DATE : 13/09/2020

Test Booklet Code

E1

KANHA

Time : 3 hrs.

Answers & Solutions

for

NEET (UG) - 2020

Max. Marks : 720

Important Instructions :

1. The test is of **3 hours** duration and Test Booklet contains **180** questions. Each question carries **4** marks. For each correct response, the candidate will get **4** marks. For each incorrect response, **one mark** will be deducted from the total scores. The maximum marks are **720**.
2. Use **Blue / Black Ball point Pen only** for writing particulars on this page/marking responses.
3. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
4. On completion of the test, the candidate must handover the Answer Sheet to the Invigilator before leaving the Room / Hall. *The candidates are allowed to take away* this *Test Booklet with them*.
5. The CODE for this Booklet is **E1**.
6. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
7. Each candidate must show on demand his/her Admission Card to the Invigilator.
8. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.
9. Use of Electronic/Manual Calculator is prohibited.
10. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
11. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
12. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

1. Which of the following is **not** an attribute of a population?

(1) Sex ratio (2) Natality

(3) Mortality (4) Species interaction

Answer (4)

Sol. Natality – Population attribute

Mortality – Population attribute

Species interaction – Population interaction

Sex ratio – Population attribute

2. The process of growth is maximum during

(1) Log phase (2) Lag phase

(3) Senescence (4) Dormancy

Answer (1)

Sol. In exponential growth, the initial growth is slow (lag phase) and it increases rapidly thereafter at an exponential rate in log or exponential phase.

3. The roots that originate from the base of the stem are

(1) Fibrous roots (2) Primary roots

(3) Prop roots (4) Lateral roots

Answer (1)

Sol. The roots that originate from the base of the stem are fibrous roots.

4. Match the following diseases with the causative organism and select the **correct** option.

Column-I	Column-II
(a) Typhoid	(i) *Wuchereria*
(b) Pneumonia	(ii) *Plasmodium*
(c) Filariasis	(iii) *Salmonella*
(d) Malaria	(iv) *Haemophilus*

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

Answer (2)

Sol. Typhoid fever in humans is caused by pathogenic bacterium *Salmonella typhi*.

Pneumonia is caused by *Streptococcus Pneumoniae* and *Haemophilus influenzae*.

Filariasis or elephantiasis is caused by the filarial worm, *Wuchereria bancrofti* and *Wuchereria malayi*.

Malaria is caused by different species of *Plasmodium*.

5. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?

(1) ZIFT and IUT

(2) GIFT and ZIFT

(3) ICSI and ZIFT

(4) GIFT and ICSI

Answer (1)

Sol. Option (1) is the Answer because ART in which embryos are transferred, include ZIFT and IUT i.e. Zygote Intrafallopian Transfer and Intra Uterine Transfer respectively, both are embryo transfer (ET) methods.

Option (2), (3) and (4) are incorrect because in GIFT (Gamete Intrafallopian Transfer), gamete is transferred into the fallopian tube of female who cannot produce ova. ICSI is Intra cytoplasmic sperm injection in which sperm is directly injected into the ovum.

6. Identify the **wrong** statement with reference to the gene 'I' that controls ABO blood groups.

(1) The gene (I) has three alleles.

(2) A person will have only two of the three alleles.

(3) When I^A and I^B are present together, they express same type of sugar.

(4) Allele 'i' does not produce any sugar.

Answer (3)

Sol. ABO blood groups are controlled by the gene I. The gene I has three alleles I^A, I^B and i. The alleles I^A and I^B produce a slightly different form of the sugar while allele i does not produce any sugar. Because humans are diploid organisms, each person can possess at the most any two of the three I gene alleles.

7. Choose the **correct** pair from the following

(1) Ligases - Join the two DNA molecules

(2) Polymerases - Break the DNA into fragments

(3) Nucleases - Separate the two strands of DNA

(4) Exonucleases - Make cuts at specific positions within DNA

Answer (1)

Sol. Ligases join the two DNA molecules.

8. Select the **correct** match

(1) Haemophilia – Y linked

(2) Phenylketonuria – Autosomal dominant trait

(3) Sickle cell anaemia – Autosomal recessive trait, chromosome-11

(4) Thalassemia – X linked

Answer (3)

Sol. Phenylketonuria – Autosomal recessive disorder

Thalassemia – Autosomal recessive disorder

Haemophilia – X linked recessive disorder

Sickle cell anaemia – Autosomal recessive trait, caused due to mutation in gene present on chromosome no. 11

9. Match the following columns and select the **correct** option.

Column-I	Column-II
(a) Gregarious, polyphagous pest	(i) *Asterias*
(b) Adult with radial symmetry and larva with bilateral symmetry	(ii) Scorpion
(c) Book lungs	(iii) *Ctenoplana*
(d) Bioluminescence	(iv) *Locusta*

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

Answer (2)

Sol. (a) *Locusta* is a gregareous pest.

(b) In Echinoderms, adults are radially symmetrical but larvae are bilaterally symmetrical.

(c) Scorpions respire through book lungs.

(d) Bioluminescence is well marked in ctenophores.

10. The infectious stage of *Plasmodium* that enters the human body is

(1) Trophozoites

(2) Sporozoites

(3) Female gametocytes

(4) Male gametocytes

Answer (2)

Sol. *Plasmodium* enters the human body as sporozoites (Infectious stage) through the bite of Infected Female *Anopheles* mosquito.

11. Identify the substances having glycosidic bond and peptide bond, respectively in their structure

(1) Chitin, cholesterol

(2) Glycerol, trypsin

(3) Cellulose, lecithin

(4) Inulin, insulin

Answer (4)

Sol. Inulin is a fructan (polysaccharide of fructose). Adjacent fructose units are linked through glycosidic bond.

Insulin is a protein composed of 51 aminoacids. Adjacent aminoacids are attached through peptide bond.

12. The plant parts which consist of two generations - one within the other

(a) Pollen grains inside the anther

(b) Germinated pollen grain with two male gametes

(c) Seed inside the fruit

(d) Embryo sac inside the ovule

(1) (a) only (2) (a), (b) and (c)

(3) (c) and (d) (4) (a) and (d)

Answer (4)

Sol. The plant parts which consist of two generations one within the other are pollen grains inside the anther and embryo sac inside the ovule.

Pollen grain is haploid inside the diploid anther.

Embryo sac is haploid inside the diploid ovule.

13. The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants is/are

(1) Ammonia alone

(2) Nitrate alone

(3) Ammonia and oxygen

(4) Ammonia and hydrogen

Answer (4)

Sol. $N_2 + 8e^- + 8H^+ + 16ATP \xrightarrow{Mg^{++}} 2NH_3 + H_2 + 16ADP + 16Pi$

Ammonia and Hydrogen.

14. Identify the correct statement with regard to G_1 phase (Gap 1) of interphase.

(1) DNA synthesis or replication takes place.

(2) Reorganisation of all cell components takes place.

(3) Cell is metabolically active, grows but does not replicate its DNA.

(4) Nuclear Division takes place.

Answer (3)

Sol. During G_1 phase the cell is metabolically active and continuously grows but does not replicate its DNA.

DNA synthesis takes place in S phase. Nuclear division occurs during Karyokinesis.

Reorganisation of all cell components takes place in M-Phase.

15. Cuboidal epithelium with brush border of microvilli is found in

(1) Lining of intestine

(2) Ducts of salivary gland

(3) Proximal convoluted tubule of nephron

(4) Eustachian tube

Answer (3)

Sol. Cuboidal epithelium with brush border of microvilli is found in proximal convoluted tubule of nephron (PCT).

16. Which of the following statements about inclusion bodies is **incorrect**?

(1) They are not bound by any membrane

(2) These are involved in ingestion of food particles

(3) They lie free in the cytoplasm

(4) These represent reserve material in cytoplasm

Answer (2)

Sol. These are not involved in ingestion of food particles

17. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?

(1) Endoplasmic reticulum

(2) Peroxisomes

(3) Golgi bodies

(4) Polysomes

Answer (3)

Sol. Golgi bodies are site of formation of glycoproteins and glycolipids in eukaryotic cells.

18. In gel electrophoresis, separated DNA fragments can be visualized with the help of

(1) Acetocarmine in bright blue light

(2) Ethidium bromide in UV radiation

(3) Acetocarmine in UV radiation

(4) Ethidium bromide in infrared radiation

Answer (2)

Sol. The separated DNA fragments can be visualised only after staining the DNA with Ethidium bromide followed by exposure to UV radiation.

19. Identify the **wrong** statement with reference to transport of oxygen

(1) Binding of oxygen with haemoglobin is mainly related to partial pressure of O_2

(2) Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin

(3) Higher H^+ conc. in alveoli favours the formation of oxyhaemoglobin

(4) Low pCO_2 in alveoli favours the formation of oxyhaemoglobin

Answer (3)

Sol. The correct option is (3) because higher H^+ concentration favours the dissociation of oxygen from oxyhaemoglobin in tissues.

In the alveoli, high pO_2, low pCO_2, lesser H^+ concentration and lower temperature favour formation of oxyhaemoglobin.

20. Ray florets have

(1) Inferior ovary

(2) Superior ovary

(3) Hypogynous ovary

(4) Half inferior ovary

Answer (1)

Sol.
- Ray floret have inferior ovary.
- Epigynous flower are formed in family Asteraceae (e.g., Sunflower)

21. The specific palindromic sequence which is recognized by EcoRI is

(1) 5′ - GAATTC - 3′
3′ - CTTAAG - 5′

(2) 5′ - GGAACC - 3′
3′ - CCTTGG - 5′

(3) 5′ - CTTAAG - 3′
3′ - GAATTC - 5′

(4) 5′ - GGATCC - 3′
3′ - CCTAGG - 5′

Answer (1)

Sol. The correct option is (1) because the specific palindromic sequence which is recognised by *Eco*RI is

5′ - GAATTC - 3′

3′ - CTTAAG - 5′

22. Identify the **wrong** statement with regard to Restriction Enzymes.

(1) Each restriction enzyme functions by inspecting the length of a DNA sequence.

(2) They cut the strand of DNA at palindromic sites.

(3) They are useful in genetic engineering.

(4) Sticky ends can be joined by using DNA ligases.

Answer (4)

Sol. Restriction endonucleases make cuts at specific positions within the DNA.

They function by inspecting the length of a DNA sequence.

Restriction endonuclease bind to the DNA and cut the two strands of double helix at specific points in their sugar-phosphate backbones.

They are used in genetic engineering to form recombinant molecules of DNA.

DNA ligases join the DNA fragments.

23. Which of the following is put into Anaerobic sludge digester for further sewage treatment?

(1) Primary sludge

(2) Floating debris

(3) Effluents of primary treatment

(4) Activated sludge

Answer (4)

Sol. The sediment in settlement tank is called activated sludge.

A small part of the activated sludge is pumped back into aeration tank

Remaining major part of the sludge is pumped into large tank called anaerobic sludge digesters.

24. Select the **correct** events that occur during inspiration.

(a) Contraction of diaphragm

(b) Contraction of external inter-costal muscles

(c) Pulmonary volume decreases

(d) Intra pulmonary pressure increases

(1) (a) and (b)

(2) (c) and (d)

(3) (a), (b) and (d)

(4) only (d)

Answer (1)

Sol. Inspiration is initiated by the contraction of diaphragm, which increases the volume of thoracic chamber in the anterio-posterior axis.

The contraction of external intercostal muscles increase the volume of the thoracic chamber in the dorsoventral axis.

25. If the head of cockroach is removed, it may live for few days because

(1) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.

(2) the cockroach does not have nervous system.

(3) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

(4) the head holds a 1/3rd of a nervous system while the rest is situated along the dorsal part of its body.

Answer (3)

Sol. The head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

26. Which of the following statements are **true** for the phylum-Chordata?

(a) In Urochordata notochord extends from head to tail and it is present throughout their life.

(b) In Vertebrata notochord is present during the embryonic period only.

(c) Central nervous system is dorsal and hollow.

(d) Chordata is divided into 3 subphyla : Hemichordata, Tunicata and Cephalochordata.

(1) (d) and (c) (2) (c) and (a)

(3) (a) and (b) (4) (b) and (c)

Answer (4)

Sol. In vertebrata, notochord is present during embryonic period only as it is replaced by vertebral column.

In chordates, central nervous system is dorsal and hollow.

27. Match the organism with its use in biotechnology.

(a) *Bacillus thuringiensis*	(i) Cloning vector
(b) *Thermus aquaticus*	(ii) Construction of first rDNA molecule
(c) *Agrobacterium tumefaciens*	(iii) DNA polymerase
(d) *Salmonella typhimurium*	(iv) Cry proteins

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

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

Answer (2)

Sol. (a) *Bacillus thuringiensis* is a source of Cry-proteins.

(b) *Thermus aquaticus* is a source of thermostable DNA polymerase (Taq polymerase) used in PCR.

(c) *Agrobacterium tumefaciens* is a cloning vector.

(d) The construction of 1st recombinant DNA molecule was performed using native plasmid of *Salmonella typhimurium*.

28. Match the following concerning essential elements and their functions in plants

(a) Iron	(i) Photolysis of water
(b) Zinc	(ii) Pollen germination
(c) Boron	(iii) Required for chlorophyll biosynthesis
(d) Manganese	(iv) IAA biosynthesis

Select the **correct** option

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

Answer (3)

Sol. (a) Iron – Essential for the formation of chlorophyll

(b) Zinc – Needed for synthesis of auxin

(c) Boron – Have a role in pollen grain germination

(d) Manganese – Is involved in the splitting of water to liberate O_2 during photosynthesis

29. Identify the **incorrect** statement.

(1) Heart wood does not conduct water but gives mechanical support

(2) Sapwood is involved in conduction of water and minerals from root to leaf

(3) Sapwood is the innermost secondary xylem and is lighter in colour

(4) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour

Answer (3)

Sol. **Incorrect statement:** Sapwood is the innermost secondary xylem and is lighter in colour.

Correct statement: Sapwood is outermost secondary xylem.

30. Match the following

(a)	Inhibitor of catalytic activity	(i)	Ricin
(b)	Possess peptide bonds	(ii)	Malonate
(c)	Cell wall material in fungi	(iii)	Chitin
(d)	Secondary metabolite	(iv)	Collagen

Choose the **correct** option from the following

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

Answer (1)

Sol. Option (1) is the correct Answer because Malonate is the competitive inhibitor of catalytic activity of succinic dehydrogenase, so (a) matches with (ii) in column II.

Collagen is proteinaceous in nature and possesses peptide bonds, so (b) matches with (iv) in column II.

Chitin is a homopolymer present in the cell wall of fungi and exoskeleton of arthropods, so, (c) matches with (iii) in column II.

Abrin and Ricin are toxins, secondary metabolites, so (d) in column I matches with (i) in column II.

31. Meiotic division of the secondary oocyte is completed

(a) In Ur

(1) Prior to ovulation

(2) At the time of copulation

(3) After zygote formation

(4) At the time of fusion of a sperm with an ovum

Answer (4)

Sol. Meiotic division of secondary oocyte is completed after the entry of sperm in secondary oocyte which lead to the formation of a large ovum and a tiny IInd polar body.

32. According to Robert May, the global species diversity is about

(1) 1.5 million (2) 20 million

(3) 50 million (4) 7 million

Answer (4)

Sol.
- Robert May estimated global species diversity at about 7 million.
- Although some extreme estimates range from 20 to 50 million.

33. The first phase of translation is

(1) Binding of mRNA to ribosome

(2) Recognition of DNA molecule

(3) Aminoacylation of tRNA

(4) Recognition of an anti-codon

Answer (3)

Sol. The first phase of translation involves activation of amino acid in the presence of ATP and linked to their cognate tRNA - a process commonly called as charging of tRNA or aminoacylation of tRNA.

34. Which of the following regions of the globe exhibits highest species diversity?

(1) Western Ghats of India

(2) Madagascar

(3) Himalayas

(4) Amazon forests

Answer (4)

Sol. The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth.

35. Which of the following statements is not correct?

(1) In man insulin is synthesised as a proinsulin

(2) The proinsulin has an extra peptide called C-peptide.

(3) The functional insulin has A and B chains linked together by hydrogen bonds.

(4) Genetically engineered insulin is produced in *E.Coli.*

Answer (3)

Sol. The correct option is (3) because functional insulin has A and B chains linked together by disulphide bridges.

36. The transverse section of a plant shows following anatomical features :

(a) Large number of scattered vascular bundles surrounded by bundle sheath

(b) Large conspicuous parenchymatous ground tissue

(c) Vascular bundles conjoint and closed

(d) Phloem parenchyma absent

Identify the category of plant and its part :

(1) Monocotyledonous stem

(2) Monocotyledonous root

(3) Dicotyledonous stem

(4) Dicotyledonous root

Answer (1)

Sol. All features are related to monocotyledonous stems

37. Match the following columns and select the correct option.

	Column-I		Column-II
(a)	6-15 pairs of gill slits	(i)	*Trygon*
(b)	Heterocercal caudal fin	(ii)	Cyclostomes
(c)	Air Bladder	(iii)	Chondrichthyes
(d)	Poison sting	(iv)	Osteichthyes

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

Answer (1)

Sol. Cyclostomes have an elongated body bearing 6-15 pairs of gill slits for respiration, so (a) matches with (ii) in column-II.

Air bladder is present in bony fishes belonging to class Osteichthyes which regulates buoyancy, so (c) matches with (iv) in column-II.

Trygon, a cartilaginous fish, possesses poison sting, so, (d) matches with (i) in column-II.

Heterocercal caudal fin is present in members of class Chondrichthyes, so (b) in column-I matches with (iii) in column-II

38. From his experiments, S.L. Miller produced amino acids by mixing the following in a closed flask

(1) CH_4, H_2, NH_3 and water vapor at 800°C

(2) CH_3, H_2, NH_4 and water vapor at 800°C

(3) CH_4, H_2, NH_3 and water vapor at 600°C

(4) CH_3, H_2, NH_3 and water vapor at 600°C

Answer (1)

Sol. In 1953, S.L. Miller, an American scientist created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapor at 800°C.

39. Embryological support for evolution was disapproved by

(1) Karl Ernst von Baer

(2) Alfred Wallace

(3) Charles Darwin

(4) Oparin

Answer (1)

Sol. Embryological support for evolution was disapproved by Karl Ernst von Baer, he noted that embryos never pass through the adult stages of other animals during embryonic development.

40. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is

(1) Transpiration (2) Root pressure

(3) Imbibition (4) Plasmolysis

Answer (2)

Sol.
- Root pressure is positive hydrostatic pressure.
- It develops in tracheary element at night and in early morning.

41. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their

(1) Nutritive value

(2) Growth response

(3) Defence action

(4) Effect on reproduction

Answer (3)

Sol.: A wide variety of chemical substances that we extract from plants on a commercial scale (nicotine, caffeine, quinine, strychnine, opium, etc) are produced by them (plants) as defences against grazers and browsers.

42. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of

(1) 2 molecules of 3-C compound

(2) 1 molecule of 3-C compound

(3) 1 molecule of 6-C compound

(4) 1 molecule of 4-C compound and 1 molecule of 2-C compound

Answer (2)

Sol. In photorespiration, O_2 binds to RubisCo. As a result RuBP instead to being converted to 2 molecules of PGA bind with O_2 to form one molecule each of phosphoglycerate (3 carbon compound) and phosphoglycolate (2 carbon compound).

43. Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to

(1) Insect pests (2) Fungal diseases

(3) Plant nematodes (4) Insect predators

Answer (1)

Sol. Bt cotton is resistant to cotton bollworm (Insect pest).

cry I Ac and *cry* II Ab genes have been introduced in cotton to protect it from cotton bollworm. This makes Bt cotton as biopesticide.

44. Which of the following refer to **correct** example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

(a) Darwin's Finches of Galapagos islands.

(b) Herbicide resistant weeds.

(c) Drug resistant eukaryotes.

(d) Man-created breeds of domesticated animals like dogs.

(1) only (a) (2) (a) and (c)

(3) (b), (c) and (d) (4) only (d)

Answer (3)

Sol. The correct option is (3) because :

- Herbicide resistant weeds, drug resistant eukaryotes and man-created breeds of domesticated animals like dogs are examples of evolution by anthropogenic action.
- Darwin's Finches of Galapagos islands are example of natural selection, adaptive radiation and founder's effect.

45. Identify the **wrong** statement with reference to immunity.

(1) When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".

(2) When ready-made antibodies are directly given, it is called "Passive immunity".

(3) Active immunity is quick and gives full response.

(4) Foetus receives some antibodies from mother, it is an example for passive immunity.

Answer (3)

Sol. The correct option is (3) because active immunity is slow and takes time to give its full effective response in comparison to passive immunity where pre-formed antibodies are administered.

46. By which method was a new breed 'Hisardale' of sheep formed by using Bikaneri ewes and Marino rams?

(1) Out crossing (2) Mutational breeding

(3) Cross breeding (4) Inbreeding

Answer (3)

Sol. Hisardale is a new breed of sheep developed in Punjab by crossing **Bikaneri-ewe** and **Marino rams**. In cross-breeding, superior male of one breed are mated with superior females of another breed.

47. Identify the correct statement with reference to human digestive system.

(1) Ileum opens into small intestine

(2) Serosa is the innermost layer of the alimentary canal

(3) Ileum is a highly coiled part

(4) Vermiform appendix arises from duodenum

Answer (3)

Sol. Option (3) is correct as ileum is a highly coiled tube. Serosa is the outermost layer of the alimentary canal, thus, option (2) is an incorrect statement.

A narrow finger-like tubular projection, the vermiform appendix arises from caecum part of large intestine thus, option (4) is incorrect statement. Ileum opens into the large intestine, thus option (1) is also an incorrect statement.

48. Match the following columns and select the correct option.

Column-I	Column-II
(a) *Clostridium butylicum*	(i) Cyclosporin-A
(b) *Trichoderma polysporum*	(ii) Butyric Acid
(c) *Monascus purpureus*	(iii) Citric Acid
(d) *Aspergillus niger*	(iv) Blood cholesterol lowering agent

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

Answer (2)

Sol.

Column-I	Column-II
(a) *Clostridium butylicum*	(ii) Butyric acid
(b) *Trichoderma polysporum*	(i) Cyclosporin-A
(c) *Monascus purpureus*	(iv) Blood cholesterol lowering agent
(d) *Aspergillus niger*	(iii) Citric acid

49. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus?

(1) Uremia and Ketonuria

(2) Uremia and Renal Calculi

(3) Ketonuria and Glycosuria

(4) Renal calculi and Hyperglycaemia

Answer (3)

Sol. Presence of Ketone bodies in urine (Ketonuria) and presence of glucose in urine (Glycosuria) are indicative of Diabetes mellitus.

50. Floridean starch has structure similar to

(1) Starch and cellulose

(2) Amylopectin and glycogen

(3) Mannitol and algin

(4) Laminarin and cellulose

Answer (2)

Sol. Floridean starch is stored food material in red algae. It's structure is similar to Amylopectin and Glycogen.

51. Select the option including all sexually transmitted diseases.

(1) Gonorrhoea, Syphilis, Genital herpes

(2) Gonorrhoea, Malaria, Genital herpes

(3) AIDS, Malaria, Filaria

(4) Cancer, AIDS, Syphilis

Answer (1)

Sol. Gonorrhoea, Syphilis, Genital herpes are sexually transmitted diseases.

Gonorrhoea is caused by a bacterium *Neisseria gonorrhoeae*.

Syphilis is caused by a bacterium *Treponema pallidum*.

Genital herpes is caused by a virus Type-II-Herpes simplex virus.

52. Match the following with respect to meiosis

(a) Zygotene	(i) Terminalization
(b) Pachytene	(ii) Chiasmata
(c) Diplotene	(iii) Crossing over
(d) Diakinesis	(iv) Synapsis

Select the correct option from the following

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

Answer (2)

Sol. Zygotene $\rightarrow$ Synapsis

Pachytene $\rightarrow$ Crossing over

Diplotene $\rightarrow$ Chiasmata formation

Diakinesis $\rightarrow$ Terminalisation

53. Which of the following pairs is of unicellular algae?

(1) *Laminaria* and *Sargassum*

(2) *Gelidium* and *Gracilaria*

(3) *Anabaena* and *Volvox*

(4) *Chlorella* and *Spirulina*

Answer (4)

Sol. *Chlorella* and *Spirulina* are unicellular algae.

Gelidium, *Gracilaria*, *Laminaria* and *Sargassum* are multicellular. *Volvox* is colonial.

54. Which of the following hormone levels will cause release of ovum (ovulation) from the graffian follicle?

(1) High concentration of Estrogen

(2) High concentration of Progesterone

(3) Low concentration of LH

(4) Low concentration of FSH

Answer (1)

Sol.
- High level of estrogen will send positive feedback to anterior pituitary for release of LH.
- FSH, LH and estrogen are at peak level during mid of menstrual cycle (28 day cycle).
- LH surge leads to ovulation.

55. Match the following columns and select the correct option.

	Column-I		Column-II
(a)	Bt cotton	(i)	Gene therapy
(b)	Adenosine deaminase deficiency	(ii)	Cellular defence
(c)	RNAi	(iii)	Detection of HIV infection
(d)	PCR	(iv)	*Bacillus thuringiensis*

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

Answer (1)

Sol. The correct option is (1) because

(a) In Bt cotton the specific Bt toxin gene was isolated from *Bacillus thuringiensis*.

(b) The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.

(c) RNAi (RNA interference) takes place in all eukaryotic organisms as a method of cellular defense.

(d) PCR is now routinely used to detect HIV in suspected AIDS patients.

56. Montreal protocol was signed in 1987 for control of

(1) Transport of Genetically modified organisms from one country to another

(2) Emission of ozone depleting substances

(3) Release of Green House gases

(4) Disposal of e-wastes

Answer (2)

Sol. Montreal protocol – Signed in 16 Sep, 1987 (Ozone day)

Came into force – 1 Jan, 1989.

It was aimed at stopping the production and import of ODS and reduce their concentration in the atmosphere.

57. Which of the following is correct about viroids?

(1) They have RNA with protein coat

(2) They have free RNA without protein coat

(3) They have DNA with protein coat

(4) They have free DNA without protein coat

Answer (2)

Sol. Viroids have free RNA without protein coat.

58. The ovary is half inferior in :

(1) Brinjal (2) Mustard

(3) Sunflower (4) Plum

Answer (4)

Sol. The ovary is half inferior in Plum.

59. The enzyme enterokinase helps in conversion of

(1) protein into polypeptides

(2) trypsinogen into trypsin

(3) caseinogen into casein

(4) pepsinogen into pepsin

Answer (2)

Sol. The correct option is (2) because trypsinogen is activated by an enzyme, enterokinase, secreted by the intestinal mucosa into active trypsin. Trypsinogen is a zymogen from pancreas.

60. Match the trophic levels with their correct species examples in grassland ecosystem.

(a)	Fourth trophic level	(i)	Crow
(b)	Second trophic level	(ii)	Vulture
(c)	First trophic level	(iii)	Rabbit
(d)	Third trophic level	(iv)	Grass

Select the correct option

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

Answer (1)

Sol. Grassland ecosystem is a terrestrial ecosystem. It includes various trophic levels

First trophic level (T_1) – Grass

Second trophic level (T_2) – Rabbit

Third trophic level (T_3) – Crow

Fourth trophic level (T_4) – Vulture

61. How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?

(1) 4 (2) 2

(3) 14 (4) 8

Answer (3)

Sol. Mendel selected 14 True breeding plant varieties.

62. Match the following columns and select the correct option.

	Column-I		Column-II
(a)	Organ of Corti	(i)	Connects middle ear and pharynx
(b)	Cochlea	(ii)	Coiled part of the labyrinth
(c)	Eustachian tube	(iii)	Attached to the oval window
(d)	Stapes	(iv)	Located on the basilar membrane

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

Answer (3)

Sol.
- Option (3) is correct because organ of Corti is located on the Basilar membrane, thus (a) in column-I matches with (iv) in column-II.
- The coiled portion of the labyrinth is called cochlea, so (b) matches with (ii) in column II.
- The eustachian tube connects the middle ear cavity with the pharynx, thus (c) matches with (i) in column-II.
- The middle ear contains ossicle called Stapes that is attached to the oval window of the cochlea, so (d) matches with (iii) in column II.

63. In water hyacinth and water lily, pollination takes place by :

(1) Insects or wind

(2) Water currents only

(3) Wind and water

(4) Insects and water

Answer (1)

Sol. In majority of aquatic plants, the flowers emerge above the level of water.

These may be pollinated by insects or wind

eg.: Water hyacinth and water lily

64. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

(1) Cytokinin (2) Gibberellin

(3) Ethylene (4) Abscisic acid

Answer (2)

Sol. Spraying sugarcane crop with gibberellins increases the length of the stem, thus increasing the yield by as much as 20 tonnes per acre.

65. In light reaction, plastoquinone facilitates the transfer of electrons from

(1) PS-II to $Cytb_6f$ complex

(2) $Cytb_6f$ complex to PS-I

(3) PS-I to $NADP^+$

(4) PS-I to ATP synthase

Answer (1)

Sol. After excitement, e^- is passed from PS-II (P_{680}) to primary electron acceptor (Pheophytin). From primary e^- acceptor, e^- is passed to plastoquinone. Plastoquinone (PQ) in turn transfer its e^- to Cyt b_6f complex. Therefore plastoquinone facilitates the transfer of electrons from PS-II to Cyt b_6f complex.

66. Which of the following is **not** an inhibitory substance governing seed dormancy?

(1) Gibberellic acid (2) Abscisic acid

(3) Phenolic acid (4) Para-ascorbic acid

Answer (1)

Sol.
- Gibberellic acid break seed dormancy.
- It activate synthesis of α-amylase which breakdown starch into simple sugar.

67. Name the enzyme that facilitates opening of DNA helix during transcription.

(1) DNA ligase (2) DNA helicase

(3) DNA polymerase (4) RNA polymerase

Answer (4)

Sol. RNA polymerase facilitates opening of DNA helix during transcription.

68. Which of the following would help in prevention of diuresis?

(1) More water reabsorption due to undersecretion of ADH

(2) Reabsorption of Na^+ and water from renal tubules due to aldosterone

(3) Atrial natriuretic factor causes vasoconstriction

(4) Decrease in secretion of renin by JG cells

Answer (2)

Sol. Adrenal cortex secretes mineralocorticoids like aldosterone which increase the reabsorption of Na^+ and water from renal tubule that prevent diuresis.

69. In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?

(1) Gross primary productivity is always less than net primary productivity

(2) Gross primary productivity is always more than net primary productivity

(3) Gross primary productivity and Net primary productivity are one and same

(4) There is no relationship between Gross primary productivity and Net primary productivity

Answer (2)

Sol. Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.

Net primary productivity is GPP-respiration

Hence gross primary productivity is always more than NPP

70. Match the following columns and select the correct option.

Column-I	Column-II
(a) Placenta	(i) Androgens
(b) Zona pellucida	(ii) Human Chorionic Gonadotropin (hCG)
(c) Bulbo-urethral glands	(iii) Layer of the ovum
(d) Leydig cells	(iv) Lubrication of the Penis

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

Answer (4)

Sol. The correct option is (4) becuase

(a) Placenta secretes human chorionic gonadotropin (hCG)

(b) Zona pellucida is a primary egg membrane secreted by the secondary oocyte

(c) The secretions of bulbourethral glands help in lubrication of the penis

(d) Leydig cells synthesise and secrete testicular hormones called androgens

71. Strobili or cones are found in

(1) *Salvinia* (2) *Pteris*

(3) *Marchantia* (4) *Equisetum*

Answer (4)

Sol. Strobili or cones are found in *Equisetum*.

72. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G_0). This process occurs at the end of

(1) M phase (2) G_1 phase

(3) S phase (4) G_2 phase

Answer (1)

Sol. Some dividing cells exit the cell cycle and enter vegetative inactive stage, called quiescent stage (G_0). This process occurs at the end of M-phase and beginning of G_1 phase.

73. Flippers of Penguins and Dolphins are examples of

(1) Adaptive radiation

(2) Convergent evolution

(3) Industrial melanism

(4) Natural selection

Answer (2)

Sol. The correct option is (2) because flippers of Penguins and Dolphins are an example of analogous organs. Analogous structures are a result of convergent evolution.

74. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^9 bp, then the length of the DNA is approximately

(1) 2.0 meters

(2) 2.5 meters

(3) 2.2 meters

(4) 2.7 meters

Answer (3)

Sol. Length of DNA = $[0.34 \times 10^{-9}]$m $\times 6.6 \times 10^9$ bp

= 2.2 m

Distance between 2 base pair in DNA helix

= 0.34 nm = 0.34×10^{-9} m

Total number of base pair = 6.6×10^9 bp

75. The QRS complex in a standard ECG represents

(1) Repolarisation of auricles

(2) Depolarisation of auricles

(3) Depolarisation of ventricles

(4) Repolarisation of ventricles

Answer (3)

Sol. QRS complex represents the depolarisation of ventricles.

76. Match the following columns and select the correct option.

Column - I	Column - II
(a) Eosinophils	(i) Immune response
(b) Basophils	(ii) Phagocytosis
(c) Neutrophils	(iii) Release histaminase, destructive enzymes
(d) Lymphocytes	(iv) Release granules containing histamine

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

Answer (1)

Sol. Option (1) is the correct Answer because Eosinophils are associated with allergic reactions and release histaminase, destructive enzymes, so (a) in column I matches with (iii) in column II.

Basophils secrete histamine, serotonin, heparin etc. and are involved in inflammatory reactions, so (b) matches with (iv).

Neutrophils are phagocytic cells; so (c) matches with (ii). Both B and T lymphocytes are responsible for immune responses of the body, so, (d) in column I matches with (i) in column II.

77. Which of the following statements is correct?

(1) Adenine pairs with thymine through two H-bonds

(2) Adenine pairs with thymine through one H-bond

(3) Adenine pairs with thymine through three H-bonds

(4) Adenine does not pair with thymine

Answer (1)

Sol. Adenine pairs with thymine through two H-bonds *i.e.,* A ═ T

78. The sequence that controls the copy number of the linked DNA in the vector, is termed

(1) Selectable marker

(2) Ori site

(3) Palindromic sequence

(4) Recognition site

Answer (2)

Sol. The correct option is (2) because *Ori* sequence is responsible for controlling the copy number of the linked DNA in the vector. Ori *i.e.* origin of replication is responsible for initiation of replication.

79. Identify the basic amino acid from the following.

(1) Tyrosine (2) Glutamic Acid

(3) Lysine (4) Valine

Answer (3)

Sol. Option (3) is the correct Answer because lysine is a basic amino acid.

Valine is a neutral amino acid.

Glutamic acid is an acidic amino acid while Tyrosine is an aromatic amino acid.

80. Match the following columns and select the correct option.

Column-I	Column-II
(a) Pituitary gland	(i) Grave's disease
(b) Thyroid gland	(ii) Diabetes mellitus
(c) Adrenal gland	(iii) Diabetes insipidus
(d) Pancreas	(iv) Addison's disease

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

Answer (3)

Sol. Graves' disease is due to excess secretion of thyroid hormones (T_3 & T_4).

Diabetes mellitus is due to hyposecretion of insulin from β-cells of pancreas.

Diabetes insipidus is due to hyporelease of ADH from posterior pituitary.

Addison's disease is due to hyposecretion of hormone from adrenal cortex.

81. Select the correct statement.

(1) Glucocorticoids stimulate gluconeogenesis.

(2) Glucagon is associated with hypoglycemia.

(3) Insulin acts on pancreatic cells and adipocytes.

(4) Insulin is associated with hyperglycemia.

Answer (1)

Sol. Glucagon is associated with hyperglycemia. Insulin acts on hepatocytes and adipocytes and is associated with hypoglycemia. Glucocorticoids stimulate gluconeogenesis, so increase blood sugar level.

82. Which one of the following is the most abundant protein in the animals?

(1) Haemoglobin

(2) Collagen

(3) Lectin

(4) Insulin

Answer (2)

Sol. Collagen is the most abundant protein in animal world and RuBisCO is the most abundant protein in the whole of the Biosphere.

83. Experimental verification of the chromosomal theory of inheritance was done by

(1) Mendel (2) Sutton

(3) Boveri (4) Morgan

Answer (4)

Sol. Experimental verification of the chromosomal theory of inheritance was done by Morgan.

Note:

Sutton and Boveri proposed chromosomal theory of inheritance but it was experimentally verified by T.H. Morgan.

84. Match the following columns and select the correct option.

Column-I	Column-II
(a) Floating Ribs	(i) Located between second and seventh ribs
(b) Acromion	(ii) Head of the Humerus
(c) Scapula	(iii) Clavicle
(d) Glenoid cavity	(iv) Do not connect with the sternum

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

Answer (4)

Sol. (a) 11th and 12th pairs of ribs are not connected ventrally and are therefore, called floating ribs.

(b) Acromion is a flat expanded process of spine of scapula. The lateral end of clavicle articulates with acromion process.

(c) Scapula is a flat triangular bone in the dorsal part of the thorax between 2nd and the 7th rib.

(d) Glenoid cavity of scapula articulates with head of the humerus to form the shoulder joint.

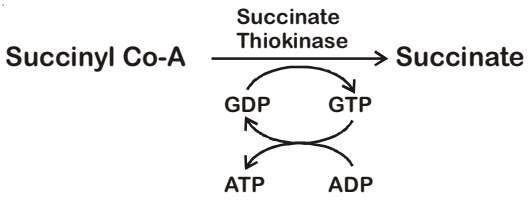
85. The number of substrate level phosphorylations in one turn of citric acid cycle is

(1) Zero (2) One

(3) Two (4) Three

Answer (2)

Sol. One substrate level phosphorylation in one turn of citric acid cycle as per following reaction:



86. Dissolution of the synaptonemal complex occurs during

(1) Pachytene (2) Zygotene

(3) Diplotene (4) Leptotene

Answer (3)

Sol. Dissolution of the synaptonemal complex occurs During Diplotene stage of Prophase-I of Meiosis-I.

87. Bilaterally symmetrical and acoelomate animals are exemplified by

(1) Ctenophora (2) Platyhelminthes

(3) Aschelminthes (4) Annelida

Answer (2)

Sol. Platyhelminthes are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of organisation.

88. The body of the ovule is fused within the funicle at

(1) Hilum (2) Micropyle

(3) Nucellus (4) Chalaza

Answer (1)

Sol. The attachment point of funicle and body of ovule is known as hilum.

89. Goblet cells of alimentary canal are modified from

(1) Squamous epithelial cells

(2) Columnar epithelial cells

(3) Chondrocytes

(4) Compound epithelial cells

Answer (2)

Sol. Goblet cells of alimentary canal are modified from columnar epithelial cells which secrete mucus.

90. Snow-blindness in Antarctic region is due to

(1) Freezing of fluids in the eye by low temperature

(2) Inflammation of cornea due to high dose of UV-B radiation

(3) High reflection of light from snow

(4) Damage to retina caused by infra-red rays

Answer (2)

Sol. UV-B radiations damage DNA and mutations may occur.

In human eye, cornea absorbs UV-B radiations, and a high dose of UV-B causes inflammation of cornea called snow blindness, cataract, etc.

91. Identify a molecule which does not exist.

(1) He_2 (2) Li_2

(3) C_2 (4) O_2

Answer (1)

Sol. For He_2 molecule

Electronic configuration is $\sigma 1s^2, \sigma^* 1s^2$

so bond order = $\frac{1}{2}[N_b - N_a]$

$= \frac{1}{2}[2-2]$

$= 0$

Since, bond order is zero, so He_2 molecule does not exist.

92. Find out the solubility of $Ni(OH)_2$ in 0.1 M NaOH. Given that the ionic product of $Ni(OH)_2$ is 2×10^{-15}

(1) 2×10^{-13} M (2) 2×10^{-8} M

(3) 1×10^{-13} M (4) 1×10^{8} M

Answer (1)

Sol. $\underset{s}{Ni(OH)_2} \rightleftharpoons \underset{s}{Ni^{2+}} + \underset{2s}{2\overset{\ominus}{O}H}$

$\underset{0.1}{NaOH} \longrightarrow \underset{0.1}{Na^+} + \underset{0.1}{\overset{\ominus}{O}H}$

Total $[\overset{\ominus}{O}H] = 2s + 0.1 \approx 0.1$

Ionic product = $[Ni^{2+}][\bar{O}H]^2$

$2 \times 10^{-15} = s(0.1)^2$

$s = 2 \times 10^{-13}$

Solubility of $Ni(OH)_2 = 2 \times 10^{-13}$ M

93. Identify the correct statements from the following :

(a) $CO_2(g)$ is used as refrigerant for ice-cream and frozen food.

(b) The structure of C_{60} contains twelve six carbon rings and twenty five carbon rings.

(c) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.

(d) CO is colorless and odourless gas.

(1) (a), (b) and (c) only

(2) (a) and (c) only

(3) (b) and (c) only

(4) (c) and (d) only

Answer (4)

Sol.
- Dry ice, $CO_2(s)$, is used as refrigerant
- C_{60} contains 20 six membered rings, 12 five membered rings

94. Hydrolysis of sucrose is given by the following reaction.

$$\text{Sucrose} + H_2O \rightleftharpoons \text{Glucose} + \text{Fructose}$$

If the equilibrium constant (K_C) is 2×10^{13} at 300 K, the value of $\Delta_r G^\ominus$ at the same temperature will be :

(1) -8.314 J $mol^{-1}K^{-1} \times 300$ K $\times \ln(2 \times 10^{13})$

(2) 8.314 J $mol^{-1}K^{-1} \times 300$ K $\times \ln(2 \times 10^{13})$

(3) 8.314 J $mol^{-1}K^{-1} \times 300$ K $\times \ln(3 \times 10^{13})$

(4) -8.314 J $mol^{-1}K^{-1} \times 300$ K $\times \ln(4 \times 10^{13})$

Answer (1)

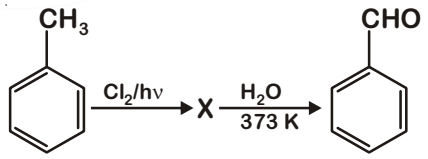
Sol. $\Delta G = \Delta G^\circ + RT \ln Q$

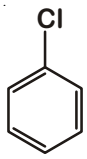
At equilibrium $\Delta G = 0$, $Q = K_{eq}$

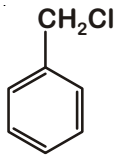
So $\Delta_r G^\circ = -RT \ln K_{eq}$

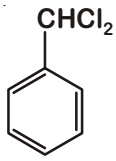
$\Delta_r G^\circ = -8.314$ J mol^{-1} $K^{-1} \times 300$ K $\times \ln(2 \times 10^{13})$

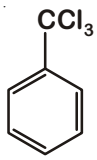
95. Identify compound X in the following sequence of reactions



(1) 

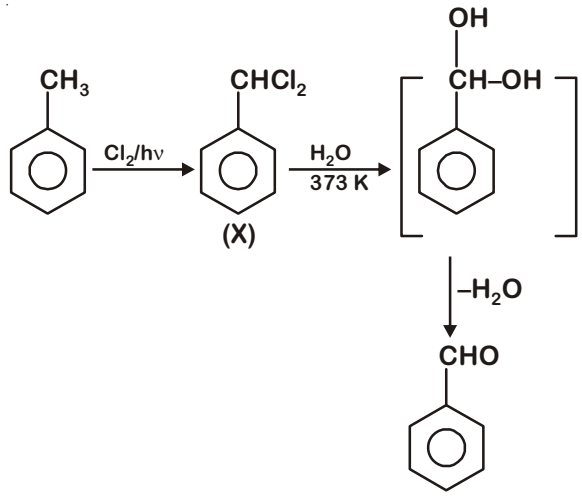
(2) 

(3) 

(4) 

Answer (3)

Sol.



96. Identify the incorrect match.

Name	IUPAC Official Name
(a) Unnilunium	(i) Mendelevium
(b) Unniltrium	(ii) Lawrencium
(c) Unnilhexium	(iii) Seaborgium
(d) Unununnium	(iv) Darmstadtium

(1) (a), (i) (2) (b), (ii)

(3) (c), (iii) (4) (d), (iv)

Answer (4)

Sol. Unununium

Atomic number = 111

IUPAC official name : Roentgenium

97. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is

(1) $\frac{\sqrt{3}}{4}\times 288$ pm (2) $\frac{\sqrt{2}}{4}\times 288$ pm

(3) $\frac{4}{\sqrt{3}}\times 288$ pm (4) $\frac{4}{\sqrt{2}}\times 288$ pm

Answer (1)

Sol. For BCC,

$\sqrt{3}a = 4r$ $a = \text{edge length}$

$r = \frac{\sqrt{3}a}{4}$ $r = \text{radius}$

Given, a = 288 pm

$r = \frac{\sqrt{3}}{4}\times 288$

98. Which of the following set of molecules will have zero dipole moment?

(1) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene

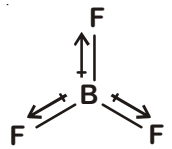
(2) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene

(3) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene

(4) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene

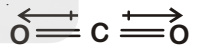
Answer (4)

Sol.

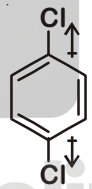


$\mu = 0$

$\mu = 0$



$\mu = 0$



$\mu = 0$

99. On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be

(1) Hydrogen gas (2) Oxygen gas

(3) H_2S gas (4) SO_2 gas

Answer (2)

Sol. During the electrolysis of dil. sulphuric acid using Pt electrodes following reaction will take place.

At cathode :

$$4H^+(aq) + 4e^- \longrightarrow 2H_2(g)$$

At anode :

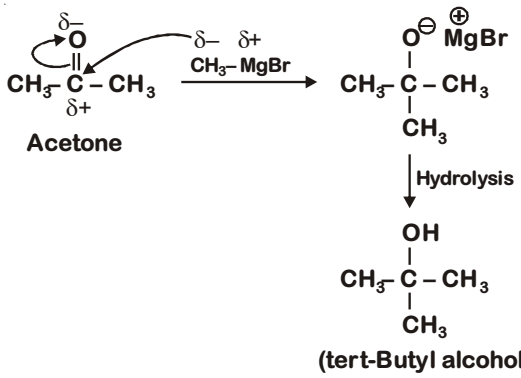
$$2H_2O(l) \longrightarrow O_2(g) + 4H^+(aq) + 4e^-$$

100. Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give :

(1) Isopropyl alcohol (2) Sec. butyl alcohol
(3) Tert. butyl alcohol (4) Isobutyl alcohol

Answer (3)

Sol.

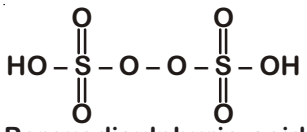


101. Which of the following oxoacid of sulphur has – O – O – linkage?

(1) H_2SO_3, sulphurous acid
(2) H_2SO_4, sulphuric acid
(3) $H_2S_2O_8$, peroxodisulphuric acid
(4) $H_2S_2O_7$, pyrosulphuric acid

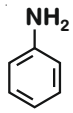
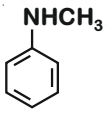
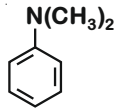
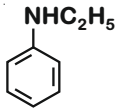
Answer (3)

Sol.



Peroxodisulphuric acid

102. Which of the following amine will give the carbyle test?

(1) 
(2) 
(3) 
(4) 

Answer (1)

Sol. Aliphatic and aromatic primary es give carbyle reaction.

103. The calculated spin only magnetic moment of Cr^{2+} ion is

(1) 3.87 BM (2) 4.90 BM
(3) 5.92 BM (4) 2.84 BM

Answer (2)

Sol. Electronic configuration of Cr – [Ar] $3d^5\,4s^1$

Electronic configuration of Cr^{2+} – [Ar] $3d^4$

1	1	1	1	

Number of unpaired e^- = 4

Spin only magnetic moment = $\sqrt{n(n+2)}$

n = number of unpaired e^-

Spin only magnetic moment = $\sqrt{4(4+2)}$

$= \sqrt{24}$ BM

= 4.9 BM

104. The correct option for free expansion of an ideal gas under adiabatic condition is

(1) q = 0, ΔT = 0 and w = 0
(2) q = 0, ΔT < 0 and w > 0
(3) q < 0, ΔT = 0 and w = 0
(4) q > 0, ΔT > 0 and w > 0

Answer (1)

Sol. Free expansion $\Rightarrow P_{ex} = 0$

$\therefore$ $w = -P_{ex}\Delta V = 0$

$\because$ Adiabatic process $\Rightarrow$ q = 0

also, $\Delta U = q + w$ [first law of thermodynamics]

$\therefore$ $\Delta U = 0$

$\because$ Internal energy of an ideal gas is a function of temperature

$\therefore$ If internal energy remains constant

$\therefore$ $\Delta T = 0$

105. The freezing point depression constant (K_f) of benzene is 5.12 K kg mol^{-1}. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places) :

(1) 0.20 K
(2) 0.80 K
(3) 0.40 K
(4) 0.60 K

Answer (3)

Sol. $\Delta T_f = k_f m$

$= 5.12\ (K.kg\ mol^{-1}) \times 0.078\ (mol\ kg^{-1})$

= 0.399 K

$\approx$ 0.40 K

106. The number of Faradays(F) required to produce 20 g of calcium from molten $CaCl_2$ (Atomic mass of Ca = 40 g mol^{-1}) is

(1) 1 (2) 2

(3) 3 (4) 4

Answer (1)

Sol. 1 equivalent of any substance is deposited by 1 F of charge.

We have, 20 g calcium

$$\text{Number of equivalents} = \frac{\text{Given mass}}{\text{Equivalent mass}}$$

$$= \frac{20}{20} = 1$$

$$\text{Equivalent mass of Ca} = \frac{40}{2} = 20$$

So, 1 faraday of charge is required.

107. Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as

(1) Aldol condensation

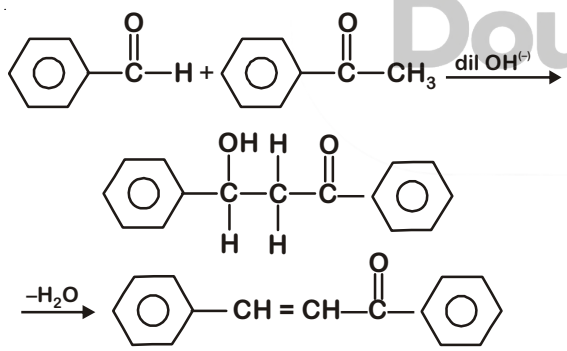
(2) Cannizzaro's reaction

(3) Cross Cannizzaro's reaction

(4) Cross Aldol condensation

Answer (4)

Sol.



In the presence of dil.$OH^{(-)}$, benzaldehyde and acetophenone will react to undergo cross-aldol condensation.

108. Paper chromatography is an example of

(1) Adsorption chromatography

(2) Partition chromatography

(3) Thin layer chromatography

(4) Column chromatography

Answer (2)

Sol. Paper chromatography is a type of partition chromatography in which a special quality paper known as chromatography paper is used.

109. An increase in the concentration of the reactants of a reaction leads to change in

(1) activation energy

(2) heat of reaction

(3) threshold energy

(4) collision frequency

Answer (2)

Sol. Heat of reaction is an extensive property. Hence, on change of amount/concentration of reactants heat of reaction changes.

110. A mixture of N_2 and Ar gases in a cylinder contains 7 g of N_2 and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N_2 is :

[Use atomic masses (in g mol^{-1}) : N = 14, Ar = 40]

(1) 9 bar (2) 12 bar

(3) 15 bar (4) 18 bar

Answer (3)

Sol. $n_{N_2} = \frac{7}{28} = \frac{1}{4} = 0.25$

$n_{Ar} = \frac{8}{40} = \frac{1}{5} = 0.20$

Now, Applying Dalton's law of partial pressure, $p_{N_2} = (\chi_{N_2})P_{Total}$

$$= \frac{0.25}{0.45} \times 27 \text{ bar}$$

$$= \frac{5}{9} \times 27 = 15 \text{ bar}$$

111. Identify the correct statement from the following :

(1) Wrought iron is impure iron with 4% carbon.

(2) Blister copper has blistered appearance due to evolution of CO_2.

(3) Vapour phase refining is carried out for Nickel by Van Arkel method.

(4) Pig iron can be moulded into a variety of shapes.

Answer (4)

Sol. The iron obtained from blast furnace contains about 4% carbon and many impurities like S, P, Si, Mn in smaller amount. This is known as pig iron and cast into variety of shapes.

112. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of ?

(1) – I effect of – CH_3 groups

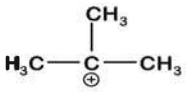
(2) + R effect of – CH_3 groups

(3) – R effect of – CH_3 groups

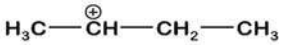
(4) Hyperconjugation

Answer (4)

Sol.



Tertiary butyl carbocation (9 α-H atoms)



Secondary butyl carbocation (5 α-H atoms)

More the number of α-H atoms, more will be the hyperconjugation effect hence more will be the stability of carbocation.

113. Which of the following is a cationic detergent?

(1) Sodium lauryl sulphate

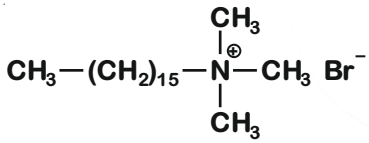
(2) Sodium stearate

(3) Cetyltrimethyl ammonium bromide

(4) Sodium dodecylbenzene sulphonate

Answer (3)

Sol.



Cetyltrimethyl ammonium bromide

114. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is

(a) β-Elimination reaction

(b) Follows Zaitsev rule

(c) Dehydrohalogenation reaction

(d) Dehydration reaction

(1) (a), (b), (c)

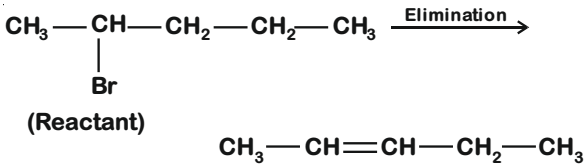
(2) (a), (c), (d)

(3) (b), (c), (d)

(4) (a), (b), (d)

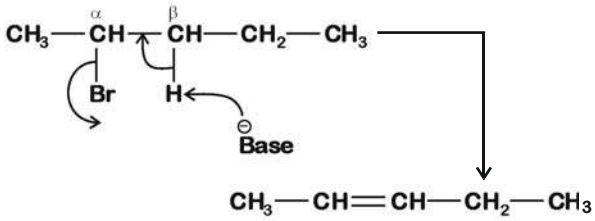
Answer (1)

Sol.



(Reactant)

Mechanism:



Since β-hydrogen is abstracted it is β-elimination.

Since more substituted alkene is formed, it follows zaitsev's rule.

Since 'H' and 'Br' are removed, it is dehydro-halogenation.

115. The mixture which shows positive deviation from Raoult's law is

(1) Ethanol + Acetone

(2) Benzene + Toluene

(3) Acetone + Chloroform

(4) Chloroethane + Bromoethane

Answer (1)

Sol. Pure ethanol molecules are hydrogen bonded. On adding acetone, its molecules get in between the ethanol molecules and break some of the hydrogen bonds between them. This weakens the intermolecular attractive interactions and the solution shows positive deviation from Raoult's law.

116. Which of the following is the **correct** order of increasing field strength of ligands to form coordination compounds?

(1) $SCN^- < F^- < C_2O_4^{2-} < CN^-$

(2) $SCN^- < F^- < CN^- < C_2O_4^{2-}$

(3) $F^- < SCN^- < C_2O_4^{2-} < CN^-$

(4) $CN^- < C_2O_4^{2-} < SCN^- < F^-$

Answer (1)

Sol. Spectrochemical series (as given in NCERT) :

$I^- < Br^- < SCN^{\ominus} < Cl^- < S^{2-} < F^- < \bar{O}H < C_2O_4^{2-} <$

$H_2O < NCS^{\ominus} < EDTA^{4-} < NH_3 < en < \overset{\ominus}{C}N < CO$

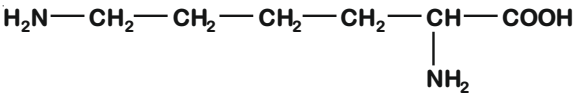
117. Which of the following is a basic o acid ?

(1) Serine (2) Alanine

(3) Tyrosine (4) Lysine

Answer (4)

Sol.



(Structure of Lysine)

Lysine is a basic o acid.

118. HCl was passed through a solution of $CaCl_2$, $MgCl_2$ and NaCl. compound(s) crystallise(s)?

(1) Both $MgCl_2$ and $CaCl_2$

(2) Only NaCl

(3) Only $MgCl_2$

(4) NaCl, $MgCl_2$ and $CaCl_2$

Answer (2)

Sol. Since $CaCl_2$ and $MgCl_2$ are more soluble than NaCl, on passing HCl(g) through a solution containing $CaCl_2$, $MgCl_2$ and NaCl then NaCl crystallizes out.

119. Which of the following is a natural polymer?

(1) cis-1, 4-polyisoprene

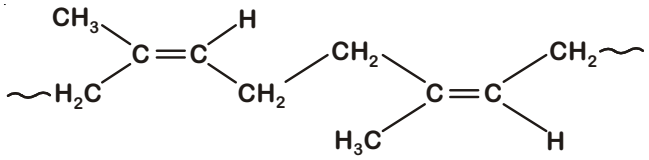
(2) poly (Butadiene-styrene)

(3) polybutadiene

(4) poly (Butadiene-acrylonitrile)

Answer (1)

Sol. Naturally occuring polymer, natural rubber is cis-1, 4– polyisoprene



120. Which of the following is **not** correct about carbon monoxide ?

(1) It forms carboxyhaemoglobin

(2) It reduces oxygen carrying ability of blood.

(3) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.

(4) It is produced due to incomplete combustion.

Answer (3)

Sol. The carboxyhaemoglobin is about 300 times more stable than oxyhaemoglobin.

121. Sucrose on hydrolysis gives

(1) β-D-Glucose + α-D-Fructose

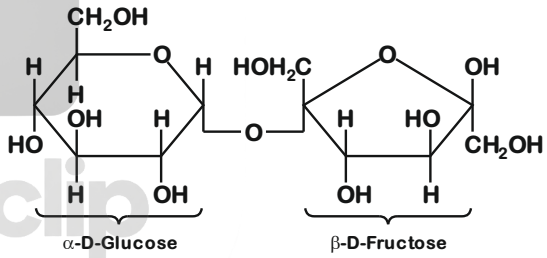
(2) α-D-Glucose + β-D-Glucose

(3) α-D-Glucose + β-D-Fructose

(4) α-D-Fructose + β-D-Fructose

Answer (3)

Sol. Sucrose $\xrightarrow{\text{Hydrolysis}}$ α-D-Glucose + β-D-Fructose



122. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.

(1) Iron

(2) Copper

(3) Calcium

(4) Potassium

Answer (4)

Sol. Potassium (K) activates many enzymes participate in oxidation of glucose to produce ATP and helps in the transmission of nerve signal along with Na.

123. Which one of the followings has maximum number of atoms ?

(1) 1 g of Ag(s) [Atomic mass of Ag = 108]

(2) 1 g of Mg(s) [Atomic mass of Mg = 24]

(3) 1 g of O_2(g) [Atomic mass of O = 16]

(4) 1 g of Li(s) [Atomic mass of Li = 7]

Answer (4)

Sol.
- Number of Mg atoms = $\frac{1}{24} \times N_A$
- Number of O atoms = $\frac{1}{32} \times 2 \times N_A$
- Number of Li atoms = $\frac{1}{7} \times N_A$
- Number of Ag atoms = $\frac{1}{108} \times N_A$

124. The number of protons, neutrons and electrons in $^{175}_{71}Lu$, respectively, are

(1) 71, 104 and 71 (2) 104, 71 and 71

(3) 71, 71 and 104 (4) 175, 104 and 71

Answer (1)

Sol. $^{175}_{71}Lu$

No. of Protons= 71 = No. of Electrons

No. of Neutrons = Mass no. – No. of Protons

= 175 – 71

= 104

125. What is the change in oxidation number of carbon in the following reaction?

$$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(l) + 4HCl(g)$$

(1) + 4 to + 4

(2) 0 to + 4

(3) – 4 to + 4

(4) 0 to – 4

Answer (3)

Sol. $CH_4 \Rightarrow x + 4 \times 1 = 0 \Rightarrow x = -4$

$CCl_4 \Rightarrow x + 4 \times (-1) = 0 \Rightarrow x = +4$

$$\overset{-4}{C}H_4(g) + 4Cl_2(g) \rightarrow \overset{+4}{C}Cl_4(l) + 4HCl(g)$$

Change in oxidation state of carbon is from –4 to +4

126. Identify the **incorrect** statement.

(1) Cr^{2+} (d^4) is a stronger reducing agent than Fe^{2+} (d^6) in water.

(2) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.

(3) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.

(4) The oxidation states of chromium in CrO_4^{2-} and $Cr_2O_7^{2-}$ are not the same.

Answer (4)

Sol. Oxidation state of Cr in CrO_4^{2-} and $Cr_2O_7^{2-}$ is +6

127. For the reaction, $2Cl(g) \longrightarrow Cl_2(g)$, the correct option is :

(1) $\Delta_rH > 0$ and $\Delta_rS > 0$

(2) $\Delta_rH > 0$ and $\Delta_rS < 0$

(3) $\Delta_rH < 0$ and $\Delta_rS > 0$

(4) $\Delta_rH < 0$ and $\Delta_rS < 0$

Answer (4)

Sol. Given reaction, $2Cl(g) \longrightarrow Cl_2(g)$

We know that,

$Cl_2(g) \longrightarrow 2Cl(g)$ is endothermic reaction because it requires energy to break bond.

So reverse reaction is exothermic $\Delta_rH < 0$

Also, two gaseous atom combine together to form 1 gaseous molecule.

So, randomness $\Delta_rS < 0$

128. Measuring Zeta potential is useful in determining which property of colloidal solution?

(1) Viscosity

(2) Solubility

(3) Stability of the colloidal particles

(4) Size of the colloidal particles

Answer (3)

Sol. In colloidal solution, the potential difference between the fixed layer and the diffused layer of opposite charge is known as Zeta potential.

The presence of equal and similar charges on colloidal particles is largely responsible in providing stability to the colloidal solution.

129. Urea reacts with water to form A which will decompose to form B. B when passed through Cu^{2+} (aq), deep blue colour solution C is formed. What is the formula of C from the following ?

(1) $CuSO_4$

(2) $[Cu(NH_3)_4]^{2+}$

(3) $Cu(OH)_2$

(4) $CuCO_3 \cdot Cu(OH)_2$

Answer (2)

Sol.

$$NH_2CONH_2 + H_2O \longrightarrow \underset{(A)}{(NH_4)_2CO_3}$$

$$\downarrow \Delta$$

$$\underset{(B)}{NH_3(g)} + CO_2(g) + H_2O(l)$$

$$\underset{(B)}{NH_3(g)} \xrightarrow{Cu^{2+}(aq)} \underset{\substack{(C)\\ \text{[Blue coloured solution]}}}{[Cu(NH_3)_4]^{2+}}$$

130. Match the following and identify the correct option.

(a) $CO(g) + H_2(g)$	(i) $Mg(HCO_3)_2 + Ca(HCO_3)_2$
(b) Temporary hardness of water	(ii) An electron deficient hydride
(c) B_2H_6	(iii) Synthesis gas
(d) H_2O_2	(iv) Non-planar structure

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

Answer (1)

Sol.
- Mixture of CO and H_2 gases is known as water gas or synthesis gas.
- Temporary hardness of water is due to bicarbonates of calcium and magnesium.
- Diborane (B_2H_6) is an electron deficient hydride.
- H_2O_2 is non-planar molecule having open book like structure.

131. Match the following :

Oxide	Nature
(a) CO	(i) Basic
(b) BaO	(ii) Neutral
(c) Al_2O_3	(iii) Acidic
(d) Cl_2O_7	(iv) Amphoteric

is correct option?

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

Answer (2)

Sol. CO : Neutral oxide

BaO : Basic oxide

Al_2O_3 : Amphoteric oxide

Cl_2O_7 : Acidic oxide

132. The rate constant for a first order reaction is $4.606 \times 10^{-3}\ s^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is :

(1) 100 s

(2) 200 s

(3) 500 s

(4) 1000 s

Answer (3)

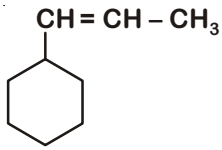
Sol. $k = \frac{2.303}{t}\log\frac{A_0}{A}$ (First order rate equation)

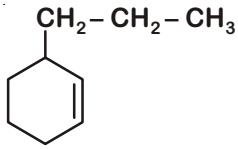
$$4.606\times10^{-3} = \frac{2.303}{t}\log\frac{2}{0.2}$$

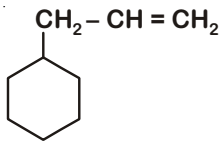
$$t = \frac{2.303}{4.606\times10^{-3}}\times\log10$$

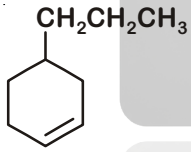
$$= \frac{10^3}{2} = 500 \text{ sec}$$

133. An alkene on ozonolysis gives methanal as one of the product. Its structure is

(1) 

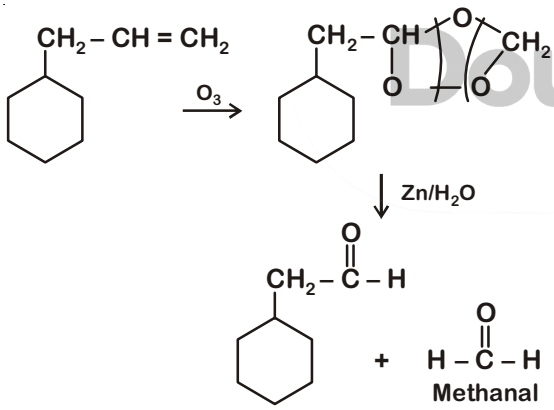
(2) 

(3) 

(4) 

Answer (3)

Sol.



134. Which of the following alkane cannot be made in good yield by Wurtz reaction?

(1) n-Hexane

(2) 2,3-Dimethylbutane

(3) n-Heptane

(4) n-Butane

Answer (3)

Sol. Wurtz reaction is used to prepare symmetrical alkanes like $R_1 - R_1$, as

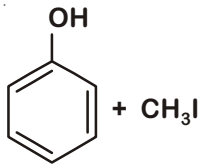
$$R_1 - X + 2Na + X - R_1 \xrightarrow{\text{Dry ether}} R_1 - R_1 + 2NaX$$

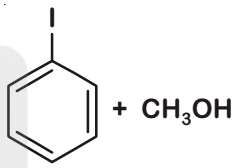
If R_1 and R_2 are different, then mixture of alkanes may be obtained as

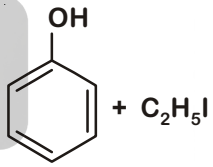
$$R_1 - X + 2Na + R_2 - X \xrightarrow{\text{Dry ether}}$$

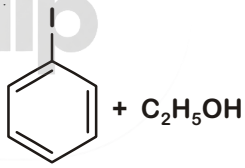
$$R_1 - R_1 + R_1 - R_2 + R_2 - R_2 + 2NaX$$

135. Anisole on cleavage with HI gives

(1) 

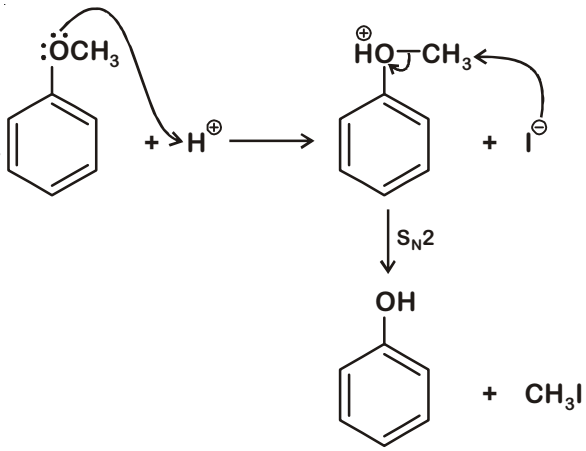
(2) 

(3) 

(4) 

Answer (1)

Sol.



136. For which one of the following, Bohr model is **not** valid ?

(1) Hydrogen atom

(2) Singly ionised helium atom (He^+)

(3) Deuteron atom

(4) Singly ionised neon atom (Ne^+)

Answer (4)

Sol. Bohr model is only valid for single electron species.

Singly ionised neon atom has more than one electron in orbit. Hence, Bohr model is not valid.

137. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is : (c = speed of electromagnetic waves)

(1) c : 1 (2) 1 : 1

(3) 1 : c (4) 1 : c^2

Answer (2)

Sol. In an electromagnetic wave, half of the intensity is provided by the electric field and half by the magnetic field

Hence required ratio should be 1 : 1

138. The Brewsters angle i_b for an interface should be

(1) $0° < i_b < 30°$ (2) $30° < i_b < 45°$

(3) $45° < i_b < 90°$ (4) $i_b = 90°$

Answer (3)

Sol. $\mu = \tan i_b$

$1 < \mu < \infty$

$1 < \tan i_b < \infty$

$\tan^{-1}(1) < i_b < \tan^{-1}(\infty)$

$45° < i_b < 90°$

139. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C.

Its density is : ($R = 8.3\ J\ mol^{-1}\ K^{-1}$)

(1) 0.5 kg/m^3 (2) 0.2 kg/m^3

(3) 0.1 kg/m^3 (4) 0.02 kg/m^3

Answer (2)

Sol. $PM = \rho RT \quad \Rightarrow \quad \rho = \frac{PM}{RT}$

$P = 249 \times 10^3\ N/m^2$

$M = 2 \times 10^{-3}$ kg

$T = 300$ K

$$\therefore \quad \rho = \frac{(249\times10^3)(2\times10^{-3})}{8.3\times300} = \frac{0.2\ kg}{m^3}$$

140. A ray is incident at an angle of incidence i on one surface of a small angle prism (with angle of prism A) and emerges normally from the opposite surface. If the refractive index of the material of the prism is μ, then the angle of incidence is nearly equal to :

(1) $\frac{A}{2\mu}$ (2) $\frac{2A}{\mu}$

(3) μA (4) $\frac{\mu A}{2}$

Answer (3)

Sol. Light ray emerges normally from another surface, hence e(angle of emergence) = 0

$r_2 = 0$

$r_1 + r_2 = A$

$\Rightarrow \quad r_1 = A$

Applying Snell's law on first surface

$1.\sin i = \mu \sin r_1$

$\Rightarrow \quad \sin i = \mu \sin A$

For small angles ($\sin\theta \approx \theta$)

hence $i = \mu A$

141. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is :

(1) isothermal

(2) adiabatic

(3) isochoric

(4) isobaric

Answer (2)

Sol. Entire system is thermally insulated. So, no heat exchange will take place. Hence, process will be adiabatic.

142. The energy equivalent of 0.5 g of a substance is :

(1) 4.5×10^{16} J

(2) 4.5×10^{13} J

(3) 1.5×10^{13} J

(4) 0.5×10^{13} J

Answer (2)

Sol. From mass-energy equivalence.

$E = mc^2$

$= 0.5 \times 10^{-3} \times (3 \times 10^8)^2$

$= 4.5 \times 10^{13}$ J

143. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

(1) 48 N (2) 32 N

(3) 30 N (4) 24 N

Answer (2)

Sol. $mg_h = \dfrac{mg_0}{\left(1+\dfrac{h}{R}\right)^2}$

$W = \dfrac{72}{\left(1+\dfrac{R/2}{R}\right)^2}$

$W = \dfrac{72}{(3/2)^2} = \dfrac{4}{9}\times 72 = 32\text{ N}$

144. The solids which have the negative temperature coefficient of resistance are:

(1) metals

(2) insulators only

(3) semiconductors only

(4) insulators and semiconductors

Answer (4)

Sol. For metals temperature coefficient of resistance is positive while for insulators and semiconductors, temperature coefficient of resistance is negative.

145. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is :

(1) π rad (2) $\dfrac{3\pi}{2}$ rad

(3) $\dfrac{\pi}{2}$ rad (4) zero

Answer (1)

Sol. If $y = A\sin\omega t$

then $v = \dfrac{dy}{dt}$

$v = A\omega\cos\omega t$

$a = \dfrac{dv}{dt}$

$a = -A\omega^2\sin(\omega t)$

$a = A\omega^2\sin(\omega t + \pi)$

So phase difference between displacement and acceleration is π.

146. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale.

The pitch of the screw gauge is :

(1) 0.01 mm (2) 0.25 mm

(3) 0.5 mm (4) 1.0 mm

Answer (3)

Sol. Least count

$= \dfrac{\text{Pitch}}{\text{Number of divisions on circular scale}}$

$0.01\text{ mm} = \dfrac{\text{Pitch}}{50}$

Pitch = 0.5 mm

147. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:

(1) 523 Hz (2) 524 Hz

(3) 536 Hz (4) 537 Hz

Answer (2)

Sol. Difference of f_A and f_B is 6 Hz

If tension decreases, f_B decreases and becomes f_B'.

Now, difference of f_A and f_B' = 7 Hz (increases)

So, $f_A > f_B$

$f_A - f_B = 6$ Hz

$f_A = 530$ Hz

$f_B = 524$ Hz (original)

148. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass.

The centre of mass of the system from the 5 kg particle is nearly at a distance of :

(1) 33 cm (2) 50 cm

(3) 67 cm (4) 80 cm

Answer (3)

Sol.

$x_{cm} = \dfrac{m_1x_1 + m_2x_2}{m_1 + m_2}$

$= \dfrac{5\times 0 + 100\times 10}{5+10} = \dfrac{200}{3} = 66.66\text{ cm}$

$x_{cm} \simeq 67$ cm

149. Find the torque about the origin when a force of $3\hat{j}$ N acts on a particle whose position vector is $2\hat{k}$ m.

(1) $6\hat{i}$ Nm (2) $6\hat{j}$ Nm

(3) $-6\hat{i}$ Nm (4) $6\hat{k}$ Nm

Answer (3)

Sol. $\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{\tau} = 2\hat{k} \times 3\hat{j}$

$\vec{\tau} = -6\hat{i}$ Nm

150. Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2. The energy received by the surface during time span of 1 minute is :

(1) 10×10^3 J

(2) 12×10^3 J

(3) 24×10^3 J

(4) 48×10^3 J

Answer (3)

Sol. Energy received = Intensity × Area × Time

= 20 × 20 × 60

= 24×10^3 J

151. A spherical conductor of radius 10 cm has a charge of 3.2×10^{-7} C distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2\right)$

(1) 1.28×10^4 N/C

(2) 1.28×10^5 N/C

(3) 1.28×10^6 N/C

(4) 1.28×10^7 N/C

Answer (2)

Sol. Electric field outside a conducting sphere

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q}{r^2}$$

$$= \frac{9 \times 10^9 \times 3.2 \times 10^{-7}}{225 \times 10^{-4}}$$

$= 0.128 \times 10^6$

$= 1.28 \times 10^5$ N/C

152. In a certain region of space with volume 0.2 m^3, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is :

(1) zero (2) 0.5 N/C

(3) 1 N/C (4) 5 N/C

Answer (1)

Sol. Since, electric potential is found throughout constant, hence electric field, $E = -\frac{dV}{dr} = 0$

153. The increase in the width of the depletion region in a p-n junction diode is due to :

(1) forward bias only

(2) reverse bias only

(3) both forward bias and reverse bias

(4) increase in forward current

Answer (2)

Sol. Due to reverse biasing, the width of the depletion region increases.

154. A 40 μF capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly :

(1) 1.7 A

(2) 2.05 A

(3) 2.5 A

(4) 25.1 A

Answer (3)

Sol. $i_{rms} = c\omega\,\varepsilon_{rms}$

$c = 40 \times 10^{-6}$ F

$\omega = 2\pi f = 100\pi$

$\varepsilon_{rms} = 200$ V

$\therefore\ i_{rms} = 200 \times 40 \times 10^{-6} \times 2\pi \times 50$

= 2.5 A

155. The mean free path for a gas, with molecular diameter d and number density n can be expressed as :

(1) $\frac{1}{\sqrt{2}\,n\pi d}$ (2) $\frac{1}{\sqrt{2}\,n\pi d^2}$

(3) $\frac{1}{\sqrt{2}\,n^2\pi d^2}$ (4) $\frac{1}{\sqrt{2}\,n^2\pi^2 d^2}$

Answer (2)

Sol. According to the formula

$$\lambda = \frac{1}{\sqrt{2}\,n\pi d^2}$$

156. For transistor action, which of the following statements is **correct**?

(1) Base, emitter and collector regions should have same doping concentrations.

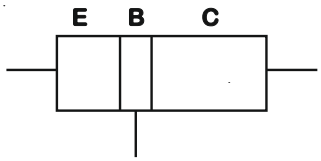
(2) Base, emitter and collector regions should have same size.

(3) Both emitter junction as well as the collector junction are forward biased.

(4) The base region must be very thin and lightly doped.

Answer (4)

Sol.



For Bi-polar junction transistor

Length Profile is $L_C > L_E > L_B$

and doping profile is E > C > B

For transistor action Base-emitter junction is forward biased and Base-collector junction is reversed biased.

157. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?

(1) doubled (2) four times

(3) one-fourth (4) zero

Answer (4)

Sol. $\nu = \frac{3}{2}\nu_0$

$\nu' = \frac{\nu}{2} = \frac{3}{4}\nu_0$

$\because \quad \nu' < \nu_0$

$\therefore$ No photoelectric emission will take place.

158. When a uranium isotope ${}^{235}_{92}U$ is bombarded with a neutron, it generates ${}^{89}_{36}Kr$, three neutrons and :

(1) ${}^{144}_{56}Ba$ (2) ${}^{91}_{40}Zr$

(3) ${}^{101}_{36}Kr$ (4) ${}^{103}_{36}Kr$

Answer (1)

Sol. $U^{235}_{92} + {}^{1}_{0}n \rightarrow Kr^{89}_{36} + 3n^{1}_{0} + X^{A}_{Z}$

92 + 0 = 36 + Z

$\Rightarrow$ Z = 56

235 + 1 = 89 + 3 + A

$\Rightarrow$ A = 144

So, ${}^{144}_{56}Ba$ is generated.

159. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly:

(1) 6 (2) 0.6

(3) 0.06 (4) 0.006

Answer (3)

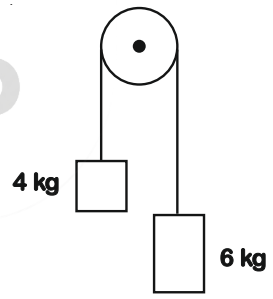
Sol. 1 eV = 1.6×10^{-19} J

$1\,J = \frac{1}{1.6\times10^{-19}}\,eV$

$10^{-20}\,J = \frac{10^{-20}}{1.6\times10^{-19}}\,eV$

= 0.06 eV

160. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is :



(1) g (2) g/2

(3) g/5 (4) g/10

Answer (3)

Sol. $a = \frac{(m_1 - m_2)g}{(m_1 + m_2)}$ where $m_1 > m_2$

$a = \frac{(6-4)g}{6+4}$

$a = \frac{g}{5}$

Note : Here no option is given according to acceleration of COM of the system.

161. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is :

(1) $\frac{MgL_1}{AL}$ (2) $\frac{Mg(L_1-L)}{AL}$

(3) $\frac{MgL}{AL_1}$ (4) $\frac{MgL}{A(L_1-L)}$

Answer (4)

Sol. Stress = $\frac{Mg}{A}$

Strain = $\frac{\Delta L}{L} = \frac{L_1-L}{L}$

Young's modulus = $\frac{\text{Stress}}{\text{Strain}} = \frac{MgL}{A(L_1-L)}$

162. The average thermal energy for a mono-atomic gas is : (k_B is Boltzmann constant and T, absolute temperature)

(1) $\frac{1}{2}k_BT$ (2) $\frac{3}{2}k_BT$

(3) $\frac{5}{2}k_BT$ (4) $\frac{7}{2}k_BT$

Answer (2)

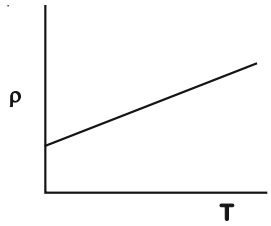
Sol. For monoatomic gases, degree of freedom is 3.

Hence average thermal energy per molecule is

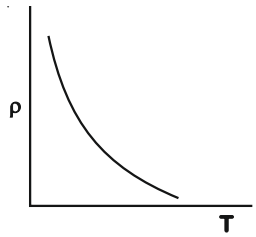
$KE_{avg} = \frac{3}{2}k_BT$

163. Which of the following graph represents the variation of resistivity (ρ) with temperature (T) for copper?

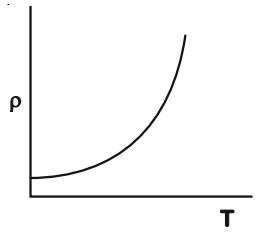
(1)



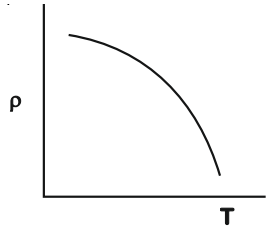
(2)



(3)



(4)



Answer (3)

Sol. At temperature much lower than 0°C, graph deviates considerably from a straight line.

Option (3) is correct

164. The color code of a resistance is given below

The values of resistance and tolerance, respectively, are

(1) 470 kΩ, 5% (2) 47 kΩ, 10%

(3) 4.7 kΩ, 5% (4) 470 Ω, 5%

Answer (4)

Sol. According to colour coding

Yellow	Violet	Brown	Gold
4	7	1	5%

So, $R = 47 \times 10^1 \pm 5\%$

$R = 470 \pm 5\ \Omega$

165. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes :

(1) double (2) half

(3) four times (4) one-fourth

Answer (3)

Sol. Fringe width $\beta = \frac{\lambda D}{d}$

Now, $d' = \frac{d}{2}$ and $D' = 2D$

So, $\beta' = \frac{\lambda(2D)}{d/2} = \frac{4\lambda D}{d}$

$\beta' = 4\beta$

166. The capacitance of a parallel plate capacitor with air as medium is 6 μF. With the introduction of a dielectric medium, the capacitance becomes 30 μF. The permittivity of the medium is :

($\epsilon_0 = 8.85 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$)

(1) $0.44 \times 10^{-13}\ C^2\ N^{-1}\ m^{-2}$

(2) $1.77 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$

(3) $0.44 \times 10^{-10}\ C^2\ N^{-1}\ m^{-2}$

(4) $5.00\ C^2\ N^{-1}\ m^{-2}$

Answer (3)

Sol. $C = KC_0$

$$K = \frac{C}{C_0} = \frac{30}{6} = 5$$

$$K = \frac{\varepsilon}{\varepsilon_0}$$

$$\varepsilon = K\varepsilon_0$$

$= 5 \times 8.85 \times 10^{-12}$

$= 0.44 \times 10^{-10}\ C^2\ N^{-1}\ m^{-2}$

167. Dimensions of stress are :

(1) $[MLT^{-2}]$ (2) $[ML^2T^{-2}]$

(3) $[ML^0T^{-2}]$ (4) $[ML^{-1}\ T^{-2}]$

Answer (4)

Sol. Stress = $\frac{\text{Force}}{\text{Area}}$

$$= \frac{[MLT^{-2}]}{[L^2]}$$

$$= [ML^{-1}T^{-2}]$$

168. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is :

(1) 3.66×10^{-7} rad

(2) 1.83×10^{-7} rad

(3) 7.32×10^{-7} rad

(4) 6.00×10^{-7} rad

Answer (1)

Sol. $\theta_R = 1.22\frac{\lambda}{d}$; $\lambda = 600 \times 10^{-9}$ m d = 2 m

$$= \frac{1.22 \times 600 \times 10^{-9}}{2}$$

$\theta = 3.66 \times 10^{-7}$ rad

169. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\frac{\pi}{3}$. If instead C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$ between current and voltage. The power factor of the circuit is :

(1) zero (2) 0.5

(3) 1.0 (4) –1.0

Answer (3)

Sol. When L is removed,

$$\tan\phi = \frac{|X_C|}{R} \Rightarrow \tan\frac{\pi}{3} = \frac{X_C}{R} \quad ...(i)$$

When C is removed,

$$\tan\phi = \frac{|X_L|}{R} \Rightarrow \tan\frac{\pi}{3} = \frac{X_L}{R} \quad ...(ii)$$

From (i) and (ii), $X_L = X_C$

Since, $X_L = X_C$, the circuit is in resonance.

Z = R

Power factor = cos ϕ = $\frac{R}{Z} = 1$

170. A short electric dipole has a dipole moment of 16×10^{-9} C m. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is :

$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9\ N\,m^2/C^2\right)$$

(1) 50 V (2) 200 V

(3) 400 V (4) zero

Answer (2)

Sol. $V = \frac{kp\cos\theta}{r^2}$

$$V = \frac{9 \times 10^9 \times 16 \times 10^{-9} \times \cos 60}{0.36}$$

V = 200 V

171. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m^{-1}. The permeability of the material of the rod is :

($\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1})

(1) $2.4\pi \times 10^{-4}$ T m A^{-1}

(2) 8.0×10^{-5} T m A^{-1}

(3) $2.4\pi \times 10^{-5}$ T m A^{-1}

(4) $2.4\pi \times 10^{-7}$ T m A^{-1}

Answer (1)

Sol. $\chi_m = 599$

$\mu_r = 1 + \chi_m = 600$

$\mu = \mu_r \mu_0$

$\mu = 600 \times 4\pi \times 10^{-7}$

$\mu = 2400\pi \times 10^{-7}$

$\mu = 2.4\pi \times 10^{-4}$ T m A^{-1}

172. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is :
($\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1})

(1) 6.28×10^{-4} T (2) 3.14×10^{-4} T
(3) 6.28×10^{-5} T (4) 3.14×10^{-5} T

Answer (1)

Sol. Magnetic field at centre of solenoid = $\mu_0 nI$

$n = \frac{N}{L} = \frac{100}{50 \times 10^{-2}} = 200$ turns / m

I = 2.5 A

On putting the values

$B = 4\pi \times 10^{-7} \times 200 \times 2.5$

$= 6.28 \times 10^{-4}$ T

173. A charged particle having drift velocity of 7.5×10^{-4} m s^{-1} in an electric field of 3×10^{-10} Vm^{-1}, has a mobility in $m^2 V^{-1} s^{-1}$ of :

(1) 2.25×10^{15} (2) 2.5×10^{6}
(3) 2.5×10^{-6} (4) 2.25×10^{-15}

Answer (2)

Sol. Mobility, $\mu = \frac{v_d}{E}$

$= \frac{7.5 \times 10^{-4}}{3 \times 10^{-10}}$

$= 2.5 \times 10^{6}$ $m^2 V^{-1} s^{-1}$

174. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5\ r_2$) through 1 K are in the ratio :

(1) $\frac{27}{8}$ (2) $\frac{9}{4}$
(3) $\frac{3}{2}$ (4) $\frac{5}{3}$

Answer (1)

Sol. $\Delta Q = ms\Delta T$

$\Delta Q = \frac{4}{3}\pi r^3 \rho s \Delta T$

$\frac{\Delta Q_1}{\Delta Q_2} = \left(\frac{r_1}{r_2}\right)^3$

$= (1.5)^3$

$= \frac{27}{8}$

175. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is 1.227×10^{-2} nm, the potential difference is :

(1) 10 V (2) 10^2 V
(3) 10^3 V (4) 10^4 V

Answer (4)

Sol. $\lambda = \frac{12.27}{\sqrt{V}}$ Å

$\sqrt{V} = \frac{12.27 \times 10^{-10}}{1.227 \times 10^{-11}} = 10^2$

$\therefore$ V = 10^4 volts

176. Taking into account of the significant figures, what is the value of 9.99 m – 0.0099 m?

(1) 9.9801 m
(2) 9.98 m
(3) 9.980 m
(4) 9.9 m

Answer (2)

Sol.
$$\begin{array}{r} 9.99 \\ -\ 0.0099 \\ \hline 9.9801\,\text{m} \end{array}$$

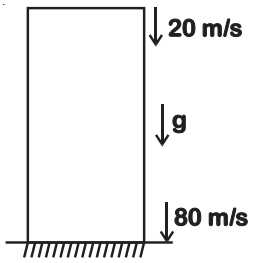
In subtraction, answer should be reported to least number of decimal places, so answer should be 9.98 m.

177. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is : (g = 10 m/s^2)

(1) 360 m (2) 340 m
(3) 320 m (4) 300 m

Answer (4)

Sol.



$v^2 = u^2 + 2gh$

v = 80 m/s

u = 20 m/s

$h = \frac{v^2 - u^2}{2g} = \frac{6400 - 400}{20} = 300$ m

178. A capillary tube of radius r is immersed in water and water rises in it to a height h. The mass of the water in the capillary is 5 g. Another capillary tube of radius 2r is immersed in water. The mass of water that will rise in this tube is :

(1) 2.5 g (2) 5.0 g

(3) 10.0 g (4) 20.0 g

Answer (3)

Sol. Force of surface tension balances the weight of water in capillary tube.

$F_S = 2\pi r T\cos\theta = mg$

Here, T and θ are constant

So, $m \propto r$

Hence, $\frac{m_2}{5.0} = \frac{2r}{r}$

$\Rightarrow m_2 = 10.0$ g

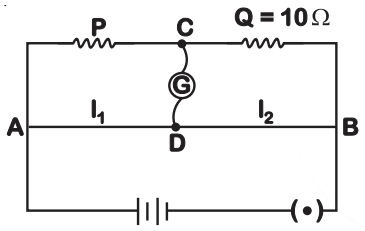
179. A resistance wire connected in the left gap of a metre bridge balances a 10 Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 Ω of the resistance wire is :

(1) 1.0×10^{-2} m (2) 1.0×10^{-1} m

(3) 1.5×10^{-1} m (4) 1.5×10^{-2} m

Answer (2)

Sol.



Initially, $\frac{P}{10} = \frac{l_1}{l_2} = \frac{3}{2}$

$\Rightarrow P = \frac{30}{2} = 15\,\Omega$

Now Resistance, $R = \frac{\rho l}{A}$

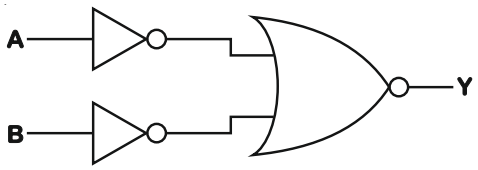
$\frac{R_1}{R_2} = \frac{l_1}{l_2}$

$\Rightarrow \frac{15}{1} = \frac{1.5}{l_2}$

$l_2 = 0.1$ m

$= 1.0 \times 10^{-1}$ m

180. For the logic circuit shown, the truth table is:



(1)

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

(2)

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

(3)

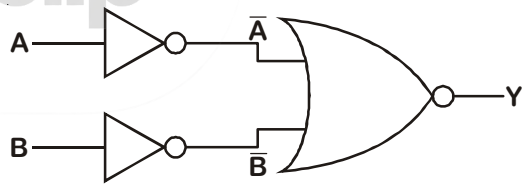
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(4)

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

Answer (1)

Sol.



$Y = \overline{\bar{A} + \bar{B}}$

$= \overline{\overline{A \cdot B}}$

$= A \cdot B \Rightarrow$ AND Gate

Truth Table

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

❑ ❑ ❑