

DATE : 13/09/2020



# Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Limited)

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Test Booklet Code

**F2**

AKANH

Time : 3 hrs.

## Answers & Solutions

Max. Marks : 720

*for*

## NEET (UG) - 2020

### 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/markings 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 **F2**.
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. Name the enzyme that facilitates opening of DNA helix during transcription.
- (1) DNA polymerase
  - (2) RNA polymerase
  - (3) DNA ligase
  - (4) DNA helicase

**Answer (2)**

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

2. Which of the following would help in prevention of diuresis?
- (1) Atrial natriuretic factor causes vasoconstriction
  - (2) Decrease in secretion of renin by JG cells
  - (3) More water reabsorption due to undersecretion of ADH
  - (4) Reabsorption of Na<sup>+</sup> and water from renal tubules due to aldosterone

**Answer (4)**

**Sol.** Adrenal cortex secretes mineralocorticoids like aldosterone which increase the reabsorption of Na<sup>+</sup> and water from renal tubule that prevent diuresis.

3. Meiotic division of the secondary oocyte is completed
- (1) After zygote formation
  - (2) At the time of fusion of a sperm with an ovum
  - (3) Prior to ovulation
  - (4) At the time of copulation

**Answer (2)**

**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 II<sup>nd</sup> polar body.

4. 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) | (iii) | (iv)  | (ii) | (i)   |
| (2) | (iv)  | (i)   | (ii) | (iii) |
| (3) | (ii)  | (i)   | (iv) | (iii) |
| (4) | (iv)  | (iii) | (ii) | (i)   |

**Answer (1)**

- 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<sub>2</sub> during photosynthesis

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

- (1) *Anabaena* and *Volvox*
- (2) *Chlorella* and *Spirulina*
- (3) *Laminaria* and *Sargassum*
- (4) *Gelidium* and *Gracilaria*

**Answer (2)**

**Sol.** *Chlorella* and *Spirulina* are unicellular algae. *Gelidium*, *Gracilaria*, *Laminaria* and *Sargassum* are multicellular. *Volvox* is colonial.

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

- (1) 1 molecule of 6-C compound
- (2) 1 molecule of 4-C compound and 1 molecule of 2-C compound
- (3) 2 molecules of 3-C compound
- (4) 1 molecule of 3-C compound

**Answer (4)**

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

7. 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) (i)	(ii)	(iv)	(iii)
(2) (ii)	(i)	(iii)	(iv)
(3) (iii)	(iv)	(ii)	(i)
(4) (iv)	(i)	(ii)	(iii)

Answer (3)

Sol. Option (3) 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.

8. 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) (iii)	(ii)	(iv)	(i)
(2) (ii)	(iii)	(iv)	(i)
(3) (iv)	(iii)	(i)	(ii)
(4) (i)	(iv)	(ii)	(iii)

Answer (2)

Sol. The correct option is (2) because

- (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

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

Answer (2)

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.

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

- (1) They lie free in the cytoplasm
- (2) These represent reserve material in cytoplasm
- (3) They are not bound by any membrane
- (4) These are involved in ingestion of food particles

Answer (4)

Sol. These are not involved in ingestion of food particles

11. Strobili or cones are found in

- (1) *Marchantia*                      (2) *Equisetum*
- (3) *Salvinia*                          (4) *Pteris*

Answer (2)

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

12. Montreal protocol was signed in 1987 for control of
- (1) Release of Green House gases
  - (2) Disposal of e-wastes
  - (3) Transport of Genetically modified organisms from one country to another
  - (4) Emission of ozone depleting substances

**Answer (4)**

**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.

13. Which of the following statements is correct?
- (1) Adenine pairs with thymine through three H-bonds
  - (2) Adenine does not pair with thymine
  - (3) Adenine pairs with thymine through two H-bonds
  - (4) Adenine pairs with thymine through one H-bond

**Answer (3)**

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

14. The body of the ovule is fused within the funicle at
- (1) Nucellus
  - (2) Chalaza
  - (3) Hilum
  - (4) Micropyle

**Answer (3)**

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

15. The sequence that controls the copy number of the linked DNA in the vector, is termed
- (1) Palindromic sequence
  - (2) Recognition site
  - (3) Selectable marker
  - (4) Ori site

**Answer (4)**

**Sol.** The correct option is (4) 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.

16. Identify the wrong statement with regard to Restriction Enzymes.

- (1) They are useful in genetic engineering.
- (2) Sticky ends can be joined by using DNA ligases.
- (3) Each restriction enzyme functions by inspecting the length of a DNA sequence.
- (4) They cut the strand of DNA at palindromic sites.

**Answer (2)**

**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.

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

- (1) Ammonia and oxygen
- (2) Ammonia and hydrogen
- (3) Ammonia alone
- (4) Nitrate alone

**Answer (2)**



Ammonia and Hydrogen.

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

- (1) PS-I to NADP<sup>+</sup>
- (2) PS-I to ATP synthase
- (3) PS-II to Cytb<sub>6</sub>f complex
- (4) Cytb<sub>6</sub>f complex to PS-I

**Answer (3)**

**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.

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

- (1) Low concentration of LH
- (2) Low concentration of FSH
- (3) High concentration of Estrogen
- (4) High concentration of Progesterone

**Answer (3)**

**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.

20. The first phase of translation is

- (1) Aminoacylation of tRNA
- (2) Recognition of an anti-codon
- (3) Binding of mRNA to ribosome
- (4) Recognition of DNA molecule

**Answer (1)**

**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.

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

- (1) Prop roots
- (2) Lateral roots
- (3) Fibrous roots
- (4) Primary roots

**Answer (3)**

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

22. Identify the wrong statement with reference to transport of oxygen

- (1) Higher  $H^+$  conc. in alveoli favours the formation of oxyhaemoglobin
- (2) Low  $pCO_2$  in alveoli favours the formation of oxyhaemoglobin
- (3) Binding of oxygen with haemoglobin is mainly related to partial pressure of  $O_2$
- (4) Partial pressure of  $CO_2$  can interfere with  $O_2$  binding with haemoglobin

**Answer (1)**

**Sol.** The correct option is (1) 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.

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

- (1) Acetocarmine in UV radiation
- (2) Ethidium bromide in infrared radiation
- (3) Acetocarmine in bright blue light
- (4) Ethidium bromide in UV radiation

**Answer (4)**

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

24. The enzyme enterokinase helps in conversion of

- (1) caseinogen into casein
- (2) pepsinogen into pepsin
- (3) protein into polypeptides
- (4) trypsinogen into trypsin

**Answer (4)**

**Sol.** The correct option is (4) because trypsinogen is activated by an enzyme, enterokinase, secreted by the intestinal mucosa into active trypsin. Trypsinogen is a zymogen from pancreas.

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

- (1) Boveri
- (2) Morgan
- (3) Mendel
- (4) Sutton

**Answer (2)**



**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.

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

- (1) 50 million                      (2) 7 million  
(3) 1.5 million                      (4) 20 million

**Answer (2)**

**Sol.** • Robert May estimated global species diversity at about 7 million.

- Although some extreme estimates range from 20 to 50 million.

27. Match the organism with its use in biotechnology.

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

Select the correct option from the following:

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

**Answer (4)**

**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 1<sup>st</sup> recombinant DNA molecule was performed using native plasmid of *Salmonella typhimurium*.

28. Identify the correct statement with regard to G<sub>1</sub> phase (Gap 1) of interphase.

- (1) Cell is metabolically active, grows but does not replicate its DNA.  
(2) Nuclear Division takes place.  
(3) DNA synthesis or replication takes place.  
(4) Reorganisation of all cell components takes place.

**Answer (1)**

**Sol.** During G<sub>1</sub> 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.

29. Which of the following is correct about viroids?

- (1) They have DNA with protein coat  
(2) They have free DNA without protein coat  
(3) They have RNA with protein coat  
(4) They have free RNA without protein coat

**Answer (4)**

**Sol.** Viroids have free RNA without protein coat.

30. 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) Dicotyledonous stem  
(2) Dicotyledonous root  
(3) Monocotyledonous stem  
(4) Monocotyledonous root

**Answer (3)**

**Sol.** All features are related to monocotyledonous stems

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

- (1)  $\text{CH}_4$ ,  $\text{H}_2$ ,  $\text{NH}_3$  and water vapor at  $600^\circ\text{C}$
- (2)  $\text{CH}_3$ ,  $\text{H}_2$ ,  $\text{NH}_3$  and water vapor at  $600^\circ\text{C}$
- (3)  $\text{CH}_4$ ,  $\text{H}_2$ ,  $\text{NH}_3$  and water vapor at  $800^\circ\text{C}$
- (4)  $\text{CH}_3$ ,  $\text{H}_2$ ,  $\text{NH}_4$  and water vapor at  $800^\circ\text{C}$

**Answer (3)**

**Sol.** In 1953, S.L. Miller, an American scientist created electric discharge in a closed flask containing  $\text{CH}_4$ ,  $\text{H}_2$ ,  $\text{NH}_3$  and water vapor at  $800^\circ\text{C}$ .

32. Identify the basic amino acid from the following.

- (1) Lysine
- (2) Valine
- (3) Tyrosine
- (4) Glutamic Acid

**Answer (1)**

**Sol.** Option (1) 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.

33. Snow-blindness in Antarctic region is due to

- (1) High reflection of light from snow
- (2) Damage to retina caused by infra-red rays
- (3) Freezing of fluids in the eye by low temperature
- (4) Inflammation of cornea due to high dose of UV-B radiation

**Answer (4)**

**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.

34. 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) S phase
- (2)  $G_2$  phase
- (3) M phase
- (4)  $G_1$  phase

**Answer (3)**

**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.

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

- (1) Himalayas
- (2) Amazon forests
- (3) Western Ghats of India
- (4) Madagascar

**Answer (2)**

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

36. Identify the incorrect statement.

- (1) Sapwood is the innermost secondary xylem and is lighter in colour
- (2) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour
- (3) Heart wood does not conduct water but gives mechanical support
- (4) Sapwood is involved in conduction of water and minerals from root to leaf

**Answer (1)**

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

**Correct statement:** Sapwood is outermost secondary xylem.

37. Floridean starch has structure similar to

- (1) Mannitol and algin
- (2) Laminarin and cellulose
- (3) Starch and cellulose
- (4) Amylopectin and glycogen

**Answer (4)**

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

38. Which of the following is not an attribute of a population?
- (1) Mortality
  - (2) Species interaction
  - (3) Sex ratio
  - (4) Natality

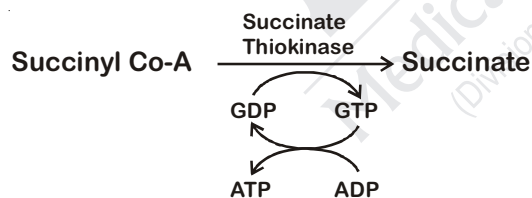
**Answer (2)**

Sol. Natality	-	Population attribute
Mortality	-	Population attribute
Species interaction	-	Population interaction
Sex ratio	-	Population attribute

39. The number of substrate level phosphorylations in one turn of citric acid cycle is
- (1) Two
  - (2) Three
  - (3) Zero
  - (4) One

**Answer (4)**

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



40. Identify the correct statement with reference to human digestive system.
- (1) Ileum is a highly coiled part
  - (2) Vermiform appendix arises from duodenum
  - (3) Ileum opens into small intestine
  - (4) Serosa is the innermost layer of the alimentary canal

**Answer (1)**

**Sol.** Option (1) is correct as ileum is a highly coiled tube. Serosa is the outermost layer of the alimentary canal, thus, option (4) is an incorrect statement.

A narrow finger-like tubular projection, the vermiform appendix arises from caecum part of large intestine thus, option (2) is incorrect statement. Ileum opens into the large intestine, thus option (3) is also an incorrect statement.

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

- (1) ICSI and ZIFT
- (2) GIFT and ICSI
- (3) ZIFT and IUT
- (4) GIFT and ZIFT

**Answer (3)**

**Sol.** Option (3) 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 (1), (2) 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.

42. 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 and Net primary productivity are one and same
- (2) There is no relationship between Gross primary productivity and Net primary productivity
- (3) Gross primary productivity is always less than net primary productivity
- (4) Gross primary productivity is always more than net primary productivity

**Answer (4)**

**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



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

- (1) Ethylene
- (2) Abscisic acid
- (3) Cytokinin
- (4) Gibberellin

**Answer (4)**

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

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

- (1) Defence action
- (2) Effect on reproduction
- (3) Nutritive value
- (4) Growth response

**Answer (1)**

**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.

45. Select the correct match

- (1) Sickle cell anaemia – Autosomal recessive trait, chromosome-11
- (2) Thalassemia – X linked
- (3) Haemophilia – Y linked
- (4) Phenylketonuria – Autosomal dominant trait

**Answer (1)**

**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

46. Select the correct statement.

- (1) Insulin acts on pancreatic cells and adipocytes.
- (2) Insulin is associated with hyperglycemia.
- (3) Glucocorticoids stimulate gluconeogenesis.
- (4) Glucagon is associated with hypoglycemia.

**Answer (3)**

**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.

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

**Answer (1)**

**Sol.** The correct option is (1) 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.

48. Choose the correct pair from the following

- (1) Nucleases – Separate the two strands of DNA
- (2) Exonucleases – Make cuts at specific positions within DNA
- (3) Ligases – Join the two DNA molecules
- (4) Polymerases – Break the DNA into fragments

**Answer (3)**

**Sol.** Ligases join the two DNA molecules.

49. Embryological support for evolution was disapproved by
- (1) Charles Darwin
  - (2) Oparin
  - (3) Karl Ernst von Baer
  - (4) Alfred Wallace

**Answer (3)**

**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.

50. Goblet cells of alimentary canal are modified from
- (1) Chondrocytes
  - (2) Compound epithelial cells
  - (3) Squamous epithelial cells
  - (4) Columnar epithelial cells

**Answer (4)**

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

51. Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to
- (1) Plant nematodes
  - (2) Insect predators
  - (3) Insect pests
  - (4) Fungal diseases

**Answer (3)**

**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.

52. 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) (a) and (b)
- (2) (b) and (c)
- (3) (d) and (c)
- (4) (c) and (a)

**Answer (2)**

**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.

53. Which of the following is put into Anaerobic sludge digester for further sewage treatment?
- (1) Effluents of primary treatment
  - (2) Activated sludge
  - (3) Primary sludge
  - (4) Floating debris

**Answer (2)**

**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.

54. Identify the substances having glycosidic bond and peptide bond, respectively in their structure
- (1) Cellulose, lecithin
  - (2) Inulin, insulin
  - (3) Chitin, cholesterol
  - (4) Glycerol, trypsin

**Answer (2)**

**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.

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

Column-I		Column-II	
(a) Typhoid		(i) <i>Wuchereria</i>	
(b) Pneumonia		(ii) <i>Plasmodium</i>	
(c) Filariasis		(iii) <i>Salmonella</i>	
(d) Malaria		(iv) <i>Haemophilus</i>	
(a)	(b)	(c)	(d)
(1) (ii)	(i)	(iii)	(iv)
(2) (iv)	(i)	(ii)	(iii)
(3) (i)	(iii)	(ii)	(iv)
(4) (iii)	(iv)	(i)	(ii)

Answer (4)

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*.

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

Column-I		Column-II	
(a) <i>Clostridium butylicum</i>		(i) Cyclosporin-A	
(b) <i>Trichoderma polysporum</i>		(ii) Butyric Acid	
(c) <i>Monascus purpureus</i>		(iii) Citric Acid	
(d) <i>Aspergillus niger</i>		(iv) Blood cholesterol lowering agent	
(a)	(b)	(c)	(d)
(1) (i)	(ii)	(iv)	(iii)
(2) (iv)	(iii)	(ii)	(i)
(3) (iii)	(iv)	(ii)	(i)
(4) (ii)	(i)	(iv)	(iii)

Answer (4)

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

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

- (1) Cross breeding
- (2) Inbreeding
- (3) Out crossing
- (4) Mutational breeding

Answer (1)

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.

58. 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), (b) and (d)
  - (2) only (d)
  - (3) (a) and (b)
  - (4) (c) and (d)

Answer (3)

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

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

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

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

Answer (4)

Sol. (a) *Locusta* is a gregarious 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.

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

- (1) Golgi bodies
- (2) Polysomes
- (3) Endoplasmic reticulum
- (4) Peroxisomes

Answer (1)

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

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

- (1) 5' - CTTAAG - 3'  
3' - GAATTC - 5'
- (2) 5' - GGATCC - 3'  
3' - CCTAGG - 5'
- (3) 5' - GAATTC - 3'  
3' - CTTAAG - 5'
- (4) 5' - GGAACC - 3'  
3' - CCTTGG - 5'

Answer (3)

Sol. The correct option is (3) because the specific palindromic sequence which is recognised by *EcoRI* is

5' - GAATTC - 3'

3' - CTTAAG - 5'

62. Dissolution of the synaptonemal complex occurs during

- (1) Diplotene
- (2) Leptotene
- (3) Pachytene
- (4) Zygotene

Answer (1)

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

63. 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) (iv)  | (iii) | (ii)  | (i)  |
| (2) (i)   | (ii)  | (iii) | (iv) |
| (3) (ii)  | (iii) | (iv)  | (i)  |
| (4) (iii) | (ii)  | (i)   | (iv) |

Answer (3)

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

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

- (1) 14
- (2) 8
- (3) 4
- (4) 2

Answer (1)

Sol. Mendel selected 14 True breeding plant varieties.

65. 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) <i>Bacillus thuringiensis</i>	
(a)	(b)	(c)	(d)
(1) (ii)	(iii)	(iv)	(i)
(2) (i)	(ii)	(iii)	(iv)
(3) (iv)	(i)	(ii)	(iii)
(4) (iii)	(ii)	(i)	(iv)

Answer (3)

Sol. The correct option is (3) because

- In Bt cotton the specific Bt toxin gene was isolated from *Bacillus thuringiensis*.
- The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.
- RNAi (RNA interference) takes place in all eukaryotic organisms as a method of cellular defense.
- PCR is now routinely used to detect HIV in suspected AIDS patients.

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

Column-I		Column-II	
(a) 6-15 pairs of gill slits		(i) <i>Trygon</i>	
(b) Heterocercal caudal fin		(ii) Cyclostomes	
(c) Air Bladder		(iii) Chondrichthyes	
(d) Poison sting		(iv) Osteichthyes	
(a)	(b)	(c)	(d)
(1) (iv)	(ii)	(iii)	(i)
(2) (i)	(iv)	(iii)	(ii)
(3) (ii)	(iii)	(iv)	(i)
(4) (iii)	(iv)	(i)	(ii)

Answer (3)

- 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

67. The process of growth is maximum during

- Senescence
- Dormancy
- Log phase
- Lag phase

Answer (3)

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.

68. Identify the wrong statement with reference to immunity.

- Active immunity is quick and gives full response.
- Foetus receives some antibodies from mother, it is an example for passive immunity.
- When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".
- When ready-made antibodies are directly given, it is called "Passive immunity".

Answer (1)

Sol. The correct option is (1) 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.



69. 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) (iii)	(ii)	(iv)	(i)
(2) (iv)	(iii)	(i)	(ii)
(3) (ii)	(iv)	(i)	(iii)
(4) (i)	(iii)	(ii)	(iv)

Answer (2)

Sol. (a) 11<sup>th</sup> and 12<sup>th</sup> 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 2<sup>nd</sup> and the 7<sup>th</sup> rib.

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

70. 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  $6.6 \times 10^9$  bp, then the length of the DNA is approximately

- (1) 2.2 meters
- (2) 2.7 meters
- (3) 2.0 meters
- (4) 2.5 meters

Answer (1)

Sol. Length of DNA =  $[0.34 \times 10^{-9}] \text{ m} \times 6.6 \times 10^9 \text{ bp}$   
= 2.2 m

Distance between 2 base pair in DNA helix  
= 0.34 nm =  $0.34 \times 10^{-9} \text{ m}$

Total number of base pair =  $6.6 \times 10^9 \text{ bp}$

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

- (1) Ketonuria and Glycosuria
- (2) Renal calculi and Hyperglycaemia
- (3) Uremia and Ketonuria
- (4) Uremia and Renal Calculi

Answer (1)

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

72. Bilaterally symmetrical and acoelomate animals are exemplified by

- (1) Aschelminthes
- (2) Annelida
- (3) Ctenophora
- (4) Platyhelminthes

Answer (4)

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

73. Ray florets have

- (1) Hypogynous ovary
- (2) Half inferior ovary
- (3) Inferior ovary
- (4) Superior ovary

Answer (3)

Sol. • Ray floret have inferior ovary.

- Epigynous flower are formed in family Asteraceae (e.g., Sunflower)

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

- (1) Female gametocytes
- (2) Male gametocytes
- (3) Trophozoites
- (4) Sporozoites

Answer (4)

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

75. Which of the following statements is not correct?

- (1) The functional insulin has A and B chains linked together by hydrogen bonds.
- (2) Genetically engineered insulin is produced in *E. Coli*.
- (3) In man insulin is synthesised as a proinsulin
- (4) The proinsulin has an extra peptide called C-peptide.

**Answer (1)**

**Sol.** The correct option is (1) because functional insulin has A and B chains linked together by disulphide bridges.

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

- (1) Wind and water
- (2) Insects and water
- (3) Insects or wind
- (4) Water currents only

**Answer (3)**

**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

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

- (1) Proximal convoluted tubule of nephron
- (2) Eustachian tube
- (3) Lining of intestine
- (4) Ducts of salivary gland

**Answer (1)**

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

78. 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)	(iii)	(i)	(iv)	(ii)
(2)	(ii)	(i)	(iv)	(iii)
(3)	(iv)	(iii)	(i)	(ii)
(4)	(iii)	(ii)	(i)	(iv)

**Answer (1)**

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

Diabetes mellitus is due to hyposecretion of insulin from  $\beta$ -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.

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

- (1) Lectin
- (2) Insulin
- (3) Haemoglobin
- (4) Collagen

**Answer (4)**

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

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

- (1) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
- (2) the head holds a  $1/3^{\text{rd}}$  of a nervous system while the rest is situated along the dorsal part of its body.
- (3) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.
- (4) the cockroach does not have nervous system.

**Answer (1)**

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

81. Flippers of Penguins and Dolphins are examples of
- (1) Industrial melanism
  - (2) Natural selection
  - (3) Adaptive radiation
  - (4) Convergent evolution

**Answer (4)**

**Sol.** The correct option is (4) because flippers of Penguins and Dolphins are an example of analogous organs. Analogous structures are a result of convergent evolution.

82. 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) Imbibition
  - (2) Plasmolysis
  - (3) Transpiration
  - (4) Root pressure

**Answer (4)**

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

83. 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) (i)   | (ii)  | (iv)  | (iii) |
| (2) (ii)  | (iv)  | (iii) | (i)   |
| (3) (iii) | (iv)  | (i)   | (ii)  |
| (4) (iv)  | (iii) | (ii)  | (i)   |

**Answer (4)**

**Sol.** Zygotene → Synapsis  
 Pachytene → Crossing over  
 Diplotene → Chiasmata formation  
 Diakinesis → Terminalisation

84. The QRS complex in a standard ECG represents
- (1) Depolarisation of ventricles
  - (2) Repolarisation of ventricles
  - (3) Repolarisation of auricles
  - (4) Depolarisation of auricles

**Answer (1)**

**Sol.** QRS complex represents the depolarisation of ventricles.

85. Select the option including all sexually transmitted diseases.
- (1) AIDS, Malaria, Filaria
  - (2) Cancer, AIDS, Syphilis
  - (3) Gonorrhoea, Syphilis, Genital herpes
  - (4) Gonorrhoea, Malaria, Genital herpes

**Answer (3)**

**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.

86. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
- (1) When  $I^A$  and  $I^B$  are present together, they express same type of sugar.
  - (2) Allele 'i' does not produce any sugar.
  - (3) The gene (I) has three alleles.
  - (4) A person will have only two of the three alleles.

**Answer (1)**

**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.

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

- (1) Phenolic acid
- (2) Para-ascorbic acid
- (3) Gibberellic acid
- (4) Abscisic acid

Answer (3)

Sol. • Gibberellic acid break seed dormancy.  
 • It activate synthesis of  $\alpha$ -amylase which breakdown starch into simple sugar.

88. 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)
(4) (iii)	(i)	(iv)	(ii)
(1) (iv)	(ii)	(i)	(iii)
(2) (i)	(ii)	(iv)	(iii)
(3) (ii)	(iii)	(i)	(iv)

Answer (1)

Sol. • Option (1) 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.

89. The ovary is half inferior in :

- (1) Sunflower
- (2) Plum
- (3) Brinjal
- (4) Mustard

Answer (2)

Sol. The ovary is half inferior in Plum.

90. 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) (iii) | (iv)  | (i)   | (ii) |
| (2) (ii)  | (iii) | (i)   | (iv) |
| (3) (ii)  | (iv)  | (iii) | (i)  |
| (4) (iii) | (i)   | (iv)  | (ii) |

Answer (3)

Sol. Option (3) 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.

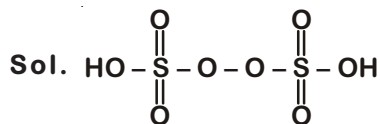
Chitin is a homopolymer present in the cell wall of fungi and exoskeleton of arthropods, so, (c) matches with (iii) in column II.

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

91. Which of the following oxoacid of sulphur has -O-O- linkage?

- (1)  $\text{H}_2\text{S}_2\text{O}_8$ , peroxodisulphuric acid
- (2)  $\text{H}_2\text{S}_2\text{O}_7$ , pyrosulphuric acid
- (3)  $\text{H}_2\text{SO}_3$ , sulphurous acid
- (4)  $\text{H}_2\text{SO}_4$ , sulphuric acid

Answer (1)



Peroxodisulphuric acid

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

- (1) threshold energy
- (2) collision frequency
- (3) activation energy
- (4) heat of reaction

Answer (4)

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

93. Identify the incorrect match.

Name	IUPAC Official Name
(a) Unnilunium	(i) Mendeleevium
(b) Unniltrium	(ii) Lawrencium
(c) Unnilhexium	(iii) Seaborgium
(d) Unununnium	(iv) Darmstadtium
(1) (c), (iii)	(2) (d), (iv)
(3) (a), (i)	(4) (b), (ii)

Answer (2)

Sol. Unununnium

Atomic number = 111

IUPAC official name : Roentgenium

94. A mixture of  $\text{N}_2$  and Ar gases in a cylinder contains 7 g of  $\text{N}_2$  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  $\text{N}_2$  is :

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

- (1) 15 bar
- (2) 18 bar
- (3) 9 bar
- (4) 12 bar

Answer (1)

Sol.  $n_{\text{N}_2} = \frac{7}{28} = \frac{1}{4} = 0.25$

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

Now, Applying Dalton's law of partial

pressure,  $p_{\text{N}_2} = (\chi_{\text{N}_2}) P_{\text{Total}}$

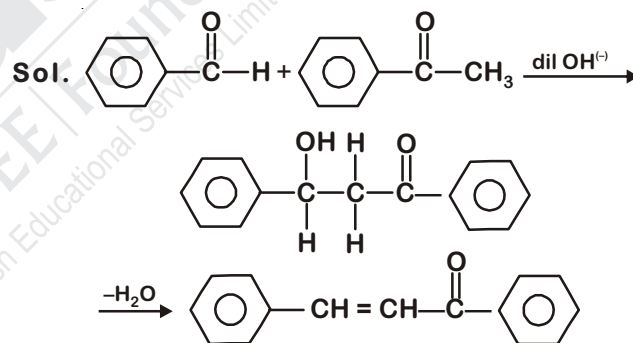
$= \frac{0.25}{0.45} \times 27 \text{ bar}$

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

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

- (1) Cross Cannizzaro's reaction
- (2) Cross Aldol condensation
- (3) Aldol condensation
- (4) Cannizzaro's reaction

Answer (2)



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

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

- (1) 1 g of  $\text{O}_2(\text{g})$  [Atomic mass of O = 16]
- (2) 1 g of Li(s) [Atomic mass of Li = 7]
- (3) 1 g of Ag(s) [Atomic mass of Ag = 108]
- (4) 1 g of Mg(s) [Atomic mass of Mg = 24]

Answer (2)

Sol. • Number of Mg atoms =  $\frac{1}{24} \times N_A$

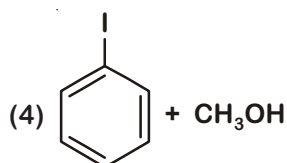
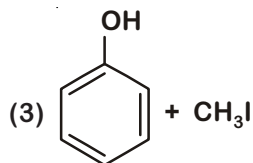
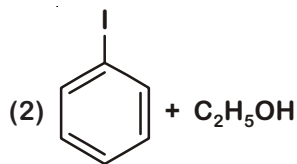
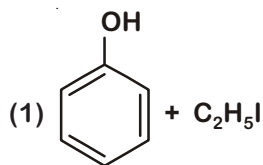
• Number of O atoms =  $\frac{1}{32} \times 2 \times N_A$

• Number of Li atoms =  $\frac{1}{7} \times N_A$

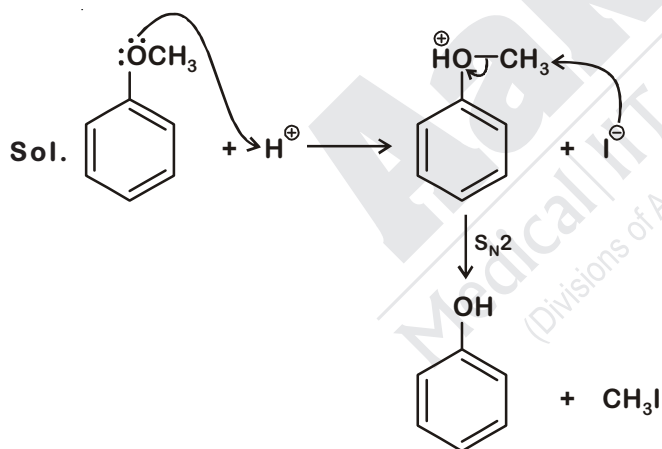
• Number of Ag atoms =  $\frac{1}{108} \times N_A$



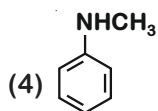
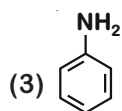
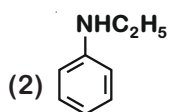
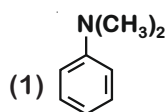
97. Anisole on cleavage with HI gives



Answer (3)



98. Which of the following amine will give the carbylamine test?



Answer (3)

Sol. Aliphatic and aromatic primary amines give carbylamine reaction.

99. Identify the incorrect statement.

- (1) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.
- (2) The oxidation states of chromium in CrO<sub>4</sub><sup>2-</sup> and Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> are not the same.
- (3) Cr<sup>2+</sup> (d<sup>4</sup>) is a stronger reducing agent than Fe<sup>2+</sup> (d<sup>6</sup>) in water.
- (4) 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.

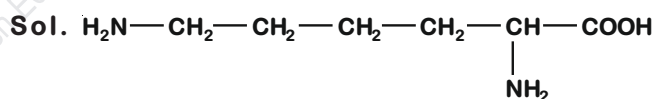
Answer (2)

Sol. Oxidation state of Cr in CrO<sub>4</sub><sup>2-</sup> and Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> is +6

100. Which of the following is a basic amino acid?

- (1) Tyrosine
- (2) Lysine
- (3) Serine
- (4) Alanine

Answer (2)



(Structure of Lysine)

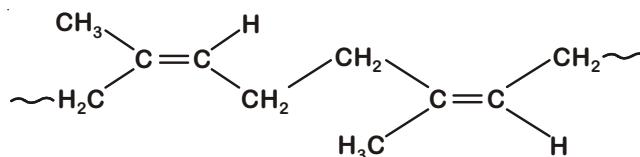
Lysine is a basic amino acid.

101. Which of the following is a natural polymer?

- (1) polybutadiene
- (2) poly (Butadiene-acrylonitrile)
- (3) cis-1, 4-polyisoprene
- (4) poly (Butadiene-styrene)

Answer (3)

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



102. Match the following and identify the correct option.

- |   |   |
|---|---|
| (a) $\text{CO(g)} + \text{H}_2\text{(g)}$ | (i) $\text{Mg}(\text{HCO}_3)_2 + \text{Ca}(\text{HCO}_3)_2$ |
| (b) Temporary hardness of water           | (ii) An electron deficient hydride                          |
| (c) $\text{B}_2\text{H}_6$                | (iii) Synthesis gas   |
| (d) $\text{H}_2\text{O}_2$                | (iv) Non-planar structure                                   |

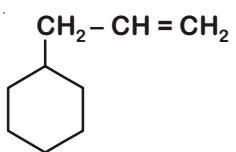
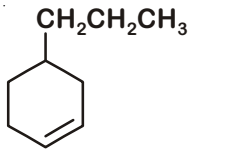
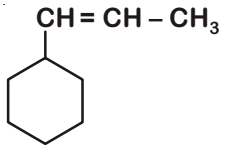
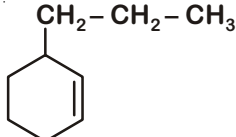
- |           |       |      |      |
|-----------|-------|------|------|
| (a)       | (b)   | (c)  | (d)  |
| (1) (iii) | (iv)  | (ii) | (i)  |
| (2) (i)   | (iii) | (ii) | (iv) |
| (3) (iii) | (i)   | (ii) | (iv) |
| (4) (iii) | (ii)  | (i)  | (iv) |

Answer (3)

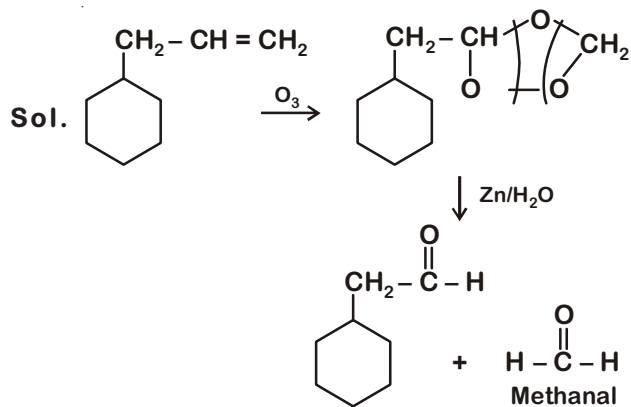
Sol. • Mixture of CO and  $\text{H}_2$  gases is known as water gas or synthesis gas.

- Temporary hardness of water is due to bicarbonates of calcium and magnesium.
- Diborane ( $\text{B}_2\text{H}_6$ ) is an electron deficient hydride.
- $\text{H}_2\text{O}_2$  is non-planar molecule having open book like structure.

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

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

Answer (1)



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

- (1) 500 s                      (2) 1000 s  
(3) 100 s                     (4) 200 s

Answer (1)

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

$$4.606 \times 10^{-3} = \frac{2.303}{t} \log \frac{2}{0.2}$$

$$t = \frac{2.303}{4.606 \times 10^{-3}} \times \log 10$$

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

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

- (1)  $\text{H}_2\text{S}$  gas  
(2)  $\text{SO}_2$  gas  
(3) Hydrogen gas  
(4) Oxygen gas

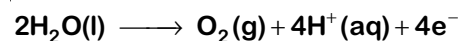
Answer (4)

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

At cathode :



At anode :



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

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

**Answer (3)**

**Sol.** For BCC,

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

$$\qquad \qquad \qquad r = \text{radius}$$

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

Given,  $a = 288$  pm

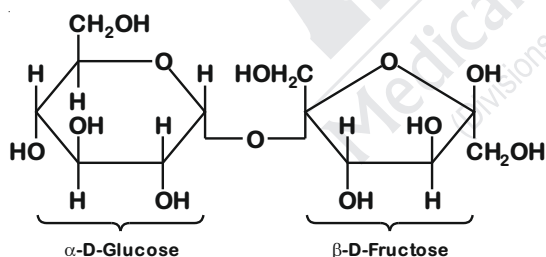
$$r = \frac{\sqrt{3}}{4} \times 288$$

107. Sucrose on hydrolysis gives

- (1)  $\alpha$ -D-Glucose +  $\beta$ -D-Fructose  
 (2)  $\alpha$ -D-Fructose +  $\beta$ -D-Fructose  
 (3)  $\beta$ -D-Glucose +  $\alpha$ -D-Fructose  
 (4)  $\alpha$ -D-Glucose +  $\beta$ -D-Glucose

**Answer (1)**

**Sol.** Sucrose  $\xrightarrow{\text{Hydrolysis}}$   $\alpha$ -D-Glucose +  $\beta$ -D-Fructose



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

- (1) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.  
 (2) It is produced due to incomplete combustion.  
 (3) It forms carboxyhaemoglobin  
 (4) It reduces oxygen carrying ability of blood.

**Answer (1)**

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

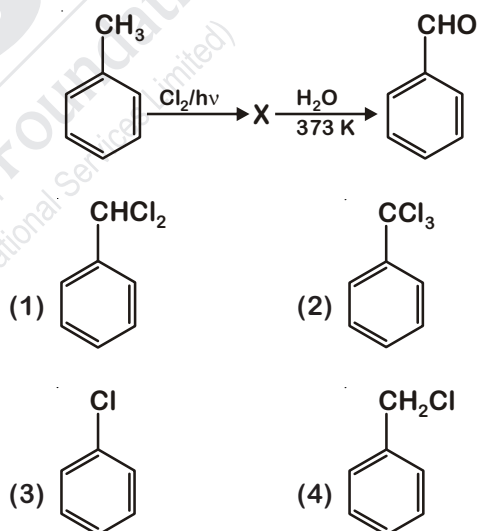
109. The mixture which shows positive deviation from Raoult's law is

- (1) Acetone + Chloroform  
 (2) Chloroethane + Bromoethane  
 (3) Ethanol + Acetone  
 (4) Benzene + Toluene

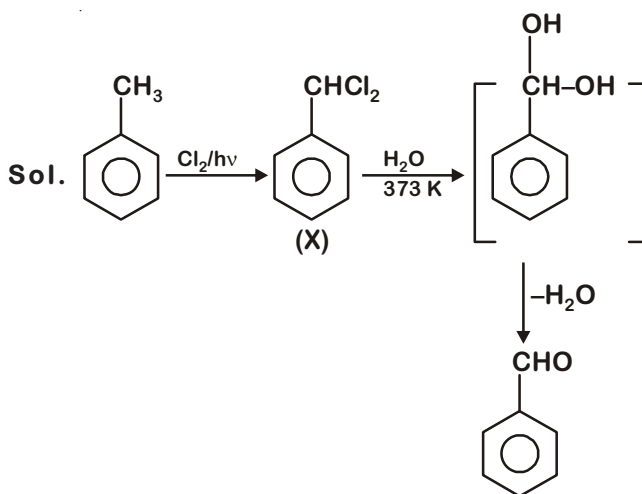
**Answer (3)**

**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.

110. Identify compound X in the following sequence of reactions



**Answer (1)**



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

- (1)  $0.40 \text{ K}$
- (2)  $0.60 \text{ K}$
- (3)  $0.20 \text{ K}$
- (4)  $0.80 \text{ K}$

**Answer (1)**

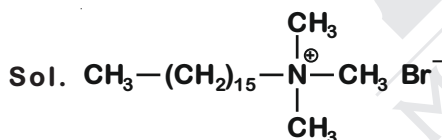
**Sol.**  $\Delta T_f = k_f m$

$$\begin{aligned} &= 5.12 (\text{K.kg mol}^{-1}) \times 0.078 (\text{mol kg}^{-1}) \\ &= 0.399 \text{ K} \\ &\approx 0.40 \text{ K} \end{aligned}$$

112. Which of the following is a cationic detergent?

- (1) Cetyltrimethyl ammonium bromide
- (2) Sodium dodecylbenzene sulphonate
- (3) Sodium lauryl sulphate
- (4) Sodium stearate

**Answer (1)**



Cetyltrimethyl ammonium bromide

113. Paper chromatography is an example of

- (1) Thin layer chromatography
- (2) Column chromatography
- (3) Adsorption chromatography
- (4) Partition chromatography

**Answer (4)**

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

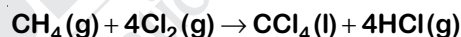
114. Identify the correct statement from the following :

- (1) Vapour phase refining is carried out for Nickel by Van Arkel method.
- (2) Pig iron can be moulded into a variety of shapes.
- (3) Wrought iron is impure iron with 4% carbon.
- (4) Blister copper has blistered appearance due to evolution of  $\text{CO}_2$ .

**Answer (2)**

**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.

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

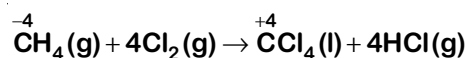


- (1)  $-4$  to  $+4$
- (2)  $0$  to  $-4$
- (3)  $+4$  to  $+4$
- (4)  $0$  to  $+4$

**Answer (1)**

**Sol.**  $\text{CH}_4 \Rightarrow x + 4 \times 1 = 0 \Rightarrow x = -4$

$$\text{CCl}_4 \Rightarrow x + 4 \times (-1) = 0 \Rightarrow x = +4$$

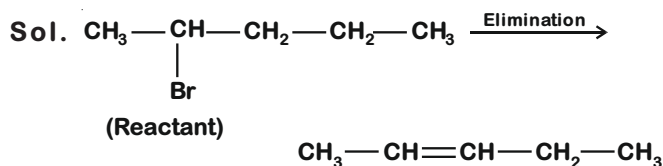


Change in oxidation state of carbon is from  $-4$  to  $+4$

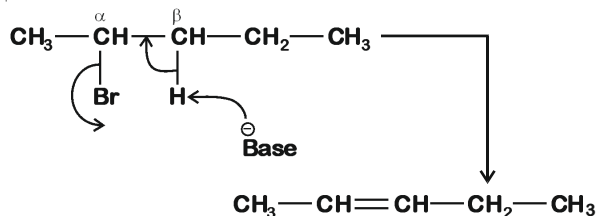
116. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is

- (a)  $\beta$ -Elimination reaction
  - (b) Follows Zaitsev rule
  - (c) Dehydrohalogenation reaction
  - (d) Dehydration reaction
- (1) (b), (c), (d)
  - (2) (a), (b), (d)
  - (3) (a), (b), (c)
  - (4) (a), (c), (d)

**Answer (3)**



Mechanism:

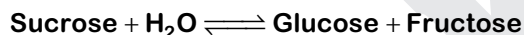


Since  $\beta$ -hydrogen is abstracted it is  $\beta$ -elimination.

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

Since 'H' and 'Br' are removed, it is dehydrohalogenation.

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



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

- (1)  $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$
- (2)  $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
- (3)  $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
- (4)  $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

Answer (3)

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

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

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

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

118. Match the following :

Oxide	Nature
(a) CO	(i) Basic
(b) BaO	(ii) Neutral
(c) $\text{Al}_2\text{O}_3$	(iii) Acidic
(d) $\text{Cl}_2\text{O}_7$	(iv) Amphoteric

Which of the following is correct option?

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

Answer (4)

Sol. CO : Neutral oxide

BaO : Basic oxide

$\text{Al}_2\text{O}_3$  : Amphoteric oxide

$\text{Cl}_2\text{O}_7$  : Acidic oxide

119. Identify a molecule which does not exist.

- |                   |                   |
|-------------------|-------------------|
| (1) $\text{C}_2$  | (2) $\text{O}_2$  |
| (3) $\text{He}_2$ | (4) $\text{Li}_2$ |

Answer (3)

Sol. For  $\text{He}_2$  molecule

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

$$\begin{aligned} \text{so bond order} &= \frac{1}{2} [N_b - N_a] \\ &= \frac{1}{2} [2 - 2] \\ &= 0 \end{aligned}$$

Since, bond order is zero, so  $\text{He}_2$  molecule does not exist.

120. The number of Faradays(F) required to produce 20 g of calcium from molten  $\text{CaCl}_2$  (Atomic mass of Ca = 40 g  $\text{mol}^{-1}$ ) is

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

Answer (3)

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.

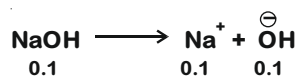
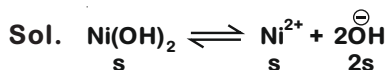




127. Find out the solubility of  $\text{Ni(OH)}_2$  in 0.1 M NaOH. Given that the ionic product of  $\text{Ni(OH)}_2$  is  $2 \times 10^{-15}$

- (1)  $1 \times 10^{-13}$  M  
 (2)  $1 \times 10^8$  M  
 (3)  $2 \times 10^{-13}$  M  
 (4)  $2 \times 10^{-8}$  M

Answer (3)



Total  $[\text{OH}^-] = 2s + 0.1 \approx 0.1$

Ionic product =  $[\text{Ni}^{2+}][\text{OH}^-]^2$

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

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

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

128. For the reaction,  $2\text{Cl(g)} \longrightarrow \text{Cl}_2(\text{g})$ , the correct option is :

- (1)  $\Delta_r H < 0$  and  $\Delta_r S > 0$   
 (2)  $\Delta_r H < 0$  and  $\Delta_r S < 0$   
 (3)  $\Delta_r H > 0$  and  $\Delta_r S > 0$   
 (4)  $\Delta_r H > 0$  and  $\Delta_r S < 0$

Answer (2)



We know that,

$\text{Cl}_2(\text{g}) \longrightarrow 2\text{Cl(g)}$  is endothermic reaction because it requires energy to break bond.

So reverse reaction is exothermic  $\Delta_r H < 0$

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

So, randomness  $\Delta_r S < 0$

129. The calculated spin only magnetic moment of  $\text{Cr}^{2+}$  ion is

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

Answer (4)

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

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

$\uparrow \uparrow \uparrow \uparrow$  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

130. Identify the correct statements from the following :

- (a)  $\text{CO}_2(\text{g})$  is used as refrigerant for ice-cream and frozen food.  
 (b) The structure of  $\text{C}_{60}$  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) (b) and (c) only  
 (2) (c) and (d) only  
 (3) (a), (b) and (c) only  
 (4) (a) and (c) only

Answer (2)

Sol. • Dry ice,  $\text{CO}_2(\text{s})$ , is used as refrigerant

- $\text{C}_{60}$  contains 20 six membered rings, 12 five membered rings

131. 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) Calcium
- (2) Potassium
- (3) Iron
- (4) Copper

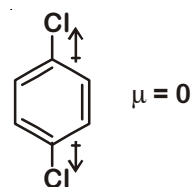
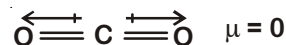
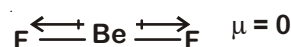
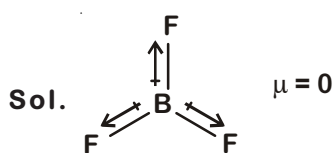
Answer (2)

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.

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

- (1) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene
- (2) Boron trifluoride, beryllium difluoride, carbon dioxide, 1,4-dichlorobenzene
- (3) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene
- (4) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene

Answer (2)



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

- (1)  $q < 0$ ,  $\Delta T = 0$  and  $w = 0$
- (2)  $q > 0$ ,  $\Delta T > 0$  and  $w > 0$
- (3)  $q = 0$ ,  $\Delta T = 0$  and  $w = 0$
- (4)  $q = 0$ ,  $\Delta T < 0$  and  $w > 0$

Answer (3)

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

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

$$\therefore \text{Adiabatic process} \Rightarrow q = 0$$

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

$$\therefore \Delta U = 0$$

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

$\therefore$  If internal energy remains constant

$$\therefore \Delta T = 0$$

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

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

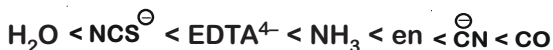
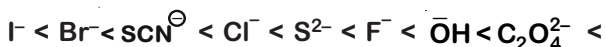
$$(2) CN^- < C_2O_4^{2-} < SCN^- < F^-$$

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

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

Answer (3)

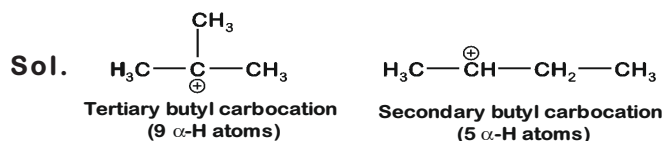
Sol. Spectrochemical series (as given in NCERT) :



135. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following ?

- (1) - R effect of - CH<sub>3</sub> groups
- (2) Hyperconjugation
- (3) - I effect of - CH<sub>3</sub> groups
- (4) + R effect of - CH<sub>3</sub> groups

Answer (2)



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

136. 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) 536 Hz                      (2) 537 Hz  
 (3) 523 Hz                      (4) 524 Hz

**Answer (4)**

**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,  $f_A > f'_B$

$$f_A - f_B = 6 \text{ Hz}$$

$$f_A = 530 \text{ Hz}$$

$$f_B = 524 \text{ Hz (original)}$$

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

- (1) both forward bias and reverse bias  
 (2) increase in forward current  
 (3) forward bias only  
 (4) reverse bias only

**Answer (4)**

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

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

**Answer (3)**

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

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

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

$$= (1.5)^3$$

$$= \frac{27}{8}$$

139. 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) 1.0                              (2) -1.0  
 (3) zero                              (4) 0.5

**Answer (1)**

**Sol.** When L is removed,

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

When C is removed,

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

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

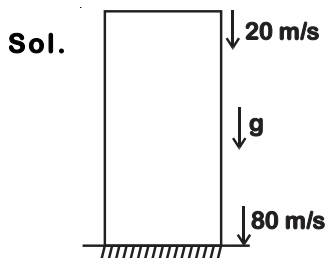
Since,  $X_L = X_C$ , the circuit is in resonance.  
 $Z = R$

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

140. 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 : ( $g = 10 \text{ m/s}^2$ )

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

**Answer (2)**



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

$$v = 80 \text{ m/s}$$

$$u = 20 \text{ m/s}$$

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

141. 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) four times                      (2) one-fourth  
(3) double                          (4) half

**Answer (1)**

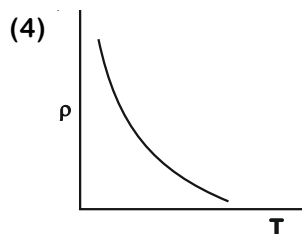
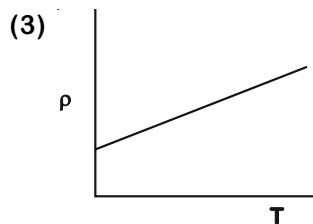
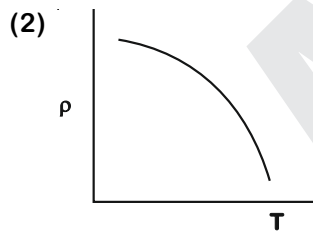
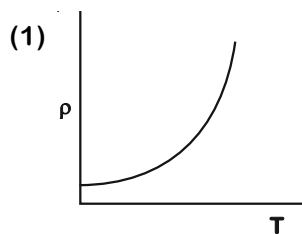
**Sol.** Fringe width  $\beta = \frac{\lambda D}{d}$

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

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

$\beta' = 4\beta$

142. Which of the following graph represents the variation of resistivity ( $\rho$ ) with temperature (T) for copper?



**Answer (1)**

**Sol.** At temperature much lower than  $0^\circ\text{C}$ , graph deviates considerably from a straight line.

Option (1) is correct

143. 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 :

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

- (1)  $6.28 \times 10^{-5} \text{ T}$   
(2)  $3.14 \times 10^{-5} \text{ T}$   
(3)  $6.28 \times 10^{-4} \text{ T}$   
(4)  $3.14 \times 10^{-4} \text{ T}$

**Answer (3)**

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

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

$$I = 2.5 \text{ A}$$

On putting the values

$$B = 4\pi \times 10^{-7} \times 200 \times 2.5 \\ = 6.28 \times 10^{-4} \text{ T}$$

144. 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) one-fourth                      (2) zero  
(3) doubled                        (4) four times

**Answer (2)**

**Sol.**  $v = \frac{3}{2}v_0$

$$v' = \frac{v}{2} = \frac{3}{4}v_0$$

$$\therefore v' < v_0$$

$\therefore$  No photoelectric emission will take place.

145. 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) 0.5 mm                          (2) 1.0 mm  
(3) 0.01 mm                        (4) 0.25 mm

**Answer (1)**

**Sol.** Least count

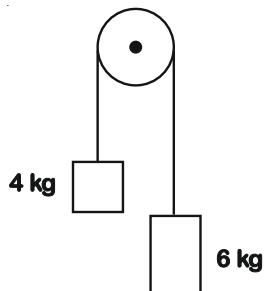
$$= \frac{\text{Pitch}}{\text{Number of divisions on circular scale}}$$

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

$$\text{Pitch} = 0.5 \text{ mm}$$



146. 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)  $g/5$                       (4)  $g/2$   
 (2)  $g/10$                     (3)  $g$

**Answer (1)**

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

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

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

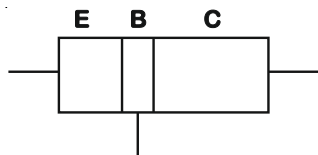
**Note :** Here no option is given according to acceleration of COM of the system.

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

- (1) Both emitter junction as well as the collector junction are forward biased.  
 (2) The base region must be very thin and lightly doped.  
 (3) Base, emitter and collector regions should have same doping concentrations.  
 (4) Base, emitter and collector regions should have same size.

**Answer (2)**

**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.

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

- (1) Deuteron atom  
 (2) Singly ionised neon atom ( $\text{Ne}^+$ )  
 (3) Hydrogen atom  
 (4) Singly ionised helium atom ( $\text{He}^+$ )

**Answer (2)**

**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.

149. 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) 10.0 g  
 (2) 20.0 g  
 (3) 2.5 g  
 (4) 5.0 g

**Answer (1)**

**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  $\theta$  are constant

So,  $m \propto r$

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

$$\Rightarrow m_2 = 10.0 \text{ g}$$

150. 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) 1 :  $c$   
 (2) 1 :  $c^2$   
 (3)  $c$  : 1  
 (4) 1 : 1

**Answer (4)**

**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

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

- (1)  $2.4\pi \times 10^{-5} \text{ T m A}^{-1}$   
 (2)  $2.4\pi \times 10^{-7} \text{ T m A}^{-1}$   
 (3)  $2.4\pi \times 10^{-4} \text{ T m A}^{-1}$   
 (4)  $8.0 \times 10^{-5} \text{ T m A}^{-1}$

**Answer (3)**

**Sol.**  $\chi_m = 599$

$$\mu_r = 1 + \chi_m = 600$$

$$\mu = \mu_r \mu_0$$

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

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

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

152. The Brewsters angle  $i_b$  for an interface should be

- (1)  $45^\circ < i_b < 90^\circ$       (2)  $i_b = 90^\circ$   
 (3)  $0^\circ < i_b < 30^\circ$       (4)  $30^\circ < i_b < 45^\circ$

**Answer (1)**

**Sol.**  $\mu = \tan i_b$

$$1 < \mu < \infty$$

$$1 < \tan i_b < \infty$$

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

$$45^\circ < i_b < 90^\circ$$

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

- (1)  $\frac{\pi}{2}$  rad      (2) zero  
 (3)  $\pi$  rad      (4)  $\frac{3\pi}{2}$  rad

**Answer (3)**

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

$$\text{then } v = \frac{dy}{dt}$$

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

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

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

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

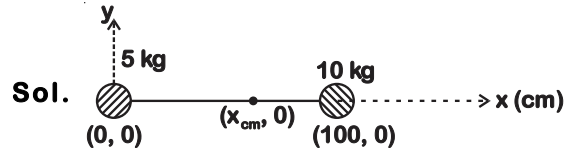
So phase difference between displacement and acceleration is  $\pi$ .

154. 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) 67 cm      (2) 80 cm  
 (3) 33 cm      (4) 50 cm

**Answer (1)**



$$x_{cm} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$$

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

$$x_{cm} \approx 67 \text{ cm}$$

155. A spherical conductor of radius 10 cm has a charge of  $3.2 \times 10^{-7} \text{ C}$  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)  $1.28 \times 10^6 \text{ N/C}$       (2)  $1.28 \times 10^7 \text{ N/C}$   
 (3)  $1.28 \times 10^4 \text{ N/C}$       (4)  $1.28 \times 10^5 \text{ N/C}$

**Answer (4)**

**Sol.** Electric field outside a conducting sphere

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

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

$$= 0.128 \times 10^6$$

$$= 1.28 \times 10^5 \text{ N/C}$$

156. 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)  $7.32 \times 10^{-7}$  rad  
 (2)  $6.00 \times 10^{-7}$  rad  
 (3)  $3.66 \times 10^{-7}$  rad  
 (4)  $1.83 \times 10^{-7}$  rad

**Answer (3)**

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

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

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

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

- (1)  $2.5 \times 10^{-6}$                       (2)  $2.25 \times 10^{-15}$   
 (3)  $2.25 \times 10^{15}$                     (4)  $2.5 \times 10^6$

**Answer (4)**

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

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

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

158. Taking into account of the significant figures, what is the value of  $9.99 \text{ m} - 0.0099 \text{ m}$ ?

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

**Answer (4)**

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

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

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

- (1)  $1.5 \times 10^{13} \text{ J}$                       (2)  $0.5 \times 10^{13} \text{ J}$   
 (3)  $4.5 \times 10^{16} \text{ J}$                     (4)  $4.5 \times 10^{13} \text{ J}$

**Answer (4)**

**Sol.** From mass-energy equivalence.

$$E = mc^2$$

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

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

160. When a uranium isotope  ${}_{92}^{235}\text{U}$  is bombarded

with a neutron, it generates  ${}_{36}^{89}\text{Kr}$ , three neutrons and :

- (1)  ${}_{36}^{101}\text{Kr}$                       (2)  ${}_{36}^{103}\text{Kr}$   
 (3)  ${}_{56}^{144}\text{Ba}$                       (4)  ${}_{40}^{91}\text{Zr}$

**Answer (3)**

**Sol.**  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{36}^{89}\text{Kr} + 3{}_0^1\text{n} + {}_Z^AX$

$$92 + 0 = 36 + Z$$

$$\Rightarrow Z = 56$$

$$235 + 1 = 89 + 3 + A$$

$$\Rightarrow A = 144$$

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

161. A short electric dipole has a dipole moment of  $16 \times 10^{-9} \text{ C m}$ . 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  $60^\circ$  with the dipole axis is :

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

- (1) 400 V                      (2) zero  
 (3) 50 V                      (4) 200 V

**Answer (4)**

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

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

$$V = 200 \text{ V}$$

162. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature  $27^\circ\text{C}$ .

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

- (1)  $0.1 \text{ kg/m}^3$   
 (2)  $0.02 \text{ kg/m}^3$   
 (3)  $0.5 \text{ kg/m}^3$   
 (4)  $0.2 \text{ kg/m}^3$

**Answer (4)**

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

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

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

$$T = 300 \text{ K}$$

$$\therefore \rho = \frac{(249 \times 10^3)(2 \times 10^{-3})}{8.3 \times 300} = \frac{0.2 \text{ kg}}{\text{m}^3}$$

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

- (1)  $\frac{5}{2} k_B T$                       (2)  $\frac{7}{2} k_B T$   
 (3)  $\frac{1}{2} k_B T$                       (4)  $\frac{3}{2} k_B T$

**Answer (4)**

**Sol.** For monoatomic gases, degree of freedom is 3. Hence average thermal energy per molecule is

$$KE_{\text{avg}} = \frac{3}{2} k_B T$$

164. The color code of a resistance is given below



Yellow Violet Brown Gold

The values of resistance and tolerance, respectively, are

- (1) 4.7 kΩ, 5%                      (2) 470 Ω, 5%  
(3) 470 kΩ, 5%                      (4) 47 kΩ, 10%

**Answer (2)**

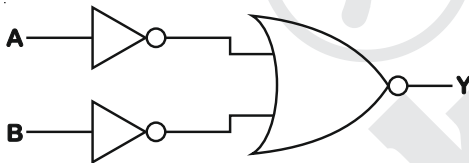
**Sol. According to colour coding**

Yellow Violet Brown Gold  
4 7 1 5%

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

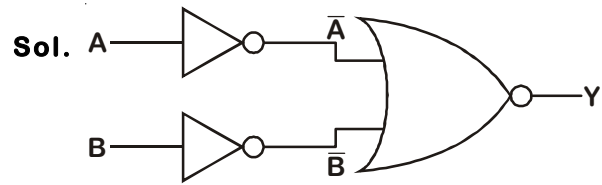
$R = 470 \pm 5\% \Omega$

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



- (1) A B Y  
0 0 1  
0 1 1  
1 0 1  
1 1 0
- (2) A B Y  
0 0 1  
0 1 0  
1 0 0  
1 1 0
- (3) A B Y  
0 0 0  
0 1 0  
1 0 0  
1 1 1
- (4) A B Y  
0 0 0  
0 1 1  
1 0 1  
1 1 1

**Answer (3)**



$Y = \overline{\overline{A} + \overline{B}}$   
 $= \overline{\overline{A \cdot B}}$   
 $= A \cdot B \Rightarrow \text{AND Gate}$

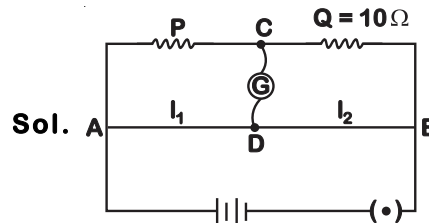
**Truth Table**

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

166. 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)  $1.5 \times 10^{-1}$  m  
(2)  $1.5 \times 10^{-2}$  m  
(3)  $1.0 \times 10^{-2}$  m  
(4)  $1.0 \times 10^{-1}$  m

**Answer (4)**



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

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

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

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

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

$l_2 = 0.1 \text{ m}$   
 $= 1.0 \times 10^{-1} \text{ m}$

167. 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)  $6\hat{k}$  Nm  
 (3)  $6\hat{i}$  Nm                        (4)  $6\hat{j}$  Nm

**Answer (1)**

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

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

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

168. 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)  $\frac{MgL}{AL_1}$                               (2)  $\frac{MgL}{A(L_1-L)}$   
 (3)  $\frac{MgL_1}{AL}$                                 (4)  $\frac{Mg(L_1-L)}{AL}$

**Answer (2)**

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

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

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

169. A  $40 \mu\text{F}$  capacitor is connected to a  $200 \text{ V}$ ,  $50 \text{ Hz}$  ac supply. The rms value of the current in the circuit is, nearly :

- (1)  $2.5 \text{ A}$                               (2)  $25.1 \text{ A}$   
 (3)  $1.7 \text{ A}$                               (4)  $2.05 \text{ A}$

**Answer (1)**

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

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

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

$$\varepsilon_{\text{rms}} = 200 \text{ V}$$

$$\therefore i_{\text{rms}} = 200 \times 40 \times 10^{-6} \times 2\pi \times 50 = 2.5 \text{ A}$$

170. A body weighs  $72 \text{ N}$  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)  $30 \text{ N}$                                 (2)  $24 \text{ N}$   
 (3)  $48 \text{ N}$                                 (4)  $32 \text{ N}$

**Answer (4)**

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

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

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

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

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

**Answer (2)**

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

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

$$\therefore V = 10^4 \text{ volts}$$

172. 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  $\mu$ , then the angle of incidence is nearly equal to :

- (1)  $\mu A$                                       (2)  $\frac{\mu A}{2}$   
 (3)  $\frac{A}{2\mu}$                                       (4)  $\frac{2A}{\mu}$

**Answer (1)**

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

$$r_2 = 0$$

$$r_1 + r_2 = A$$

$$\Rightarrow r_1 = A$$

Applying Snell's law on first surface

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

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

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

$$\text{hence } i = \mu A$$



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

- (1) semiconductors only
- (2) insulators and semiconductors
- (3) metals
- (4) insulators only

**Answer (2)**

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

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

- (1)  $1 \text{ N/C}$
- (2)  $5 \text{ N/C}$
- (3) zero
- (4)  $0.5 \text{ N/C}$

**Answer (3)**

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

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

- (1)  $24 \times 10^3 \text{ J}$
- (2)  $48 \times 10^3 \text{ J}$
- (3)  $10 \times 10^3 \text{ J}$
- (4)  $12 \times 10^3 \text{ J}$

**Answer (1)**

**Sol.** Energy received = Intensity  $\times$  Area  $\times$  Time  
 $= 20 \times 20 \times 60$   
 $= 24 \times 10^3 \text{ J}$

176. The capacitance of a parallel plate capacitor with air as medium is  $6 \mu\text{F}$ . With the introduction of a dielectric medium, the capacitance becomes  $30 \mu\text{F}$ . The permittivity of the medium is :

- ( $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$ )
- (1)  $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
  - (2)  $5.00 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
  - (3)  $0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
  - (4)  $1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

**Answer (1)**

**Sol.**  $C = KC_0$

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

$$K = \frac{\epsilon}{\epsilon_0}$$

$$\epsilon = K\epsilon_0$$

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

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

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

- (1) 0.06
- (2) 0.006
- (3) 6
- (4) 0.6

**Answer (1)**

**Sol.**  $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$

$$1 \text{ J} = \frac{1}{1.6 \times 10^{-19}} \text{ eV}$$

$$10^{-20} \text{ J} = \frac{10^{-20}}{1.6 \times 10^{-19}} \text{ eV}$$

$$= 0.06 \text{ eV}$$

178. Dimensions of stress are :

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

**Answer (2)**

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

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

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

179. 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) isochoric
- (2) isobaric
- (3) isothermal
- (4) adiabatic

**Answer (4)**

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

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

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

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

**Answer (4)**

**Sol.** According to the formula

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