{H}_{2} \mathrm{~S}<\mathrm{H}_{2} \mathrm{O}$
$100.4 d, 5 p, 5 f$ and $6 p$ orbitals are arranged in the order of decreasing energy. The correct option is
A. $6 p>5 f>5 p>4 d$
B. $6 p>5 f>4 d>5 p$
C. $5 f>6 p>4 d>5 p$
D. $5 f>6 p>5 p>4 d$

Ans. D
Sol. ( $\mathrm{n}+\mathrm{I}$ ) values for,
$4 d=4+2=6$
$5 p=5+1=6$
$5 f=5+3=8$
$6 p=6+1=7$
101. Which will make basic buffer?
A. 100 mL of $0.1 \mathrm{M} \mathrm{CH} 3 \mathrm{COOH}^{2}+100$ mL of 0.1 M NaOH
B. 100 mL of $0.1 \mathrm{M} \mathrm{HCl}+200 \mathrm{~mL}$ of
0.1 M NH 4 OH
C. 100 mL of $0.1 \mathrm{M} \mathrm{HCl}+100 \mathrm{~mL}$ of
0.1 M NaOH
D. 50 mL of $0.1 \mathrm{M} \mathrm{NaOH}+25 \mathrm{~mL}$ of $0.1 \mathrm{M} \mathrm{CH}_{3} \mathrm{COOH}$
Ans. B
Sol. 1. $\mathrm{CH}_{3} \mathrm{COOH}+\mathrm{NaOH} \mathrm{CH}_{3} \mathrm{COONa}+$ $\mathrm{H}_{2} \mathrm{O}$
Before 100 mL 100 mL 0

| x | 0.1 | M | x 0.1 | $M$ |
| :--- | :--- | :--- | :--- | :--- | $=10 \mathrm{mmol}=10 \mathrm{mmol}$ $\begin{array}{lllll}\text { After } 0 & 0 & 10 & m m o l\end{array}$ Hydrolysis of salt takes place. Not the buffer solution.


| 2. HCl | + | $\mathrm{NH}_{4} \mathrm{OH}$ | $\mathrm{NH}_{4} \mathrm{Cl}$ | + |
| :--- | :--- | :--- | :--- | :--- |
| $\mathrm{H}_{2} \mathrm{O}$ |  |  |  |  |
| Before | $100 \quad \mathrm{~mL}$ | 200 | mL | 0 |
| $\times$ | 0.1 | M | $\times 0.1$ | M |
| $=10$ | mmol | $=20$ | mmol |  |
| After 0 | 10 | mmol 10 | mmol |  |

3. $\mathrm{HCl}+\mathrm{NaOH} \mathrm{NaCl}+\mathrm{H}_{2} \mathrm{O}$ Before 100 mL 100 mL 0 $\begin{array}{lllll}\mathrm{x} & 0.1 & \mathrm{M} & \mathrm{x} 0.1 & \mathrm{M}\end{array}$ $=10 \mathrm{mmol}=10 \mathrm{mmol}$
After 00 mmol 10 mmol
Neutral solution
4. $\mathrm{CH}_{3} \mathrm{COOH}+\mathrm{NaOH} \quad \mathrm{CH}_{3} \mathrm{COONa}+$ $\mathrm{H}_{2} \mathrm{O}$ Before 25 mL 50 mL 0 $\begin{array}{lllll}\mathrm{x} & 0.1 & \mathrm{M} & x 0.1 & M\end{array}$ $=2.5 \mathrm{mmol}=5 \mathrm{mmol}$ After 02.5 mmol 2.5 mmol This is the basic solution due to NaOH This is not the buffer solution
102.For the second period elements the correct increasing order of first ionisation enthalpy is:
A. $\mathrm{Li}<\mathrm{B}<\mathrm{Be}<\mathrm{C}<\mathrm{O}<\mathrm{N}<\mathrm{F}<\mathrm{Ne}$
B. $\mathrm{Li}<\mathrm{B}<\mathrm{Be}<\mathrm{C}<\mathrm{N}<\mathrm{O}<\mathrm{F}<\mathrm{Ne}$
C. $\mathrm{Li}<\mathrm{Be}<\mathrm{B}<\mathrm{C}<\mathrm{O}<\mathrm{N}<\mathrm{F}<\mathrm{Ne}$
D. $\mathrm{Li}<\mathrm{Be}<\mathrm{B}<\mathrm{C}<\mathrm{N}<\mathrm{O}<\mathrm{F}<\mathrm{Ne}$ Ans. A
Sol. 'Be' and 'N' have comparatively more stable valence sub-shell than ' $B$ ' and ' ${ }^{\prime}$ '.
Correct order of first ionisation enthalpy
is: $\mathrm{Li}<\mathrm{B}<\mathrm{Be}<\mathrm{C}<\mathrm{O}<\mathrm{N}<\mathrm{F}<\mathrm{Ne}$
103.Identify the incorrect statement related to $\mathrm{PCl}_{5}$ from the following:
A. Two axial $\mathrm{P}-\mathrm{Cl}$ bonds make an angle of $180^{\circ}$ with each other B. Axial $\mathrm{P}-\mathrm{Cl}$ bonds are longer than equatorial $\mathrm{P}-\mathrm{Cl}$ bonds C. $\mathrm{PCl}_{5}$ molecule is non-reactive D. Three equatorial $\mathrm{P}-\mathrm{Cl}$ bonds make an angle of $120^{\circ}$ with each other Ans. C
Sol.

5. Which of the following diatomic molecular species has only $n$ bonds according to Molecular Orbital Theory?
A. $\mathrm{N}_{2}$
B. $\mathrm{C}_{2}$
C. $\mathrm{Be}_{2}$
D. $\mathrm{O}_{2}$

Ans. B
Sol. $\mathrm{C}_{2}$
$\sigma_{1 s}{ }^{2} \sigma_{1 s}{ }^{*} 2 \sigma_{2 s}{ }^{2} \sigma_{2 s}{ }^{*} 2 \pi_{2 p_{x}}^{2}=\pi_{2 p_{y}}^{2}$
105.The number of sigma ( $\sigma$ ) and pi ( $\quad$ )
bonds in pent-2-en-4-yne is
A. $8 \sigma$ bonds and $5 \pi$ bonds
B. $11 \sigma$ bonds and $2 \pi$ bonds
C. $13 \sigma$ bonds and no $n$ bonds
D. $10 \sigma$ bonds and $3 \pi$ bonds

Ans. D
Sol.

106.Among the following, the one that is not a green house gas is
A. Methane
B. Ozone
C. Sulphur dioxide
D. Nitrous oxide

Ans. C
Sol. $\mathrm{SO}_{2}$ is not a green house gas
107.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 = 100 J )
A. 5 Kj
B. 25 J
C. 30 J
D. -30 J

Ans. D
Sol. $W_{i r r}=-P_{e x t} \times \Delta V$
$=-2$ bar $\times(0.25-0.1) \mathrm{L}$
$=-2 \times 0.15 \mathrm{~L}$ bar
$=-0.30 \mathrm{Lbar}$
$=-0.30 \times 100 \mathrm{~J}$ (Because 1 L * bar
$=100$ joules)
$=-30 \mathrm{~J}$
108. Which one is malachite from the following?
A. $\mathrm{Cu}(\mathrm{OH})_{2}$
B. $\mathrm{Fe}_{3} \mathrm{O}_{4}$
C. $\mathrm{CuCO}_{3} \cdot \mathrm{Cu}(\mathrm{OH})_{2}$
D. $\mathrm{CuFeS}_{2}$

Ans. C
Sol. Malachite $\mathrm{CuCO}_{3} . \mathrm{Cu}(\mathrm{OH})_{2}$
109. The mixture that forms maximum boiling azeotrope is:
A. Ethanol + Water
B. Acetone + Carbon disulphide
C. Heptane + Octane
D. Water + Nitric acid

Ans. D
Sol. A solution that shows large negative deviation from Raoult's law forms a maximum boiling azeotrope at a specific composition. Water + Nitric acid forms the maximum boiling azeotrope.
110.The biodegradable polymer is:
A. Nylon-2-Nylon 6
B. Nylon-6
C. Buna-S
D. Nylon-6,6

Ans. A
Sol. Nylon-2-Nylon 6
111. Which of the following series of transitions in the spectrum of hydrogen atom fall in visible region?
A. Balmer series
B. Paschen series
C. Brackett series
D. Lyman series

Ans. A
Sol. In spectrum of Hydrogen atom , Balmer series transitions fall in visible region.
112.For an ideal solution, the correct option is :
A. $\Delta_{\text {mix }} V \neq 0$ at constant $T$ and $P$
B. $\Delta_{\text {mix }} \mathrm{H}=0$ at constant T and P
C. $\Delta_{\text {mix }} G=0$ at constant $T$ and $P$
D. $\Delta_{\text {mix }} S=0$ at constant $T$ and $P$

Ans. B
Sol. For ideal solution,
$\Delta_{m i x} H=0$
$\Delta_{m i x} S>0$
$\Delta_{m i x} G<0$
$\Delta_{m i x} V=0$
113. Which of the following is an amphoteric hydroxide?
A. $\mathrm{Ca}(\mathrm{OH})_{2}$
B. $\mathrm{Mg}(\mathrm{OH})_{2}$
C. $\mathrm{Be}(\mathrm{OH})_{2}$
D. $\mathrm{Sr}(\mathrm{OH})_{2}$

Ans. C
Sol. $\mathrm{Be}(\mathrm{OH})_{2}$ amphoteric in nature, since it can react both with acid and base
$\mathrm{Be}(\mathrm{OH})_{2}+2 \mathrm{HCl} \rightarrow \mathrm{BeCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}$
$\mathrm{Be}(\mathrm{OH})_{2}+2 \mathrm{NaOH} \rightarrow \mathrm{Na}_{2}\left[\mathrm{Be}(\mathrm{OH})_{4}\right]$
114.If the rate constant for a first order reaction is $k$, the time ( t ) required for the completion of $99 \%$ of the reaction is given by:
A. $t=6.909 / k$
B. $t=4.606 / k$
C. $\mathrm{t}=2.303 / \mathrm{k}$
D. $t=0.693 / k$

Ans. B
Sol. $k=\frac{2.303}{t} \log \frac{\left[A_{O}\right]}{[A]_{t}}$
for $99 \%$ completed reaction,
$k=\frac{2.303}{t} \log \frac{100}{1}$

$$
\begin{aligned}
& k=\frac{2.303}{t} \log 10^{2} \\
& k=\frac{2.303}{t} \times 2 \log 10
\end{aligned}
$$

$$
t=\frac{2.303}{k} \times 2
$$

$$
\mathrm{t}=4.606 / \mathrm{k}
$$

115. Conjugate base for Bronsted acids $\mathrm{H}_{2} \mathrm{O}$ and HF are :
A. $\mathrm{H}_{3} \mathrm{O}^{+}$and $\mathrm{F}^{-}$, respectively
B. $\mathrm{OH}^{-}$and $\mathrm{F}^{-}$, respectively
C. $\mathrm{H}_{3} \mathrm{O}^{+}$and $\mathrm{H}_{2} \mathrm{~F}^{+}$, respectively
D. $\mathrm{OH}^{-}$and $\mathrm{H}_{2} \mathrm{~F}^{+}$, respectively

Ans. B
Sol. $\mathrm{OH}^{-}$and $\mathrm{H}_{3} \mathrm{O}^{+}$are the conjugate base and conjugate acid resp. of $\mathrm{H}_{2} \mathrm{O}$.

116. The major product of the following reaction is:

A.

B.

C.

D.


Ans. A

Sol.






Phthalimide
117.The compound that is most difficult to protonate is :
A.

B.

C.

D.


Ans. C
Sol. Due to the involvement of lone pair of electrons in resonance in phenol, it will have a positive charge (partial), that's why incoming proton will not be able to attack easily.
118. For the chemical reaction $\mathrm{N}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g}) \rightleftharpoons 2 \mathrm{NH}_{3}(\mathrm{~g})$
The correct option is:
A. $-\frac{\mathrm{d}\left[\mathrm{N}_{2}\right]}{\mathrm{dt}}=2 \frac{\mathrm{~d}\left[\mathrm{NH}_{3}\right]}{\mathrm{dt}}$
B. $-\frac{\mathrm{d}\left[\mathrm{N}_{2}\right]}{\mathrm{dt}}=\frac{1}{2} \frac{\mathrm{~d}\left[\mathrm{NH}_{3}\right]}{\mathrm{dt}}$
C. $3 \frac{\mathrm{~d}\left[\mathrm{H}_{2}\right]}{\mathrm{dt}}=2 \frac{\mathrm{~d}\left[\mathrm{NH}_{3}\right]}{\mathrm{dt}}$
D. $-\frac{1}{3} \frac{\mathrm{~d}\left[\mathrm{H}_{2}\right]}{\mathrm{dt}}=-\frac{1}{2} \frac{\mathrm{~d}\left[\mathrm{NH}_{3}\right]}{\mathrm{dt}}$

Ans. B
Sol.

$$
\mathrm{N}_{2}+3 \mathrm{H}_{2} \leftrightharpoons 2 \mathrm{NH}_{3}
$$

Rate of reaction is given as
$-\frac{d\left[N_{2}\right]}{d t}=-\frac{1 d\left[H_{2}\right]}{3 d t}$
$=1 / 2 \times \frac{d\left[\mathrm{NH}_{3}\right]}{d t}$
119.In which case change in entropy is negative?
A. Expansion of a gas at constant temperature
B. Sublimation of solid to gas
C. $2 \mathrm{H}(\mathrm{g}) \rightarrow \mathrm{H}_{2}(\mathrm{~g})$
D. Evaporation of water

Ans. C
Sol. 1. Expansion of a gas at constant temperature $\Delta S>0$
2. Sublimation of solid to gas $\Delta S>0$
3. Evaporation of water $\Delta S>0$
4. $2 \mathrm{H}(\mathrm{g}) \rightarrow \mathrm{H}_{2}(\mathrm{~g}) \Delta S<0$
120.The correct order of the basic strength of methyl substituted amines in aqueous solution is:
A. $\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}>\mathrm{CH}_{3} \mathrm{NH}_{2}>\left(\mathrm{CH}_{3}\right)_{2} \mathrm{NH}$
B. $\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}>\left(\mathrm{CH}_{3}\right)_{2} \mathrm{NH}>\mathrm{CH}_{3} \mathrm{NH}_{2}$
C. $\mathrm{CH}_{3} \mathrm{NH}_{2}>\left(\mathrm{CH}_{3}\right)_{2} \mathrm{NH}>\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}$
D. $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{NH}>\mathrm{CH}_{3} \mathrm{NH}_{2}>\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}$

Ans. D
Sol. In aqueous solution, electrondonating inductive effect, solvation effect (H-bonding) and steric hindrance all together affect basic strength of substituted amines. Basic Character $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{NH}>\mathrm{CH}_{3} \mathrm{NH}_{2}>\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}$
121. For the cell reaction $2 \mathrm{Fe}^{3+}(\mathrm{aq})+2 \mathrm{I}^{-}(\mathrm{aq}) \rightarrow 2 \mathrm{Fe}^{2+}(\mathrm{aq})+\mathrm{I}_{2}(\mathrm{aq})$
$\mathrm{E}_{\text {cell }}^{\Theta}=0.24 \mathrm{Vt} 298 \mathrm{~K}$. The standard Gibbs Energy $\left(\Delta_{r} G^{\ominus}\right)$ of the cell reaction is:
[Given that Faraday constant $\mathrm{F}=$ $96500 \mathrm{C} \mathrm{mol}^{-1}$ ]
A. $-23.16 \mathrm{~kJ} \mathrm{~mol}^{-1}$
B. $46.32 \mathrm{~kJ} \mathrm{~mol}^{-1}$
C. $23.16 \mathrm{~kJ} \mathrm{~mol}^{-1}$
D. $-46.32 \mathrm{~kJ} \mathrm{~mol}^{-1}$

Ans. D
Sol.

$$
\begin{aligned}
\Delta G^{\Theta} & =-n F E_{\text {cell }}^{\Theta} \\
& =-2 \times 96500 \times 0.24 \mathrm{~J} \mathrm{~mol}^{-1} \\
& =-46320 \mathrm{~J} \mathrm{~mol}^{-1} \\
& =-46.32 \mathrm{KJ} \mathrm{~mol}^{-1}
\end{aligned}
$$

122.What is the correct electronic configuration of the central atom in $\mathrm{K}_{4}\left[\mathrm{Fe}(\mathrm{CN})_{6}\right]$ based on crystal field theory?
A. $\mathrm{t}_{2}^{6} \mathrm{e}_{9}^{0}$
B. $\mathrm{e}^{3} \mathrm{t}_{2}^{3}$
C. $e^{4} t_{2}^{2}$
D. $\mathrm{t}_{2}^{4} \mathrm{e}_{9}^{2}$

Ans. A

Sol. $\mathrm{K}_{4}\left[\mathrm{Fe}(\mathrm{CN})_{6}\right]$
Fe ground state : [Ar]3d ${ }^{6} 4 s^{2}$
$\mathrm{Fe}^{2+}$ : $[\mathrm{Ar}] 3 \mathrm{~d}^{6}$


In the presence of $\mathrm{CN}^{-}$strong field
123.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 :
A. $\mathrm{C}_{3} \mathrm{~A}_{2}$
B. $\mathrm{C}_{3} \mathrm{~A}_{4}$
C. $\mathrm{C}_{4 \mathrm{~A} 3}$
D. $\mathrm{C}_{2} \mathrm{~A}_{3}$

Ans. B
Sol. Anions A are in HCP, so number of anions are 6
Cations are in 75\% octahedral Voids, so no. of Cations are $=6 \times 3 / 4=4.5$ So formula will be $\mathrm{C}_{4.5} \mathrm{~A}_{6}$
$=\mathrm{C}_{9} \mathrm{~A}_{12}$
$=\mathrm{C}_{3} \mathrm{~A}_{4}$
124.The method used to remove temporary hardness of water is :
A. Clark's method
B. Ion-exchange method
C. Synthetic resins method
D. Calgon's method

Ans. A
Sol. Clark's method is used to remove temporary hardness of water, in which bicarbonates of calcium and magnesium are reacted with slaked line $\mathrm{Ca}(\mathrm{OH})_{2}$
125.The manganate and permanganate ions are tetrahedral, due to :
A. There is no $\pi$-bonding
B. The $п$ - bonding involves overlap of p-orbitals of oxygen with p orbitals of manganese
C. The $п$ - bonding involves overlap of d-orbitals of oxygen with dorbitals of manganese
D. The $п$ - bonding involves overlap of p-orbitals of oxygen with dorbitals of manganese
Ans. D
Sol. These ions are tetrahedral in shape and $\pi$ - bonding takes place by
overlap of p -orbitals of oxygen with d-orbitals of manganese.
126.Among the following, the reaction that proceeds through an electrophilic substitution, is:
A.

B.


C.

D.


Ans. A
Sol. Electrophilic
substitution
reactions are chemical reactions in which an electrophile displaces a functional group in a compound

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

| Column-I | Column-II |
| :--- | :--- |
| (a) $\mathrm{XeF}_{4}$ | (i) Pyramidal |
| (b) $\mathrm{XeF}_{6}$ | (ii) Square planar |
| (c) $\mathrm{XeOF}_{4}$ | (iii) Distorted octahedral |
| (d) $\mathrm{XeO}_{3}$ | (iv) Square pyramidal |

A. (a)- (ii) (b)- (iii) (c)- (iv) (d)- (i)
B. (a)- (ii) (b)- (iii) (c)- (i) (d)- (iv)
C. (a)- (iii) (b)- (iv) (c)- (i) (d)- (ii)
D. (a)- (i) (b)- (ii) (c)- (iii) (d)- (iv)

Ans. A
Sol. $\mathrm{XeF}_{4} \quad$-Square Planar XeF6- Distorted Octahedral $\mathrm{XeOF}_{4}$ - Square Pyramidal
$\mathrm{XeO}_{3}$ - Pyramidal
128. Which of the following is incorrect statement?
A. $\mathrm{SiCl}_{4}$ is easily hydrolysed
B. $\mathrm{GeX}_{4}(\mathrm{X}=\mathrm{F}, \mathrm{Cl}, \mathrm{Br}, \mathrm{I})$ is more stable than $\mathrm{GeX}_{2}$
C. $\mathrm{SnF}_{4}$ is ionic in nature
D. $\mathrm{PbF}_{4}$ is covalent in nature

Ans. D
Sol. $\mathrm{SnF}_{4}$ and $\mathrm{PbF}_{4}$ are ionic in nature
129.An alkene " A " on reaction with $\mathrm{O}_{3}$ and $\mathrm{Zn}-\mathrm{H}_{2} \mathrm{O}$ 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:
A.

B.

C.

D.


Ans. B
Sol.



(B)
130. Which mixture of the solutions will lead to the formation of negatively charged colloidal [Agl]l- sol ?
A. 50 mL of $1 \mathrm{M} \mathrm{AgNO}_{3}+50 \mathrm{~mL}$ of 2 M KI
B. 50 mL of $2 \mathrm{M} \mathrm{AgNO}_{3}+50 \mathrm{~mL}$ of
1.5 M KI
C. 50 mL of $0.1 \mathrm{M} \mathrm{AgNO}_{3}+50 \mathrm{~mL}$ of 0.1 M KI
D. 50 mL of $1 \mathrm{M} \mathrm{AgNO}_{3}+50 \mathrm{~mL}$ of 1.5 M KI

Ans. A
Sol. Charges present on the colloid is due to adsorption of common ion from dispersion medium. Millimole of KI is maximum in option (1) (50 $\times 2=$ 100) so act as solvent and anion Iis adsorbed by the colloid AgI formed $\mathrm{AgNO}_{3}+\mathrm{KI} \rightarrow \mathrm{AgI}+\mathrm{KNO}_{3}$
131.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. (a)- (ii) (b)- (iv) (c)- (i) (d)- (iii)
B. (a)- (iii) (b)- (iv) (c)- (ii) (d)- (i)
C. (a)- (iv) (b)- (iii) (c)- (ii) (d)- (i)
D. (a)- (i) (b)- (ii) (c)- (iii) (d)- (iv)

Ans. C
Sol. Pure nitrogen - Sodium azide or Barium azide Haber process Ammonia
Contact process- Sulphuric acid Deacon's process- Chlorine
132.Enzymes that utilize ATP in phosphate transfer require an alkaline earth metal (M) as the cofactor M is :
A. Mg
B. Ca
C. Sr
D. Be

Ans. A
Sol. Enzymes that utilize ATP in phosphate transfer require an alkaline earth metal (M) i.e. Magnesium (Mg) as the cofactor
133.Among the following, the narrow spectrum antibiotic is :
A. Ampicillin
B. Amoxycillin
C. Chloramphenicol
D. Penicillin G

Ans. D
Sol. Penicillin G
134. Which of the following species is not stable?
A. $\left[\mathrm{GeCl}_{6}\right]^{2-}$
B. $\left[\mathrm{Sn}(\mathrm{OH})_{6}\right]^{2-}$
C. $\left[\mathrm{SiCl}_{6}\right]^{2-}$
D. $\left[\mathrm{SiF}_{6}\right]^{2-}$

Ans. C
Sol. Ge , Sn , Si form these species $\left[\mathrm{GeCl}_{6}\right]^{2-},\left[\mathrm{Sn}(\mathrm{OH})_{6}\right]^{2-},\left[\mathrm{SiF}_{6}\right]^{2-}$ due to the presence of $d$ orbital Whereas Si will not form $\left[\mathrm{SiCl}_{6}\right]^{2-}$ because Si can accomodate maximum $4 \mathrm{Cl}^{-}$
135.pH of a saturated solution of $\mathrm{Ca}(\mathrm{OH})_{2}$ is 9 . The solubility product $\left(\mathrm{K}_{\mathrm{sp}}\right)$ of $\mathrm{Ca}(\mathrm{OH})_{2}$ is:
A. $0.25 \times 10^{-10}$
B. $0.125 \times 10^{-15}$
C. $0.5 \times 10^{-10}$
D. $0.5 \times 10^{-15}$

Ans. D
Sol. $\mathrm{Ca}(\mathrm{OH})_{2} \rightleftharpoons \mathrm{Ca}^{2+}+2 \mathrm{OH}^{-}$
$\mathrm{pH}=9$ Hence $\mathrm{pOH}=14-9=5=>$
$[\mathrm{OH}]^{-}=10^{-5} \mathrm{M}$
So, $[\mathrm{Ca}]^{2+}=10^{-5} / 2$
Thus, $\mathrm{K}_{\text {sp }}=\left[\mathrm{Ca}^{2+}\right]\left[\mathrm{OH}^{-}\right]^{2}$
$=\left(10^{-5} / 2\right)\left(10^{-5}\right)^{2}$
$=0.5 \times 10^{-15}$
136.A hollow metal sphere of radius $R$ is uniformly charged. The electric field due to the sphere at a distance $r$ from the centre
A. Zero as $r$ increases for $r<R$, decreases as $r$ increases for $r>R$
B. Zero as $r$ increases for $r<R$, increases as $r$ increases for $r>R$ C. Decreases as $r$ increases for $r<R$ and for $r>R$
D. Increases as $r$ increases for $r<R$ and for $r>R$
Ans. A
137.A force $F=20+10 y$ 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 $y=1 \mathrm{~m}$ is
A. 5 J
B. 25 J
C. 20 J
D. 30 J

Ans. B
138. 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 :

A. $9: 4$
B. 1:2
C. 2 : 1
D. $4: 9$

Ans. A
139.A soap bubble, having radius of 1 mm , is blown from a detergent solution having a surface tension of $2.5 \times 10^{-2} \mathrm{~N} / \mathrm{m}$. The pressure inside the bubble equals at a point $Z_{0}$ below the free surface of water in a container. Taking $g=10 \mathrm{~m} / \mathrm{s}^{2}$, density of water $=103 \mathrm{~kg} / \mathrm{m}^{3}$, the value of $Z_{0}$ is :
A. 10 cm
B. 1 cm
C. 0.5 cm
D. 100 cm

Ans. B
140. Which colour of the light has the longest wavelength?
A. Blue
B. Green
C. Violet
D. Red

Ans. D
141. 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 ?
A. 200 N
B. 250 N
C. 100 N
D. 150 N

Ans. C
142.A small hole of area of cross-section $2 \mathrm{~mm}^{2}$ is present near the bottom of a fully filled open tank of height 2 m . Taking $\mathrm{g}=10 \mathrm{~m} / \mathrm{s}^{2}$, the rate of flow of water through the open hole would be nearly
A. $8.9 \times 10^{-6} \mathrm{~m}^{3} / \mathrm{s}$
B. $2.23 \times 10^{-6} \mathrm{~m}^{3} / \mathrm{s}$
C. $6.4 \times 10^{-6} \mathrm{~m}^{3} / \mathrm{s}$
D. $12.6 \times 10^{-6} \mathrm{~m}^{3} / \mathrm{s}$

Ans. D
143. A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of $20 \mathrm{~cm} / \mathrm{s}$. How much work is needed to stop it?
A. 30 kJ
B. 2 J
C. 1 J
D. 3 J

Ans. D
144.Two similar thin equi-convex lenses, of focal length $f$ each, are kept coaxially in contact with each other such that the focal length of the
combination is $F_{1}$. When the space between the two lenses is filled with glycerine (which has the same refractive index ( $\mu=1.5$ ) as that of glass) then the equivalent focal length is $F_{2}$. The ratio $F_{1}: F_{2}$ will be :
A. $1: 2$
B. $2: 3$
C. $3: 4$
D. $2: 1$

Ans. A
145. In an experiment, the percentage of error occurred 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 $X=\frac{A^{2} B^{1 / 2}}{C^{1 / 3} D^{3}}$ will be
A. $16 \%$
B. $-10 \%$
C. $10 \%$
D. $\left(\frac{3}{13}\right) \%$

Ans. A
146.The unit of thermal conductivity is :
A. $\mathrm{J} \mathrm{m}^{-1} \mathrm{~K}^{-1}$
B. $\mathrm{W} \mathrm{m} \mathrm{K}^{-1}$
C. $\mathrm{W} \mathrm{m}^{-1} \mathrm{~K}^{-1}$
D. $\mathrm{J} \mathrm{m} \mathrm{K}^{-1}$

Ans. C
147.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:
A. 2 mgR
B. $\frac{1}{2} \mathrm{mgR}$
C. $\frac{3}{2} \mathrm{mgR}$
D. mgR

Ans. B
148. In which of the following processes, heat is neither absorbed nor released by a system?
A. Adiabatic
B. Isobaric
C. Isochoric
D. Isothermal

Ans. A
149.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 :
A. $\frac{9 \mathrm{~F}}{16}$
B. $\frac{16 \mathrm{~F}}{9}$
C. $\frac{4 \mathrm{~F}}{3}$
D. F

Ans. A
150.


The correct Boolean operation represented by the circuit diagram drawn is :
A. OR
B. NAND
C. NOR
D. AND

Ans. B
151. Which of the following acts as a circuit protection device?
A. Inductor
B. Switch
C. Fuse
D. Conductor

Ans. C
152.A copper rod of 88 cm and an aluminum rod of unknown length have their increase in length independent of increase in temperature. The length of aluminum rod is : $\left(a_{c u}=1.7 \times 10^{-5}\right.$ $\mathrm{K}^{-1}$ and $\left.\mathrm{a}_{\mathrm{Al}}=2.2 \times 10^{-5} \mathrm{~K}^{-1}\right)$
A. 113.9 cm
B. 88 cm
C. 68 cm
D. 6.8 cm

Ans. C
153.A parallel plate capacitor of capacitance $20 \mu \mathrm{~F}$ is being charged by a voltage source whose potential is changing at the rate of $3 \mathrm{~V} / \mathrm{s}$. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively.
A. $60 \mu \mathrm{~A}, 60 \mu \mathrm{~A}$
B. $60 \mu \mathrm{~A}$, zero
C. Zero, zero
D. Zero, $60 \mu \mathrm{~A}$

Ans. A
154.a-particle consists of :
A. 2 electrons, 2 protons and 2 neutrons
B. 2 electrons and 4 protons only
C. 2 protons only
D. 2 protons and 2 neutrons only

Ans. D
155.A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1 m . 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 ( $\mathrm{g}=10 \mathrm{~m} / \mathrm{s}^{2}$ )
A. $\frac{10}{2 \pi} \mathrm{rad} / \mathrm{s}$
B. $10 \mathrm{rad} / \mathrm{s}$
C. $10 \pi \mathrm{rad} / \mathrm{s}$
D. $\sqrt{10} \mathrm{rad} / \mathrm{s}$

Ans. B
156. Increase in temperature of a gas filled in a container would lead to:
A. Increase in its kinetic energy B. Decrease in its pressure C. Decrease in intermolecular distance
D. Increase in its mass

Ans. A
157.A 800 turn coil of effective area 0.05 $\mathrm{m}^{2}$ is kept perpendicular to a magnetic field $5 \times 10^{-5} \mathrm{~T}$. When the plane of the coil is rotated by $90^{\circ}$ around any of its coplanar axis in 0.1 $s$, the emf induced in the coil will be:
A. 0.2 V
B. $2 \times 10^{-3} \mathrm{~V}$
C. 0.02 V
D. 2 V

Ans. C
158. Two parallel infinite line charges with linear charge densities $+\lambda \mathrm{C} / \mathrm{m}$ and $\lambda \mathrm{C} / \mathrm{m}$ are placed at a distance of 2 R in free space. What is the electric field mid-way between the two line charges?
A. $\frac{2 \lambda}{\pi \varepsilon_{0} R} \mathrm{~N} / \mathrm{C}$
B. $\frac{\lambda}{\pi \varepsilon_{0} \mathrm{R}} \mathrm{N} / \mathrm{C}$
C. $\frac{\lambda}{2 \pi \varepsilon_{0} R} N / C$
D. zero

Ans. B
159. 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?
A. $0^{\circ}$
B. Equal to angle of incidence
C. $90^{\circ}$
D. $180^{\circ}$

Ans. C
160.An electron is accelerated through a potential difference of $10,000 \mathrm{~V}$. Its de Broglie wavelength is, (nearly) : $\left(\mathrm{m}_{\mathrm{e}}=9 \times 10^{-31} \mathrm{~kg}\right)$
A. $12.2 \times 10^{-12} \mathrm{~m}$
B. $12.2 \times 10^{-14} \mathrm{~m}$
C. 12.2 nm
D. $12.2 \times 10^{-13} \mathrm{~m}$

Ans. A
161. 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:
A.

B.

C.

D.


Ans. B
162. Pick the wrong answer in the context with rainbow.
A. The order of colours is reversed in the secondary rainbow
B. An observer can see a rainbow when his front is towards the sun C. Rainbow is a combined effect of dispersion refraction and reflection of sunlight
D. When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed Ans. B
163.The total energy of an electron in an atom in an orbit is -3.4 eV . Its kinetic and potential energies are, respectively:
A. $-3.4 \mathrm{eV},-6.8 \mathrm{eV}$
B. $3.4 \mathrm{eV},-6.8 \mathrm{eV}$
C. $3.4 \mathrm{eV}, 3.4 \mathrm{eV}$
D. $-3.4 \mathrm{eV},-3.4 \mathrm{eV}$

Ans. B
164.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 :
A. $\sqrt{A^{2}+B^{2}}$
B. $\sqrt{A_{0}^{2}+(A+B)^{2}}$
C. $A+B$
D. $A_{0}+\sqrt{A^{2}+B^{2}}$

Ans. A
165.For a p-type semiconductor, which of the following statements is true ?
A. Holes are the majority carriers and trivalent atoms are the dopants.
B. Holes are the majority carriers and pentavalent atoms are the dopants. C. Electrons are the majority carriers and pentavalent atoms are the dopants.
D. Electrons are the majority carriers and trivalent atoms are the dopants. Ans. A
166.In which of the following devices, the eddy current effect is not used?
A. Magnetic braking in train
B. Electromagnet
C. Electric heater
D. Induction furnace

Ans. C
167.The speed of a swimmer in still water is $20 \mathrm{~m} / \mathrm{s}$. The speed of river water is $10 \mathrm{~m} / \mathrm{s}$ 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 :
A. $0^{\circ}$
B. $60^{\circ}$ west
C. $45^{\circ}$ west
D. $30^{\circ}$ west

Ans. D
168. When a block of mass $M$ is suspended by a long wire of length $L$, the length of the wire becomes $(L+1)$. The elastic potential energy stored in the extended wire is :
A. MgL
B. $\frac{1}{2} \mathrm{Mgl}$
C. $\frac{1}{2} \mathrm{MgL}$
D. Mgl

Ans. B
169. In the circuits shown below, the readings of voltmeters and the ammeters will be

A. $V_{1}=V_{2}$ and $i_{1}>i_{2}$
B. $V_{1}=V_{2}$ and $i_{1}=i_{2}$
C. $V_{2}>V_{1}$ and $i_{1}>i_{2}$
D. $V_{2}>V_{1}$ and $i_{1}=i_{2}$

Ans. B
170.Body $A$ of mass $4 m$ moving with speed u collides with another body B of mass 2 m , 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 :
A. $\frac{8}{9}$
B. $\frac{4}{9}$
C. $\frac{5}{9}$
D. $\frac{1}{9}$

Ans. A
171.A particle moving with velocity $\overline{\mathrm{V}}$ is acted by three forces shown by the vector triangle PQR. The velocity of the particle will :

A. Decrease
B. Remain constant C. Change
according to the smallest force $\overline{\mathrm{QR}}$
D. Increase

Ans. B
172.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 :
A. $y(t)=4 \sin \left(\frac{\pi t}{2}\right)$, where $y$ in $m$
B. $y(t)=3 \cos \left(\frac{3 \pi t}{2}\right)$, where $y$ in $m$
C. $y(t)=3 \cos \left(\frac{\pi t}{2}\right)$, where $y$ in $m$
D. $y(t)=-3 \cos 2 \pi t$, where $y$ in $m$

Ans. C
173.A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm . The torque required to stop after $2 \pi$ revolutions is
A. $2 \times 10^{-3} \mathrm{~N} \mathrm{~m}$
B. $12 \times 10^{-4} \mathrm{~N} \mathrm{~m}$
C. $2 \times 10^{6} \mathrm{~N} \mathrm{~m}$
D. $2 \times 10^{-6} \mathrm{~N} \mathrm{~m}$

Ans. D
174.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:
A. $\mathrm{V}_{\mathrm{A}}: \mathrm{V}_{\mathrm{B}}$
B. $r_{B}: r_{A}$
C. $1: 1$
D. $r_{A}: r_{B}$

Ans. C
175.Ionized hydrogen atoms and aparticles with same momenta enters perpendicular to a constant magnetic field, $B$. The ratio of their radii of their paths $\mathrm{r}_{\mathrm{H}}$ : $\mathrm{ra}_{\mathrm{a}}$ will be :
A. $1: 2$
B. $4: 1$
C. 1: 4
D. $2: 1$

Ans. D
176.A mass $m$ is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when:
A. the wire is horizontal
B. the mass is at the lowest point
C. inclined at an angle of $60^{\circ}$ from vertical
D. the mass is at the highest point. Ans. B
177.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 $\operatorname{dip}, \delta=-25^{\circ}$. We can interpret that: A. A is located in the southern hemisphere and $B$ is located in the northern hemisphere.
B. $A$ is located in the northern hemisphere and $B$ is located in the southern hemisphere.
C. A and B are both located in the southern hemisphere.
D. A and B are both located in the northern hemisphere.
Ans. B
178.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 $0.2^{\circ}$. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water? ( $\mu_{\text {water }}=4 / 3$ )
A. $0.15^{\circ}$
B. $0.05^{\circ}$
C. $0.1^{\circ}$
D. $0.266^{\circ}$

Ans. A
179. When an object is shot from the bottom of a long smooth inclined plane kept at an angle $60^{\circ}$ with
horizontal, it can travel a distance $\mathrm{x}_{1}$ along the plane. But when the inclination is decreased to $30^{\circ}$ and the same object is shot with the same velocity, it can travel $\mathrm{X}_{2}$ distance.
Then $x_{1}: x_{2}$ will be:
A. $\sqrt{2}: 1$
B. $1: \sqrt{3}$
C. $1: 2 \sqrt{3}$
D. $1: \sqrt{2}$

Ans. B
180.Average velocity of a particle executing SHM in one complete vibration is :
A. $A \omega$
B. $\frac{\mathrm{A} \omega^{2}}{2}$
C. zero
D. $\frac{\mathrm{A} \omega}{2}$

Ans. C

