CBSE EXAMINATION PAPER-2025

NEET-ZOOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 718

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **180 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 180** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

Section A

Question 1.

Match List-I with List-II

Choose the option with all correct matches:

[4 Marks]

List-I	List-II
(a) Adenosine	(i) Nitrogen base
(b) Adenylic acid	(ii) Nucleotide
(c) Adenine	(iii) Nucleoside
(d) Alanine	(iv) Amino acid

(A) A-III, B-IV, C-II, D-I

(B) A-II, B-III, C-I, D-IV

(C) A-III, B-II, C-I, D-IV

(D) A-III, B-II, C-IV ,D-I,

Explanation:

A-III, B-II, C-I, D-IV

Adenosine is nucleoside

Adenylic acid is nucleotide

Adenine is nitrogen base

Alanine is amino acid

Question 2.

All living members of the class Cyclostomata are:

[4 Marks]

(A) Endoparasite

(B) Ectoparasite

(C) Symbiotic

(D) Free living

Explanation:

Cyclostomata are jawless vertebrates that are ectoparasites on fish.

Question 3.

Assertion (A): The primary function of the Golgi apparatus is to package the materials made by the endoplasmic reticulum and deliver it to intracellular targets and outside the cell.

Reason (R): Vesicles containing materials made by the endoplasmic reticulum fuse with the cis face of the Golgi apparatus, and they are modified and released from the trans face of the Golgi apparatus.

In the light of the above statements, choose the correct answer from the options given below:

[4 Marks]

(A) A is true but R is false

(B) Both A and R are true and R is the correct explanation of A

(C) Both A and R are true but R is not the correct explanation of A

(D) A is false but R is true

Explanation:

Both Aand R are true and R is the correct explanation of A.

The Golgi apparatus packages materials from the endoplasmic reticulum via vesicle fusion at the cis face and release at the trans face .

Question 4.

Match List-I with List-II. List-I List-II

choose the option with all correct matches.

[4 Marks]

List-I		List-II	
A.	Scutellum	I.	Persistent nucellus
B.	Non-albuminous seed	II.	Cotyledon of Monocot seed
C.	Epiblast	III.	Groundnut
D.	Perisperm	IV.	Rudimentary cotyledon

(A) A-II, B-III, C-IV, D-I

(B) A-IV, B-III, C-I, D-II

(C) A-II, B-IV, C-III, D-I

(D) A-IV, B-III, C-II, D-I

Explanation:

A-II; Scutellum is the cotyledon in monocot seeds B-III; Non-albuminous seeds store food in cotyledons, e.g., groundnut C-IV; Epiblast is a rudimentary cotyledon D-I; Perisperm is persistent nucellus

Question 5.

Assertion (A): All vertebrates are chordates but all chordates are not vertebrate.

Reason (R): The members of subphylum vertebrata possess notochord during the embryonic period, the notochord is replaced by a cartilaginous or bony vertebral column in adults.

In the light of the above statements, choose the correct answer from the options given below:

[4 Marks]

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A

(C) A is false but R is true

(D) A is true but R is false

Explanation:

All vertebrates are chordates, but not vice versa and in vertebrates notochord is replace with vertebral column

Question 6.

Silencing of specific mRNA is possible via RNAi because of -

[4 Marks]

(A) Non-complementary ssRNA

(B) Inhibitory ssRNA

(C) Complementary tRNA

(D) Complementary dsRNA

Explanation:

RNAi silences mRNA via complementary dsRNA (processed into siRNA).

Question 7.

Genes R and Y follow Independent assortment. If RRYY produce round yellow seeds and rryy produce wrinkled green seeds, what will be the phenotypic ratio of the F_2 generation?

[4 Marks]

(A) Phenotypic ratio-9 : 3 : 3 : 1

(B) Phenotypic ratio-1 : 2 : 1

(C) Phenotypic ratio-9 : 7

(D) Phenotypic ratio-3 : 1

Explanation:

In dihybrid cross, independent assortment — 9:3:3:1 phenotypic ratio.

Question 8.

Histones are enriched with

[4 Marks]

(A) Phenylalanine & Arginine

(B) Leucine & Lysine

(C) Phenylalanine & Leucine

(D) Lysine & Arginine

Explanation:

Histones are rich in lysine & arginine. They bind to negatively charged DNA.

Question 9.

The first menstruation is called:

[4 Marks]

(A) Menarche

(B) Ovulation

(C) Diapause

(D) Menopause

Explanation:

Menarche is the first menstruation.

Question 10.

Match List I with List - II.

Choose the correct answer from the options given below:

[4 Marks]

List-I		List-II	
A.	Heart	I.	Erythropoietin
B.	Kidney	II.	Aldosterone
C.	Gastro-intestinal tract	III.	Atrial natriuretic factor
D.	Adrenal Cortex	IV.	Secretin

(A) A-II, B-I, C-III, D-IV

(B) A IV, B-III, C-II, D-I

(C) A I, B-III, C-IV, D-II

(D) A-III, B-I, C-IV, D-II

Explanation:

A-III, B-I, C-IV, D-II

Heart- Atrial Natriuretic Factor

Kidney-Erythropoietin.

Gastro intestinal tract- Secretin

Adrenal Cortex- Aldosterone

Question 11.

The protein portion of an enzyme is called:

[4 Marks]

(A) Prosthetic group

(B) Coenzyme

(C) Apoenzyme

(D) Cofactor

Explanation:

Apoenzyme is the protein component.

Question 12.

Which of the following is the unit of productivity of an ecosystem?

[4 Marks]

(A) gm^{-2}

(B) KCal m^{-2}

(C) KCal m^{-3}

(D) (KCal m^{-2}) yr^{-1}

Explanation:

Ecosystem productivity is measured as (KCal m^{-2}) yr^{-1}.

Question 13.

Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

[4 Marks]

(A) Analogy, divergent

(B) Homology, convergent

(C) Analogy, convergent

(D) Homology, divergent

Explanation:

Sweet potato and potato are analogous structures (convergent evolution; different origins, similar function).

Question 14.

Assertion (A): Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus. Reason (R): Presence of more than one nucleus in the tapetum increase the efficiency of nourishing the developing microspore mother cells.

In light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Both A and R are true and R is NOT the correct explanation of A

(B) A is false but R is true.

(C) A is true but R is false.

(D) Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct

explaination of A.

Tapetum have dense cytoplasm and it is multinucleate to

nourishes pollen.

Question 15.

How many meiotic and mitotic divisions need to occur for the development of a mature female gametophyte from the megaspore mother cell in an angiosperm plant?

[4 Marks]

(A) 1 Meiosis and 2 Mitosis

(B) No Meiosis and 3 Mitosis

(C) 1 Meiosis and 3 Mitosis

(D) 2 Meiosis and 3 Mitosis

Explanation:

1 Meiosis and 3 Mitosis

Question 16.

Which of the following is an example of a zygomorphic flower?

[4 Marks]

(A) Chilli

(B) Datura

(C) Pea

(D) Petunia.

Explanation:

Zygomorphic flower- Pea (bilaterally symmetrical). Others are actinomorphic.

Question 17.

After maturation, in primary lymphoid organs, the lymphocytes migrate for interaction with antigens to secondary lymphoid organ(s)/ tissue(s) like:

A. thymus

B. bone marrow

C. spleen

D. lymph nodes

E. Peyer’s patches

Choose the correct answer from the options given below:

[4 Marks]

(A) C, D, E only

(B) A, B, C only

(C) B, C, D only

(D) E, A, B only

Explanation:

Secondary Lymphoid Organs are spleen, lymph nodes, Peyer’s patches (not thymus and bone marrow).

Question 18.

Statement-I: Fig fruit is a non-vegetarian fruit as it has enclosed fig wasps in it.

Statement-II: Fig wasp and fig tree exhibit mutual relationship as fig wasp completes its life cycle in fig fruit and fig fruit gets pollinated by fig wasp.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is incorrect but statement II is correct

(B) Both statement I and statement II are incorrect

(C) Both statement I and statement II are correct

(D) Statement I is correct but statement II is incorrect.

Explanation:

Both statement I and statement II are incorrect

Question 19.

What is the main function of the spindle fibers during mitosis?

[4 Marks]

(A) To provide energy for cell division (partially visible in image)

(B) To repair damaged DNA

(C) To separate the chromosomes

(D) To synthesize new DNA

Explanation:

Spindle functions to separates chromosomes during mitosis.

Question 20.

Which one of the following is the characteristic feature of gymnosperms?

[4 Marks]

(A) Gymnosperms have flowers for reproduction

(B) Seeds are naked.

(C) Seeds are absent.

(D) Seeds are enclosed in fruits.

Explanation:

Gymnosperms have naked seeds an no seeds are enclosed fruit.

Question 21.

Consider the following statements regarding function of adrenal medullary hormones:

A. It causes pupillary constriction

B. It is a hyperglycemic hormone

C. It causes piloerection

D. It increases strength of heart contraction

Choose the correct answer from the options given below:

[4 Marks]

(A) B, C and D only

(B) D only

(C) C and D only

(D) A, C and D only

Explanation:

B, C and D only, Adrenal medulla hormone epinephrine causes hyperglycemia, piloerection and increases the strength of heart contraction.

Question 22.

Why can’t insulin be given orally to diabetic patients?

[4 Marks]

(A) It will be digested in Gastro-Intestinal (GI) tract

(B) Because of structural variation

(C) Human body will elicit strong immune response

(D) Its bioavailability will be increased

Explanation:

Insulin must be injected. It will be digested in the gastro-intestinal tract if taken orally.

Question 23.

Match List-I with List-II

Choose the option with all correct matches:

[4 Marks]

List-I		List-II	
A.	Pteridophyte	I.	*Salvia*
B.	Bryophyte	II.	Ginkgo
C.	Angiosperm	III.	*Polytrichum*
D.	Gymnosperm	IV.	*Selaginella*

(A) A-IV, B-III, C-II, D-I

(B) A-IV, B-III, C-I, D-II

(C) A-III, B-IV, C-I, D-II

(D) A-III, B-IV, C-II, D-I

Explanation:

A-IV, B-III, C-I, D-II

Pteridophyte - Salvinia

Bryophyte - Polytrichum

Angiosperm - Salvia

Gymnosperm - Ginkgo

Question 24.

Who proposed that the genetic code for amino acids should be made up of three nucleotides?

[4 Marks]

(A) Francis Crick

(B) George Gamow

(C) Franklin Stahl

(D) Jacque Monod

Explanation:

George Gamow proposed triplet codon.

Question 25.

Match List-I with List-II:

Choose the option with all correct matches:

[4 Marks]

List-I		List-II	
A.	The Evil Quartet	I.	Cryopreservation
B.	Ex situ conservation	II.	Alien species invasion
C.	*Lantana camara*	III.	Causes of biodiversity losses
D.	Dodo	IV.	Extinction

(A) A-III, B-II, C-IV, D-I

(B) A-III, B-I, C-II, D-IV

(C) A-III, B-IV, C-II, D-I

(D) A-III, B-II, C-I, D-IV

Explanation:

A-III, B-I, C-II, D-IV

Question 26.

Which of the following hormones released from the pituitary is actually synthesized in the hypothalamus?

[4 Marks]

(A) Anti-diuretic hormone (ADH)

(B) Adenocorticotrophic hormone (ACTH)

(C) Follicle-stimulating hormone (FSH)

(D) Luteinizing hormone (LH)

Explanation:

Anti-diuretic hormone (ADH) is made in hypothalamic and stored in posterior pituitary.

Question 27.

Role of the water vascular system in Echinoderms is:

A. Respiration and Locomotion

B. Excretion and Locomotion

C. Capture and transport of food

D. Digestion and Respiration

E. Digestion and Excretion

Choose the correct answer from the options given below:

[4 Marks]

(A) A and B only

(B) B and C only

(C) A and C only

(D) B, D and E only

Explanation:

Echinoderm have water vascular system that helps in respiration, locomotion, capturing and transporting food.

Question 28.

Which of the following type of immunity is present at the time of birth and is a non-specific type of defence in the human body?

[4 Marks]

(A) Humoral Immunity

(B) Innate Immunity

(C) Cell-mediated Immunity

(D) Acquired Immunity

Explanation:

Innate Immunity is non-specific, present at birth.

Question 29.

In bryophytes, the gemmae help in which one of the following?

[4 Marks]

(A) Gaseous exchange

(B) Asexual reproduction

(C) Sexual reproduction

(D) Nutrient absorption

Explanation:

In bryophytes, the gemmae help in asexual reproduction.

Question 30.

In frog, the renal portal system is a special venous connection that acts to link:

[4 Marks]

(A) Liver and kidney

(B) Kidney and lower part of body

(C) Kidney and intestine

(D) Liver and intestine

Explanation:

In the Frog Renal Portal System kidney connects and hind limbs.

Question 31.

Statement-I: In ecosystem, there is unidirectional flow of energy of sun from producers to consumers.

Statement-II: Ecosystems are exempted from 2ndnd law of thermodynamics.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Both statement-I and statement II are correct

(B) Statement-I is correct but statement II is incorrect

(C) Both statement-I and statement II are incorrect

(D) Statement-I is incorrect but statement II is correct

Explanation:

Energy Flow in Ecosystems is unidirectional and it follows 2nd law. of thermodynamics.

Question 32.

Which of the following statements about RuBisCO is true?

[4 Marks]

(A) It is involved in the photolysis of water.

(B) It binds oxygen than carbon dioxide.

(C) It is active in the dark.

(D) It catalyzes the carboxylation of RuBP.

Explanation:

RuBisCO catalyzes RuBP carboxylation in Calvin cycle.

Question 33.

Which of the following enzyme(s) are **NOT** essential for gene cloning?

A. Restriction enzymes

B. DNA ligase

C. DNA mutase

D. DNA recombinase

E. DNA polymerase

Choose the correct answer from the options given below:

[4 Marks]

(A) B and C only

(B) A and B only

(C) C and D only

(D) D and E only

Explanation:

DNA mutase and recombinase are non-essential cloning enzymes

Question 34.

Which factor is important for termination of transcription?

[2 Marks]

(A) γ (gamma)

(B) σ (sigma)

(C) α (alpha)

(D) ρ (rho)

Explanation:

Transcription Termination Rho (ρ) factor stops transcription in prokaryotes.

Question 35.

Frogs respire in water by skin and buccal cavity and on land by skin, buccal cavity and lungs. Choose the correct answer from the following:

[4 Marks]

(A) The statement is false for both the environment

(B) The statement is true for both the environment

(C) The statement is true for water but false for land

(D) The statement is false for water but true for land

Explanation:

Frog respire through skin in water and on on land by skin, lungs and buccal cavity.

Question 36.

Twins are born to a family that lives next door to you. The twins are a boy and a girl. Which of the following must be true?

[4 Marks]

(A) They are fraternal twins.

(B) They have 75% identical genetic content.

(C) They were conceived through in vitro fertilization.

(D) They are monozygotic twins.

Explanation:

Fraternal or dizygotic twins are born when two eggs released from the ovary are fertilised by separate sperm.

Question 37.

Which of the following microbes is NOT involved in the preparation of household products?

A. Aspergillus niger

B. Lactobacillus

C. Trichoderma polysporum

D. Saccharomyces cerevisiae

E, Propionibacterium sharmanii

[4 Marks]

(A) A and C only

(B) C and E only

(C) Cand D only

(D) A and B only

Explanation:

A and C; Trichoderma polysporum and Aspergillus niger are not used at home

Question 38.

Match List-I with List-II.

Choose the correct answer from the options given below:

[4 Marks]

List-I		List-II	
A.	Progesterone	I.	Pars intermedia
B.	Relaxin	II.	Ovary
C.	Melanocyte stimulating hormone	III.	Adrenal Medulla
D.	Catecholamines	IV.	Corpus luteum

(A) A-IV, B-II, C-III, D-I

(B) A-IV, B-II, C-I, D-III

(C) A-III, B-II, C-IV, D-I

(D) A-II, B-IV, C-I, D-III

Explanation:

A-IV, B-II, C-I, D-III

Question 39.

The blue and white selectable markers have been developed which differentiate recombinant colonies from non-recombinant colonies on the basis of their ability to produce colour in the presence of a chromogenic substrate.

Given below are two statements about this method:

Statement-I: The blue coloured colonies have DNA insert in the plasmid and they are identified as recombinant colonies.

Statement-II: The colonies without blue colour have DNA insert in the plasmid and are identified as recombinant colonies.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is incorrect but statement II is correct

(B) Statement I is correct but statement II is incorrect

(C) Both statement I and statement II are incorrect

(D) Both statement I and statement II are correct

Explanation:

Statement I incorrect and II correct.

Non-recombinant colonies will produce functional

B-galacméidase and appear blue on plates containing

X-gal.

Recombinant colonies will not produce functional

B-galactosidase and appear white on plates containing

X-gal.

Question 40.

The complex II of mitochondrial electron transport chain is also known as

[4 Marks]

(A) Cytochrome c oxidase

(B) Cytochrome bc_1

(C) Succinate dehydrogenase

(D) NADH dehydrogenase

Explanation:

Succinate dehydrogenase is the complex II of the mitochondrial electron transport chain.

The electron transport chain consists of following complexes -

Complex I- NADH dehydrogenase

Complex II- Succinate dehydrogenase

Complex III- Cytochrome bc,

Complex IV- Cytochrome c oxidase

Question 41.

Polymerase chain reaction (PCR) amplifies DNA following the equation

[4 Marks]

(A) $2N^2$

(B) $2n + 1$

(C) 2^n

(D) N^2

Explanation:

The polymerase chain reaction (PCR) amplifies DNA exponentially. After n cycles, the number of DNA copies produced is 2^n.

Question 42.

What are the potential drawbacks in adoption of the IVF method?

A. High fatality risk to mother

B. Expensive instruments and reagents

C. Husband / wife necessary for being donors

D. Less adoption of orphans

E. Not available in India

F. Possibility that the early embryo does not survive

Choose the correct answer from the options given below:

[4 Marks]

(A) A, C, D, F only

(B) A, B, C, E, F only

(C) A, B, C, D only

(D) B, D, F only

Explanation:

B,D, F only because IVF (In Vitro Fertilization) has drawbacks such as expensive instruments and reagents, less adoption of orphans, and the possibility that the early embryo does not survive. IVF is legally and medically available in India with very low fatality risk to the mother.

Question 43.

What is the name of the blood vessel that carries deoxygenated blood from the body to the heart in a frog?

[4 Marks]

(A) Vena cava

(B) Pulmonary vein

(C) Aorta

(D) Pulmonary artery

Explanation:

In frogs, the vena cava carries deoxygenated blood from the body to the heart. The pulmonary artery carries deoxygenated blood to the lungs, while the pulmonary vein carries oxygenated blood back to the heart.

Question 44.

Which one of the following statements refers to Reductionist Biology?

[4 Marks]

(A) Behavioural approach to study and understand living organisms.

(B) Physiological approach to study and understand living organisms.

(C) Chemical approach to study and understand living organisms.

(D) Physico-chemical approach to study and understand living organisms

Explanation:

The physico-chemical approach to study and understand living organisms is called ‘Reductionist Biology’. The concepts and techniques of physics and chemistry are applied to understand biology.

Question 45.

Statement-I: In the RNA world, RNA is considered the first genetic material evolved to carry out essential life processes. RNA acts as a genetic material and also as a catalyst for some important biochemical reactions in living systems. Being reactive, RNA is unstable.

Statement-II: DNA evolved from RNA and is a more stable genetic material. Its double helical strands being complementary, resist changes by evolving repairing mechanism.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is correct but statement II is correct.

(B) Statement I is correct but statement II is incorrect.

(C) Both statement I and statement II are incorrect

(D) Both statement I and statement II are correct.

Explanation:

Both statement I and statement II are correct. RNA is considered the first genetic material (RNA world hypothesis) and is unstable. DNA evolved later as a more stable genetic material with repair mechanisms.

Question 46.

Match List-I with List-II.

Choose the correct answer from the options given below

[4 Marks]

List-I	List-II
(a) Emphysema	(i) Rapid spasms in muscle due to low Ca^{++} in body fluid
(b) Angina Pectoris	(ii) Damaged alveolar walls and decreased respiratory surface
(c) Glomerulonephritis	(iii) Acute chest pain when not enough oxygen is reaching to heart muscle
(d) Tetany	(iv) Inflammation of glomeruli of kidney

(A) A-II, B-III, C-IV, D-I

(B) A-III, B-I, C-II, D-IV

(C) A-III, B-I, C-IV, D-II

(D) A-II, B-IV, C-III, D-I

Explanation:

A-II, B-III, C-IV, D-I

Emphysema: Damaged alveolar walls and decreased respiratory surface

Angina Pectoris: Acute chest pain due to oxygen deficiency

Glomerulonephritis: Inflammation of glomeruli of kidney

Tetany: Rapid spasms in muscle due to low Ca^{++} in body fluid.

Question 47.

Which of the following is an example of non-distilled alcoholic beverage produced by yeast?

[4 Marks]

(A) Brandy

(B) Rum

(C) Beer

(D) Whisky

Explanation:

Beer is a non-distilled alcoholic beverage produced by yeast fermentation. Whisky, brandy, and rum are distilled beverages.

Question 48.

Given below are two statements:

Statement-I: In a floral formula ⊕ stands for zygomorphic nature of the flower, and (G with under line)

stands for inferior ovary.

Statement-II: In a floral Formula ⊕ stands for actinomorphic nature of the flower and (G with under line) stands for superior ovary.

In the light of the above statements,

choose the correct answer from the options given below:

[4 Marks]

(A) Statement I is incorrect but statement II is correct

(B) Both statement I and statement II are incorrect.

(C) Statement I is correct but statement II is incorrect.

(D) Both statement I and statement II are correct.

Explanation:

Statement I is incorrect but Statement II is correct. In the floral formula ⊕ represents actinomorphic nature of flower, not zygomorphic. (G with under line) represents a superior ovary, not inferior ovary.

Question 49.

Streptokinase produced by bacterium Streptococcus is used for

[4 Marks]

(A) Ethanol production

(B) Liver disease treatment

(C) Removing clots from blood vessels

(D) Curd production

Explanation:

Streptokinase produced by Streptococcus, is used as a clotbuster for removing clots from blood vessels of patients who have undergone myocardial infarction leading to heat attack.

Question 50.

Which chromosome in the human genome has the highest number of genes?

[4 Marks]

(A) Chromosome 10

(B) Chromosome 1

(C) Chromosome Y

(D) Chromosome X

Explanation:

Chromosome 1 in humans has most genes (2968 genes) and the Y has the fewest (231genes).

Question 51.

Which of the following statement is correct about location of the male frog copulatory pad?

[4 Marks]

(A) First digit of hind limb

(B) First digit of the fore limb

(C) Second digit of fore limb

(D) First and second digit of fore limb

Explanation:

In male frogs, the copulatory pad is present on the first digit of the forelimbs. It is absent in female frogs.

Question 52.

Which one of the following phytohormones promotes nutrient mobilization which help in the delay of leaf senescence in plants?

[4 Marks]

(A) Cytokinin

(B) Abscisic acid

(C) Gibberellin

(D) Ethylene

Explanation:

Cytokinins delay- leaf senescence by promoting nutrient mobilization and cell division.

Question 53.

While trying to find out the characteristic of a newly found animal, a researcher did the histology of adult animal and observed a cavity with presence of mesodermal tissue towards the body wall but no

mesodermal tissue was observed towards the alimentary canal. What could be the possible coelom of that animal?

[4 Marks]

(A) Spongocoelomate

(B) Pseudocoelomate

(C) Schizocoelomate

(D) Acoelomate

Explanation:

In pseudocoelomate, the body cavity is not lined by mesoderm, instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. The animals possessing pseudocoelom are called pseudocoelomates, e.g., Aschelminthes.

Question 54.

Match List-I with List-II.

Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
(a) Head	(i) Enzymes
(b) Middle piece	(ii) Sperm motility
(c) Acrosome	(iii) Energy
(d) Tail	(iv) Genetic material

(A) A-III, B-II, C-I, D-IV

(B) A-IV, B-III, C-I, D-II

(C) A-IV, B-III, C-II, D-I

(D) A-III, B-IV, C-II, D-I

Explanation:

A-IV, B-III, C-I, D-II,

In the structure of a sperm:

The head contains genetic material.

The acrosome contains enzymes that aid in sperm-egg fusion.

The middle piece contains mitochondria that provides energy.

The tail provides motility to the sperm.

Question 55.

Given below are the stages in the life cycle of pteridophytes. Arrange the following stages in the correct sequence.

A. Prothallus stage

B. Meiosis in spore mother cells

C. Fertilisation

D. Formation of archegonia and antheridia in gametophyte

E. Transfer of antherozoids to the archegonia in presence of water

Choose the correct answer from the options given below:

[4 Marks]

(A) B, A, E, C, D

(B) E, D, C, B, A

(C) D, E, C, A, B

(D) B, A, D, E, C

Explanation:

The correct sequence in the life cycle of pteridophytes is:

B- Meiosis in spore mother cells (sporophyte)

A- Prothallus formation

D- formation of archegonia and antheridia in gametophyte

E- Transfer of antherozoids to archegonia in presence of water.

C- Fertilization

Question 56.

Cardiac activities of the heart are regulated by:

A. Nodal tissue

B. A special neural centre in the medulla oblongata

C. Adrenal medullary hormones

D. Adrenal cortical hormones

Choose the correct answer from the options given below:

[4 Marks]

(A) A, B, C and D

(B) A, B and D only

(C) A, B and C only

(D) A, C and D only

Explanation:

Cardiac activity is regulated by nodal tissue (e.g., SA node), medulla oblongata (neural control) and adrenal medullary hormones (adrenaline). Adrenal cortical hormones do not directly regulate heart activity.

Question 57.

Which of following organisms cannot fix nitrogen?

A. *Azotobacter*
B. *Oscillatoria*
C. *Anabaena*
D. *Volvox*

[4 Marks]

(A) E only

(B) D only

(C) B only

(D) A only

Explanation:

Volvox is a green alga that cannot fix nitrogen. Azotobacter, Oscillatoria, Anabaena, Nostoc are nitrogen-fixing organisms.

Question 58.

Statement-I: Transfer RNAs and ribosomal RNA do not interact with mRNA.

Statement-II: RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defence.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Both statement I and statement II are incorrect

(B) Both statement I and statement II are correct

(C) Statement I is incorrect but statement II is correct

(D) Statement I is correct but statement II is incorrect

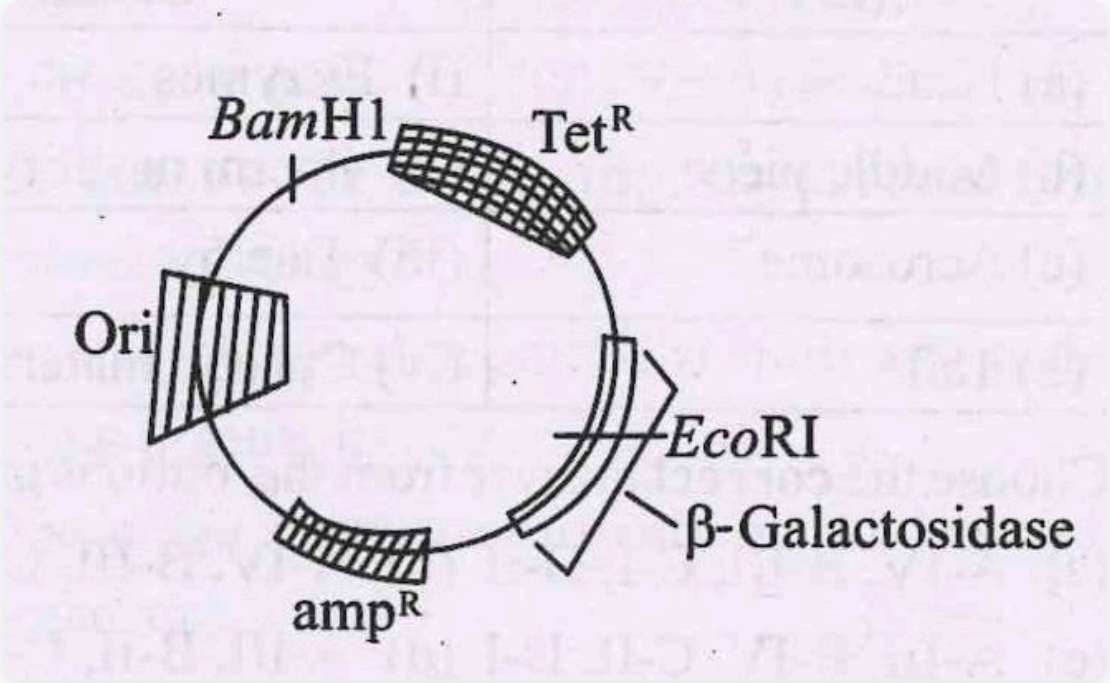
Explanation:

Statement I is incorrect but Statement II is correct. Statement I is incorrect because tRNAs interact with mRNA during translation, and rRNA forms ribosomes. Statement II is correct because RNA interference (RNAI) is a defence mechanism in eukaryotes. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).

Question 59.

In the above represented plasmid an alien piece of DNA is inserted at EcoRI site. Which of the following strategies will be chosen to select the recombinant colonies?

[4 Marks]



(A) White colour colonies will be selected

(B) Blue colour colonies grown on ampicillin plates can be selected

(C) Blue colour colonies will be selected

(D) Using ampicillin & tetracyclin containing medium plate

Explanation:

When an alien piece of DNA fragment is inserted at EcoRI site, it disrupts the β-galactosidase gene. Bacteria with this plasmid cannot produce functional β-galactosidase and will remain white when grown on medium containing X-gal.

Non-recombinant colonies will produce functional β-galactosidase and appear blue on plates containing X-gal.

Recombinant colonies will not produce functional β-galactosidase and appear white on plates containing X-gal.

Question 60.

Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?

[4 Marks]

(A) Phage

(B) Yeast

(C) Virus

(D) Bacterium

Explanation:

Eli Lilly used recombinant E.coli to produce human insulin.

Question 61.

Name the class of enzyme that usually catalyze the following reaction:

S–G + S^# → S + S^# –G

Where,

G → a group other than hydrogen

S → a substrate

S^# → another substrate

[4 Marks]

(A) Hydrolase

(B) Transferase

(C) Lyase

(D) Ligase

Explanation:

The reaction shows a functional group (G) being transferred from one substrate (S) to another (S'), which is an example of group transfer. Transferases are enzymes that catalyse the transfer of a functional group (like methyl, phosphate groups) from one molecule to another.

Question 62.

Find the statement that is NOT correct with regard to the structure of monocot stem.

[4 Marks]

(A) Phloem parenchyma is absent.

(B) Vascular bundles are scattered.

(C) Vascular bundles are conjoint and closed.

(D) Hypodermis is parenchymatous

Explanation:

In monocot stems, the hypodermis is sclerenchymatous (not parenchymatous) for mechanical support.

Question 63.

The correct sequence of events in the life cycle of bryophytes is

A. Fusion of antherozoid with egg.

B. Attachment of gametophyte to substratum.

C. Reduction division to produce haploid spores.

D. Formation of sporophyte.

E. Release of antherozoids into water.

Choose the correct answer from the options given below:

[4 Marks]

(A) B, E, A, D, C

(B) D, E, A, B, C

(C) D, E, A, C, B

(D) B, E, A, C, D

Explanation:

B,E,A,D,C.

The correct sequence in the bryophyte life cycle is:

1. Attachment of gametophyte to substratum
2. Release of antherozoids into water
3. Fertilization
4. Sporophyte formation
5. Meiosis to produce haploid spores.

Question 64.

Which are correct?

A. Computed tomography and magnetic resonance imaging detect cancers of internal organs.

B. Chemotherapeutics drugs are used to kill non-cancerous cells.

C. α-interferon activate the cancer patient's immune system and helps in destroying the tumour.

D. Chemotherapeutic drugs are biological response modifiers.

E. In the case of leukaemia blood cell counts are decreased.

Choose the correct answer from the options given below:

[4 Marks]

(A) C and D only

(B) B and D only

(C) D and E only

(D) A and C only

Explanation:

A and Conly

Computed tomography- (CT) and magnetic resonance imaging (MRI) detect internal cancers. o-interferon boosts immunity against tumour. Chemotherapeutics target cancerous cells. Blood cell counts increase in leukaemia.

Question 65.

Match List-I with List-II.

Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
(a) Centrosome	(i) Mitochondrion
(b) Cilium	(ii) Cell division
(c) Cristae	(iii) Cell movement
(d) Cell membrane	(iv) Phospholipid Bilayer

(A) A-II, B-I, C-IV, D-III

(B) A-IV, B-II, C-III, D-I

(C) A-I B-II, C-III, D-IV

(D) A-II, B-III, C-I, D-IV

Explanation:

A-II, B-III, C-I, D-IV

Centromere is involved in cell division.

Cilium helps in cell movement.

Cristae are mitochondrial folds.

Cell membrane consist of phospholipid bilayer.

Question 66.

Match List-I with List-II.

Choose the option from with all correct matches.

[4 Marks]

List-I	List-II
(a) Chlorophyll-*a*	(i) Yellow- green
(b) Chlorophyll-*b*	(ii) Yellow
(c) Xanthophylls	(iii) Blue- green
(d) Carotenoids	(iv) Yellow to Yellow-orange

(A) A-III, B-IV, C-II, D-I

(B) A-I, B-II, C-IV, D-III

(C) A-III, B-I, C-II, D-IV

(D) A-I, B-IV, C-III, D-II

Explanation:

A-III, B-I, C-II, D-IV

Chlorophyll a: Blue-green

Chlorophyll B: Yellow-green

Xanthophylls: Yellow

Carotenoids: Yellow-orange

Question 67.

Find the correct statements:

A. In human pregnancy, the major organ systems are formed at the end of 12 weeks.

B. In human pregnancy the major organ systems are formed at the end of 8 weeks.

C. In human pregnancy heart is formed after one month of gestation.

D. In human pregnancy, limbs and digits develop by the end of second month.

E. In human pregnancy the appearance of hair is usually observed in the fifth month.

Choose the correct answer from the options given below:

[4 Marks]

(A) A and E only

(B) B, C, D and E only

(C) B and C only

(D) A, C, D and E only

Explanation:

In human pregnancy, the most of the major organ systems are formed by the end of 12 weeks (first trimester).

Embryo’s heart is formed after one month.

Limbs and digits develop by the end of second month.

Hair appears in the fifth month.

Question 68.

In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein-rich layer called:

[4 Marks]

(A) Coleoptile

(B) Integument

(C) Aleurone Layer

(D) Coleorhiza

Explanation:

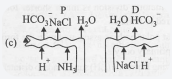
The aleurone layer is a protein-rich layer separating the embryo from the endosperm in cereal seeds.

Question 69.

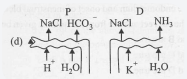
Which of the following diagrams is correct with regard to the proximal (P) and distal (D) tubule of the Nephron.

[4 Marks]

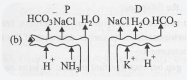
(A)



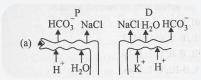
(B)



(C)



(D)



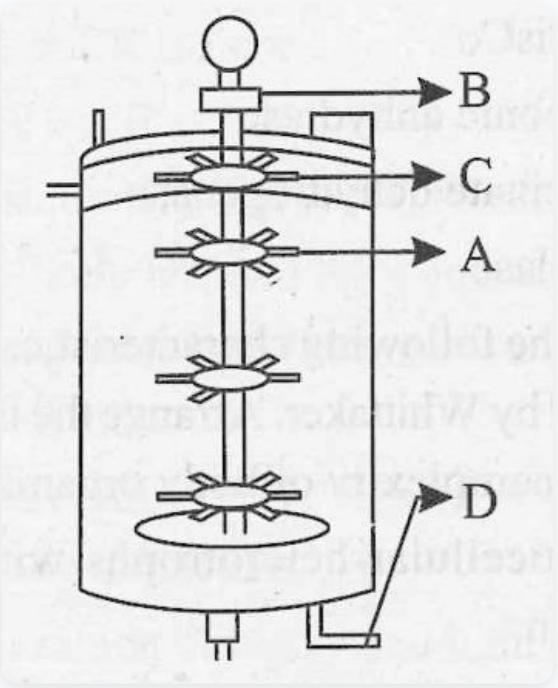
Explanation:

Proximal tubule shows reabsorption of HCO_3^-, NaCl, and H_2O, and secretion of H^+ and NH_3. Distal tubule ‘shows reabsorption of NaCl, H_2O, and HCO_3^-, and secretion of K^+ and H^+.

Question 70.

Identify the part of a bio-reactor which is used as a foam breaker from the given figure.

[4 Marks]



(A) B

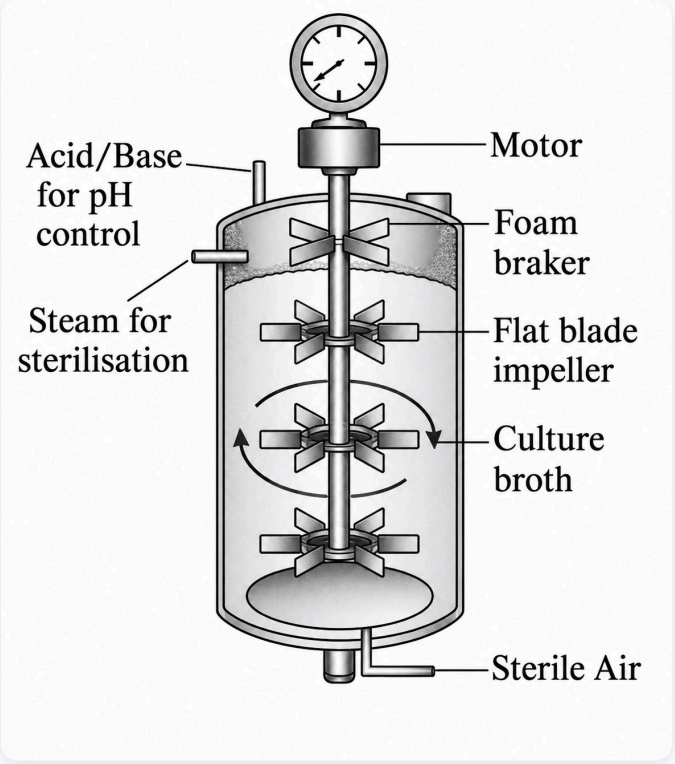
(B) D

(C) A

(D) C

Explanation:

C- foam braker



Question 71.

Assertion (A): A typical unfertilised, angiosperm embryo sac at maturity is 8 nucleated and 7-celled. Reason (R): The egg apparatus has 2 polar nuclei. In the light of the above statements, choose the correct answer from the options given below:

[4 Marks]

(A) both A and R are true but R is NOT the correct explanation of A.

(B) A is false but R is true.

(C) A is true but R is false.

(D) Both A and R are true and R is the correct explanation of A.

Explanation:

A mature unfertilized angiosperm embryo sac is 8-nucleate and 7-celled (1 egg cell, 2 synergids, 3 antipodals, and 1 central cell with 2 polar nuclei) and the egg apparatus consists of 1 egg cell and 2 synergids, not polar nuclei. The 2 polar nuclei are part of the central cell, not the egg apparatus.

Question 72.

A specialised membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration is:

[4 Marks]

(A) Chromatophores

(B) Endoplasmic Reticulum

(C) Mesosome

(D) Cristae

Explanation:

Mesosome is a specialized infolding of the plasma membrane in prokaryotes that aids in cell wall formation.

DNA replication and respiration.

Chromatophores are pigment —containing structures (in photosynthetic bacteria).

Cristae are mitochondrial folds.

Endoplasmic Reticulum is a eukaryotic organelle.

Question 73.

Which of the following are the post-transcriptional events in an eukaryotic cell?

A. Transport of pre-mRNA to cytoplasm prior to splicing.

B. Removal of introns and joining of exons.

C. Addition of methyl group 5′ end of hnRNA.

D. Addition of adenine residues at 3′ end of hnRNA.

E. Base pairing of two complementary RNAs.

Choose the correct answer from the options given below:

[4 Marks]

(A) B, C, E only

(B) B, C, D only

(C) C, D, E only

(D) A, B, C only

Explanation:

Post-transcriptional modifications in eukaryotes include:

Splicing i.e., removal of introns and joining exons

5 ' Capping i.e., addition of methyl guanosine to 5' end of hnRNA

Polyadenylation is the addition of adenine residues at 3' end to form poly-A tail

Pre-mRNA is spliced in the nucleus before transport.

Base pairing of RNAs is not a post-transcriptional event.

Question 74.

What is the pattern of inheritance for polygenic trait?

[4 Marks]

(A) X-linked recessive inheritance pattern

(B) Non-mendelian inheritance pattern

(C) Mendelian inheritance pattern

(D) Autosomal dominant pattern

Explanation:

Non-Mendelian inheritance pattern.

Question 75.

Which one of the following enzymes contains ‘Haem’ as the prosthetic group?

[4 Marks]

(A) Carbonic anhydrase

(B) Catalase

(C) RuBisCo

(D) Succinate dehydrogenase

Explanation:

Catalase contains a heam (iron) prosthetic group, which aids in breaking down hydrogen peroxide.

Question 76.

Each of the following characteristics represent a Kingdom proposed by Whittaker. Arrange the following in increasing order of complexity of body organization.

A. Multicellular heterotrophs with cell wall made of chitin.

B. Heterotrophs with tissue/organ/organ system level of body organization.

C. Prokaryotes with cell wall made of polysaccharides and amino acids.

D. Eukaryotic autotrophs with tissue/organ level of body organization.

E. Eukaryotes with cellular body organization.

Choose the correct answer from the options given below:

[4 Marks]

(A) C, E, A, B, D

(B) C, E, A, D, B

(C) A, C, E, D, B

(D) A, C, E, B, D

Explanation:

C,E,A,D,B

Increasing complexity order is as follows

Monera, Protista, Fungi (multicellular with chitin), Plants (autotrophic with tissues), Animals (heterotrophic with organ systems)

Question 77.

Who is known as the father of Ecology in India?

[4 Marks]

(A) Ramdeo Misra

(B) Birbal Sahni

(C) Ram Udar

(D) S.R. Kashyap

Explanation:

Ramdeo Misra is regarded as the father of ecology in India

Question 78.

Match List-I with List-II.

Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
(a) Alfred Hershey and Martha Chase	(i) *Streptococcus pneumoniae*
(b) Euchromatin	(ii) Densely packed and dark-stained
(c) Frederick Griffith	(iii) Loosely packed and light-stained
(d) Heterochromatin	(iv) DNA as genetic material confirmation

(A) A-IV, B-II, C-I, D-III

(B) A-IV, B-III, C-I, D-II

(C) A-II, B-IV, C-I, D-III

(D) A-III, B-II, C-IV, D-I

Explanation:

A-IV, B-III, C-I, D-II

Hershey and Chase- DNA as genetic material

Euchromatin- Loosely packed and light-stained

Griffith- Streptococcus experiments

Heterochromatin- Densely packed and dark-stained

Question 79.

Neoplastic characteristics of cells refer to:

A. A mass of proliferating cell

B. Rapid growth of cells

C. Invasion and damage to the surrounding tissue

D. Those confined to original location

Choose the correct answer from the options given below:

[4 Marks]

(A) A, B, D only

(B) A, B only

(C) B, C, D only

(D) A, B, C only

Explanation:

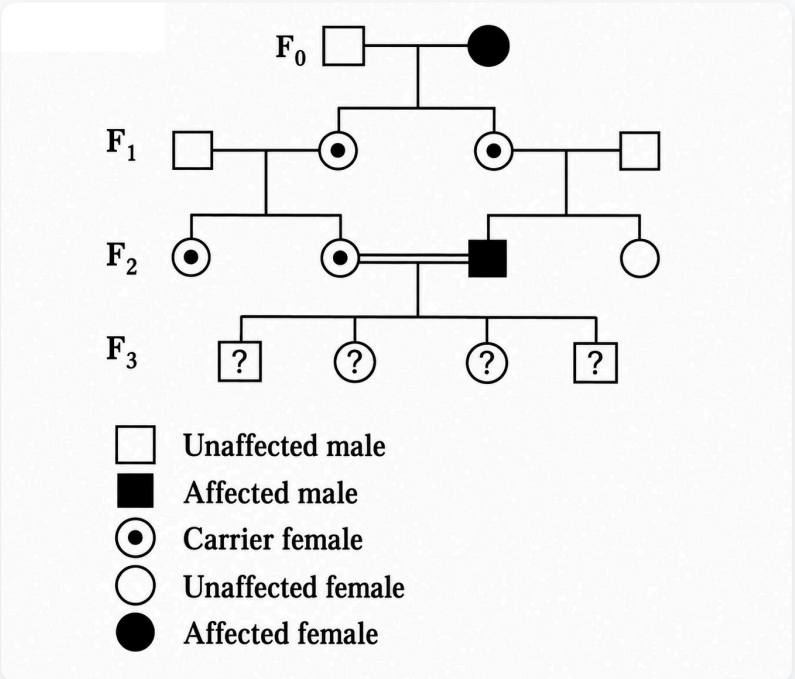
A, B, C only. Neoplastic cells show uncontrolled proliferation, rapid growth, and invasion.

Note: As neoplastic cells actively divide and grow they also starve the normal cells by competing for vital nutrients. Cells sloughed from such tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of malignant tumors.

Question 80.

With the help of given pedigree, find out the probability for the birth of a child having no disease and being a carrier (has the disease mutation in one allele of the gene) in F_3 generation

[4 Marks]



(A) zero

(B) 1/2

(C) 1/2

(D) 1/4

Explanation:

1/2

Question 81.

Statement-I: The primary source of energy in an ecosystem is solar energy.

Statement-II: The rate of production of organic matter during photosynthesis in an ecosystem is called net primary productivity (NPP).

In the light of the above statements, choose the. most appropriate answer form the options given below:

[4 Marks]

(A) Statement I is correct but statement II is correct.

(B) Both statement I and statement II are correct.

(C) Statement I is correct but statement II is incorrect.

(D) Both statement I and statement I are incorrect.

Explanation:

Statement I is correct but statement II is incorrect. Solar energy is the primary source of energy in an ecosystem. The rate of production of organic matter during photosynthesis in an ecosystem is called gross primary productivity (GPP), not net primary productivity (NPP).

Question 82.

Given below are two

Statement I: The DNA fragments extracted from gel electrophoresis can be used in construction of recombinant DNA.

Statement II: Smaller size DNA fragments are observed near anode while larger fragments are found near the wells in An agarose gel.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is incorrect but statement I is correct

(B) Statement I is correct but statement II is incorrect

(C) Both statement I and statement II are incorrect

(D) Both statement I and statement II are correct

Explanation:

Both statement I and statement II are correct. DNA fragments extracted from gel electrophoresis can be used for recombinant DNA. In which smaller DNA fragments migrate farther toward the anode (positive electrode).

Question 83.

Read the following statements on plant growth and development.

A. Parthenocarpy can be induced by auxins.

B. Plant growth regulators can be involved in promotion as well as inhibition of growth.

C. Dedifferentiation is a pre-requisite for re-differentiation.

D. Abscisic acid is a plant growth promoter.

E. Apical dominance promotes the growth of lateral buds.

Choose the option with all correct statements.

[4 Marks]

(A) A, D, E only

(B) B, D, E only

(C) A, B, E only

(D) A, B, C only

Explanation:

A, B, C only

Question 84.

Consider the following:

A. The reductive division for the human female gametogenesis starts earlier than that of the male gametogenesis.

B. The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females.

C. The first polar body is associated with the formation of the primary oocyte.

D. Luteinizing Hormone (LH) surge leads to disintegration of the endometrium and onset of menstrual bleeding.

Choose the correct answer from the options given below:

[4 Marks]

(A) A and C are true

(B) B and C are true

(C) B and D are true

(D) A and B are true

Explanation:

Aand B are true

Female gametogenesis begins earlier than male The gap between meiotic divisions is shorter in males The first polar body with the secondary oocyte

Luteinzing hormone (LH) surge triggers ovulation, not menstruation

Question 85.

Identify the statement that is NOT correct.

[4 Marks]

(A) Constant region of heavy and light chains are located at C-terminus of antibody molecules.

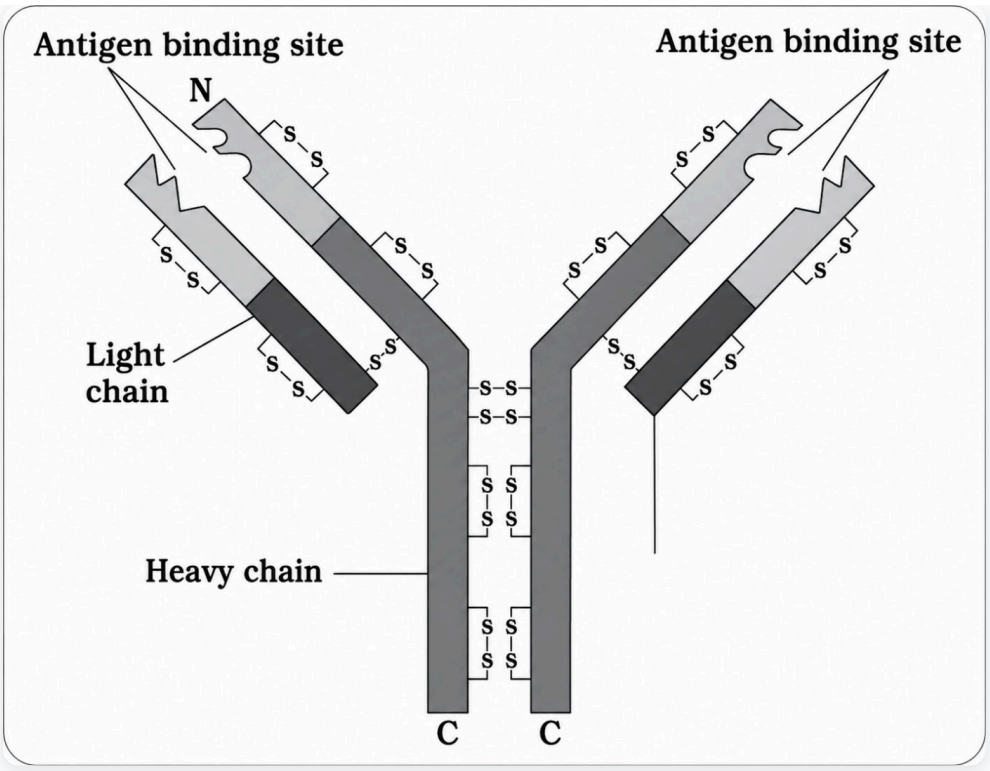
(B) Antigen binding site is located at C-terminal region of antibody molecules.

(C) The heavy and light chains are held together by disulfide bonds.

(D) Each antibody has two light and two heavy chains.

Explanation:

In antibody structure, antigen-binding site is at N-terminal, not C-terminal Antigen binding site region of antibody molecules.



Question 86. Assertion(A): Both wind and water pollinated flowers are not very colourful and do not produce nectar. Reason (R): The flowers produce enormous amount of pollen grains in wind and water pollinated flowers. In the light of the above statements, choose the correct answer from the options given below:

[4 Marks]

(A) Both A and R are true and R is NOT the correct explanation of A.

(B) Both A and R are true and R is the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Explanation: Both assertion and reason are true and reason is the correct explanation of assertion. Wind and water pollinated flowers are not colourful or nectar-rich because they rely on pollen quantity.

Question 87. Epiphytes that are growing on a mango branch is an example of which of the following?

[4 Marks]

(A) Commensalism

(B) Predation

(C) Mutualism

(D) Amensalism

Explanation: Commensalism because epiphytes grow on mango branches for support without harming or benefiting the host (mango tree).

Question 88.

From the statements given below choose the correct option:

A. The eukaryotic ribosomes are 80S and prokaryotic ribosomes are70S

B. Each ribosome has two sub-units.

C. The two sub-units of 80S ribosome are 60S and 40S while that of 70S are 50S and 30S.

D. The two sub-units of 80S ribosome are 60S and 20S and that of 70S are 50S and 20S.

E. The two sub-units of 80S ribosome are 60S and 30S and that of 70S are 50S and 30S

[4 Marks]

(A) A, B, D, are true

(B) B, D, E are true

(C) A,B,E are true

(D) A B, C are true

Explanation:

Eukaryotic ribosomes are 80S having two subunits of 60S and 40S. Prokaryotic ribosomes are 70S having two subunits of 50S and 30S.

Question 89. Which one of following is an example of ex-situ conservation?

[4 Marks]

(A) National park

(B) Wildlife Sanctuary

(C) Zoos and botanical gardens

(D) Protected areas

Explanation: Ex-situ conservation involves relocating threatened animals and plants from their natural habitats to protected environments, such as zoological parks, botanical gardens, and wildlife safari parks.

Question 90.

The ratio of the wavelengths of the light absorbed by a Hydrogen atom when it undergoes $n=2 \rightarrow n=3$ and $n=4 \rightarrow n=6$ transitions, respectively, is

[4 Marks]

(A) 1/36

(B) 1/16

(C) 1/4

(D) 1/9

Explanation:

$1/\lambda = R_Hz^2(1/n_1^2 - 1/n_2^2)$

For $2 \rightarrow 3$

$1/\lambda_1 = R_H \times (1)^2(1/2^2 - 1/3^2)$ ....(i)

For $4 \rightarrow 6$

$1/\lambda_2 = R_H \times (1)^2(1/4^2 - 1/6^2)$ ....(ii)

Divide equation (ii) by (i),

$\lambda_1/\lambda_2 = (1/4^2 - 1/6^2)/(1/2^2 - 1/3^2) = 1/4$

$\lambda_1/\lambda_2 = 1/4$

Question 91.

Which of the following statements are true? A. Unlike Ga that has a very high melting point, Cs has a very low melting point. B. On Pauling scale, the electronegativity values of N and Cl are not the same. C. Ar, K^+, Cl^-, Ca^{2+} and S^{2-} are all isoelectronic species. D. The correct order of the first ionization enthalpies of Na, Mg, Al, and Si is Si > Al > Mg > Na. E. The atomic radius of Cs is greater than that of Li and Rb. Choose the correct answer from the options given below:

[4 Marks]

(A) C and D only

(B) A, C and E only

(C) C and E only

(D) A, B and E only

Explanation:

(A) Ga has a very low melting point, approximately 303 K, and Cs has almost the same melting point (302 K).

(B) On the Pauling scale, the electronegativity value of N and Cl is 3.

(C) Ar, K^+, Cl^-, Ca^{2+} and S^{2-} all species have 18 electrons; therefore, these are isoelectronic species.

(D) The first ionisation enthalpies order of Na, Mg, Al and Si is: Si>Mg>Al>Na

(E) The atomic radius increases on going down the groups; therefore, the radius order is: Cs>Rb>K>Na>Li

Question 92.

Match List-I with List-II. Choose the correct answer from the option given below:

[4 Marks]

List-I (Ion)		List-II (Group Number in Cobalt Analysis)
A.	Co^{2+}	I. Group-I
B.	Mg^{2+}	II. Group-III
C.	Fe^{3+}	III. Group-IV
D.	Al^{3+}	IV. Group-VI

(A) A-III, B-IV, C-II, D-I

(B) A-III, B-IV, C-I, D-II

(C) A-III, B-II, C-IV, D-I

(D) A-III, B-II, C-I, D-IV

Explanation:

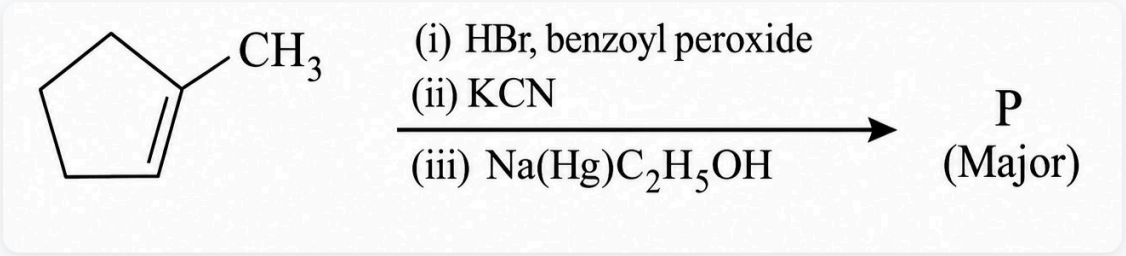
A-III, B-IV, C-I, D-II

Ion	Group Number
Co^{2+}	Group-IV
Mg^{2+}	Group-VI
Pb^{2+}	Group-I
Al^{3+}	Group-III

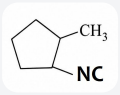
Question 93.

Predict the major product 'P' in the following sequence of reactions -

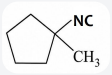
[4 Marks]



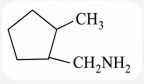
(A)



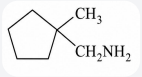
(B)



(C)



(D)



Explanation:

(A) Ga has a very low melting point, approximately 303 K, and Cs has almost the same melting point (302 K). (B) On the Pauling scale, the electronegativity value of N and Cl is 3.

(C) Ar, K^+, Cl^-, Ca^{2+} and S^{2-} all species have 18 electrons; therefore, these are isoelectronic species.

(D) The first ionisation enthalpies order of Na, Mg, Al and Si is: Si>Mg>Al>Na

(E) The atomic radius increases on going down the groups; therefore, the radius order is: Cs>Rb>K>Na>Li

Question 94.

Energy and radius of first Bohr orbit of He^2 and Li^{2+} are [Given $R_H = 2.18 \times 10^{-18}$ J, $a_0 = 52.9$ pm]

[4 Marks]

(A) $E_n(Li^{2+}) = -8.72 \times 10^{-16}$ J; $r_n(Li^{2+})$ =17.6 pm $E_n(He^+) = -19.62 \times 10^{-16}$ J; $r_n(He^+)$ = 17.6 pm

(B) $E_n(Li^{2-}) = -19.62 \times 10^{-16}$ J; $r_n(Li^{2+})$ = 17.6 pm $E_n(He^+) = -8.72 \times 10^{-16}$ J; $r_n(He^+)$ = 26.4 pm

(C) $E_n(Li^{2+}) = -19.62 \times 10^{-18}$ J; $r_n(Li^{2+})$ = 17.6 pm $E_n(He^+) = -8.72 \times 10^{-18}$ J; $r_n(He^+)$ = 26.4 pm

(D) $E_n(Li^{2+}) = -8.72 \times 10^{-18}$ J; $r_n(Li^{2+})$ = 26.4 pm $E_n(He^+) = -19.62 \times 10^{-18}$ J; $r_n(He^+)$ = 17.6 pm

Explanation:

$E_n = -2.18 \times 10^{-18}(z^2/n^2)J$ For $He^+ \Rightarrow E_1(He^+) = -2.18 \times 10^{-18}(2^2/1^2)J = -8.72 \times 10^{-18}$ J

For $Li^{2+} \Rightarrow E_1(Li^{2+}) = -2.18 \times 10^{-18}(3^2/1^2)J$

$= -19.62 \times 10^{-18}$ J

$r_n = 52.9(n^2)/z$ pm

For $He^+ \Rightarrow r_1(He^+) = 52.9 \times 1^2/2 = 26.4$ pm

For $Li^{2+} \Rightarrow r_1(Li^{2+}) = 52.9 \times 1^2/3 = 17.6$ pm

Question 95.

Which of the following are paramagnetic?

A. $[NiCl_4]^{2-}$

B. $Ni(CO)_4$

C. $[Ni(CN)_4]^{2-}$

D. $[Ni(H_2O)_6]^{2+}$

E. $Ni(PPh_3)_4$

Choose the correct answer from the options given below:

[4 Marks]

(A) A, D and E only

(B) B and E only

(C) A and C only

(D) A and D only

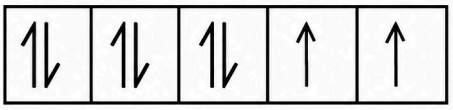
Explanation:

(A) $[NiCl_4]^{2-}$

Oxidation state of Ni = + 2

Electronic configuration = $3d^8 4s^0$

Cl is weak field Ligand therefore no pairing

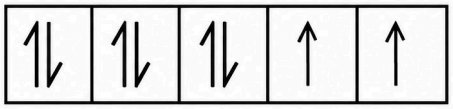
 2 unpaired electrons

(D) $[Ni(H_2O)_6]^{2+}$

Oxidation state of Ni = + 2

Electronic configuration = $3d^8 4s^0$

H_2O is weak field Ligand therefore no pairing



Question 96.

Given below are two statements :

Statement-I: Like nitrogen that can form antmonia, arsenic can form arsine,

Statement-II : Antimony cannot form antimony pentoxide.

In the light of the above statements, choose the most appropriate answer from the options given below :

[4 Marks]

(A) Both Statement I and Statement II are incorrect

(B) Both Statement I and Statement II are correct

(C) Statement I is incorrect but Statement II is correct.

(D) Statement I is correct but Statement II is incorrect

Explanation:

Nitrogen forms ammonia (NH_3) and arsenic can form arsine (AsH_3). All elements of the nitrogen family form two types of oxides, E_2O_3 and E_2O_5. Therefore, statement I is correct but statement II is incorrect.

Question 97.

Which among the following electronic configurations belong to main group elements? A. [Ne] $3s^1$ B. [Ar] $3d^3 4s^2$ C. [Kr] $4d^{10} 5s^2 5p^5$ D. [Ar] $3d^{10} 4s^1$ E. [Rn] $5f^0 6d^2 7s^2$ Choose the correct answer from the option given below:

[4 Marks]

(A) D and E only

(B) A, C and D only

(C) A and C only

(D) B and E only

Explanation:

Main group elements are s- and p-block elements. [Ne] $3s^1$ = s-block [Kr] $4d^{10} 5s^2 5p^5$ ⇒ p-block

Question 98. Dalton's Atomic theory could not explain which of the following?

[4 Marks]

(A) Law of conservation of mas

(B) Law of constant proportion

(C) Law of multiple proportion

(D) Law of gaseous volume

Explanation: Dalton's atomic theory could not explain the law of gaseous volume.

Question 99.

Consider the following compounds: KO_2, H_2O_2 and H_2SO_4. The oxidation states of the underlined elements in them are, respectively,

[4 Marks]

(A) +4, –4, and +6

(B) +1, –2, and +4

(C) +1, –1, and +6

(D) +2, –2, and +6

Explanation:

K_2O: Alkali metals always show +1 oxidation state in their compounds. For H_2SO_4: 2(+1) + x + 4(−2) = 0

⇒ x = +6

For H_2O_2: 2(+1) + 2x = 0

⇒ x −1

Question 100. If the half-life ($t_1/_2$) for a first order reaction is 1 minute, then the time required for 99.9% completion of the reaction is closest to:

[4 Marks]

(A) 2 minutes

(B) 4 minutes

(C) 5 minutes

(D) 10 minutes

Explanation: For a first-order reaction, $t_{99 \cdot 9}\% = 10 \times t_1/_2$ Thus, $t_{99 \cdot 9}\% = 10 \times 1 = 10$ minutes

Question 101.

The correct order of the wavelength of light absorbed by the following complexes is, A. $[Co(NH_3)_6]^{3+}$ B. $[Co(CN)_6]^{3-}$ C. $[Cu(H_2O)_4]^{2+}$ D. $[Ti(H_2O)_6]^{3+}$ Choose the correct answer from the options given below:

[4 Marks]

(A) C < A < D < B

(B) B < A < D < C

(C) C < D < A < B

(D) B < D < A < C

Explanation:

As the strength of the ligands increases, the splitting factor Δ_0 increases and, as a result, the energy absorbed increases and consequently, the wavelength (λ absorbed) decreases. CN^- and NH_3 are

strong-field ligands, and CN^- is a stronger ligand due to back bonding. Among tetrahedral and octahedral complexes of the same ligand, octahedral complexes are more stable as $\Delta t = 4/9\Delta_0$ where Δ_t is the tetrahedral crystal field splitting and Δ_0 is the octahedral crystal field splitting.

Thus $[Ti(H_2O)_6]^{3+}$ will have higher energy of the wavelength λ_absorbed than$[Cu(H_2O)_4]^{2+}$

Question 102.

Which one of the following compounds can exist as cis-trans isomers?

[4 Marks]

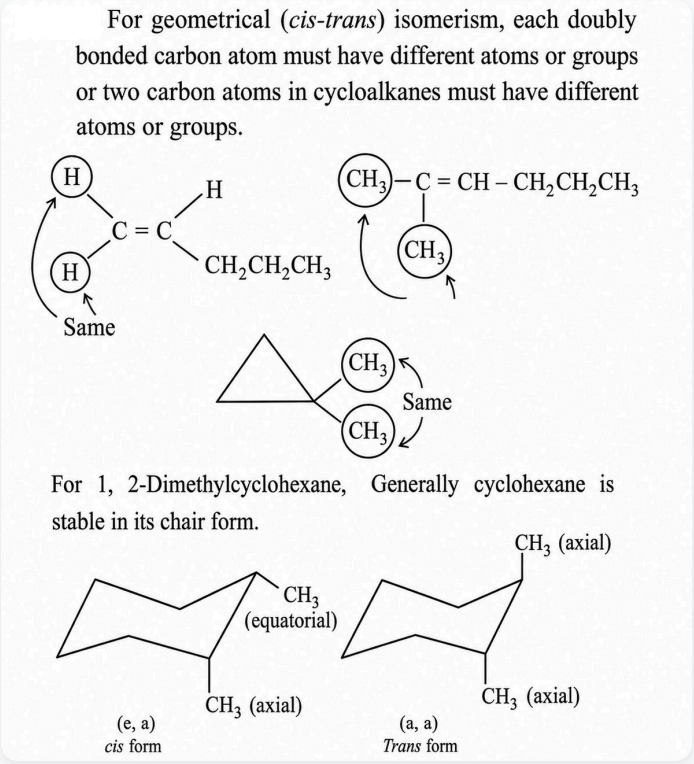
(A) 1,2-Dimethylcyclohexane

(B) 1,1-Dimethylcyclopropane

(C) 2-Methylhex-2-ene

(D) Pent-1-ene

Explanation:



Question 103.

Phosphoric acid ionizes in three steps with their ionization constant values K_{a1}, K_{a2} and K_{a3}, respectively, While K is the overall ionization constant. Which of the following statements are true?

A. $\log K = \log K_{a1} + \log K_{a2} + \log K_{a3}$

B. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-}

C. $K_{a1} > K_{a2} > K_{a3}$ D. $K_{a1} = K_{a3} + K_{a2}/2$

Choose the correct answer from the options given below:

[4 Marks]

(A) A and C only

(B) A and B only

(C) B, C and D only

(D) A, B and C only

Explanation:

For phosphoric acid, which is a polybasic acid, $K = K_{a1} \times K_{a2} \times K_{a3}$ and $K_{a1}\ K_{a2} > K_{a3}$

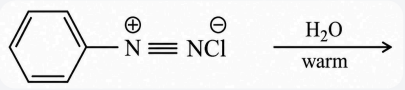
$\log K = \log(K_{a1} \times K_{a2} \times K_{a3}) = \log K_{a1} + \log K_{a2} + \log K_{a3}$ There is no particular relationship among K_{a1}, K_{a2} values of a polybasic acid. Thus, D is incorrect. Therefore, A, B and C are correct.

Question 104.

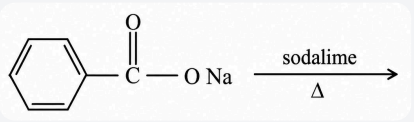
Which one of the following reactions does NOT give benzene as the product?

[4 Marks]

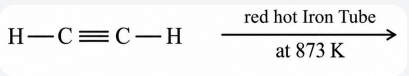
(A)



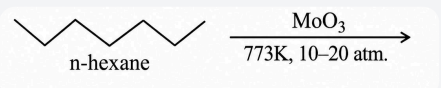
(B)



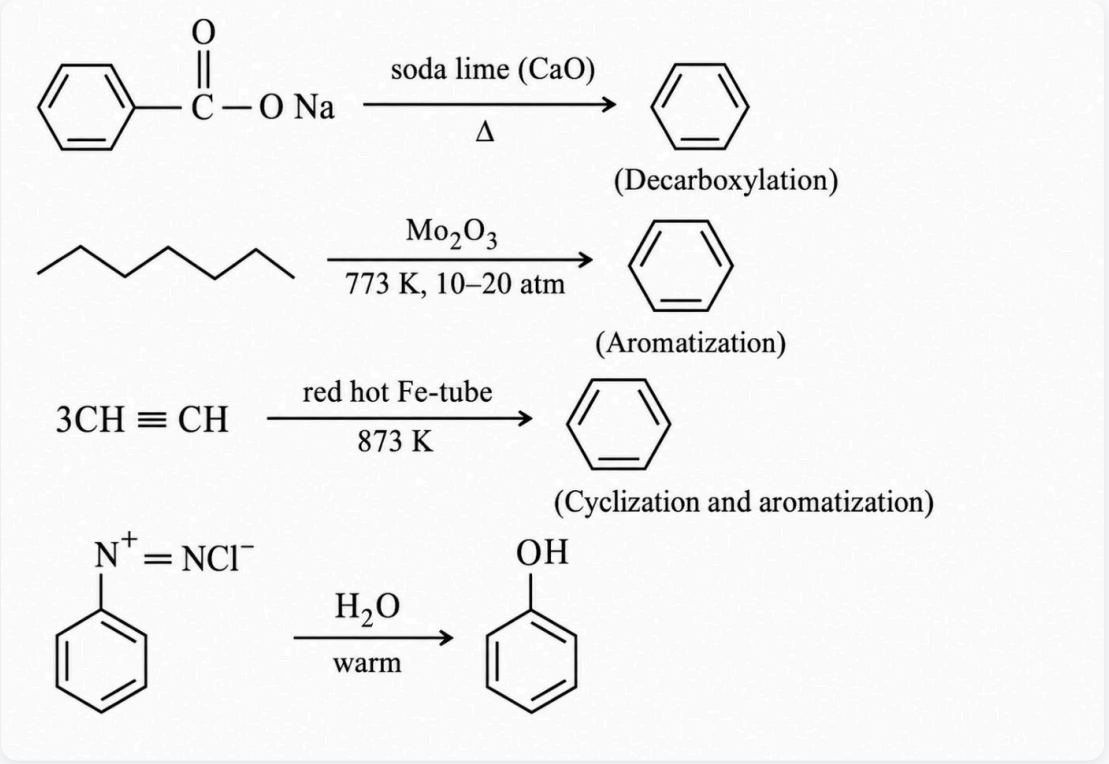
(C)



(D)



Explanation:



Question 105.

If the molar conductivity (A_m) of a 0.050 mol L^{-1} solution of a monobasic weak acid is 90 S cm^2 mol^{-1}, its extent (degree) of dissociation will be [Assume Λ^0_+ 349.6 S cm^2 mol^{-1} and Λ^0_- = 50.4 S cm^2 mol^{-1}]

[4 Marks]

(A) 0.215

(B) 0.225

(C) 0.125

(D) 0.115

Explanation:

Degree of dissociation (α) = α = Λ_m/Λ^0_m From Kohlrausch law: $\Lambda^0_m = \Lambda^0_+ + \Lambda^0_-$ = 349.6 + 50.4 = 400 S cm^2 mol^{-1} Thus, α = Λ_m/Λ^0_m = 90/400 = 0.225

Question 106.

Given below are two statements :

Statement-I: A hypothetical diatomic molecule with bond order zero is quite stable.

Statement-II: As bond order increases, the bond length increases.

In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is true but Statement II is false

(B) Statement I is false but Statement II is true

(C) Both Statement I and Statement II are false

(D) Both Statement I and Statement II are true

Explanation:

If a diatomic molecule has a bond order of zero, it does not exist. With an increase in bond order, the bond strength increases, leading to a shorter bond length. Thus, both statements are incorrect.

Question 107.

Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

[4 Marks]

(A) $[Co(NH_3)_3Cl_3]$

(B) $[Co(NH_3)_4Cl_2]$

(C) $[Co(NH_3)_6]Cl_3$

(D) $[Co(NH_3)_5Cl]Cl$

Explanation:

more will be the ions dissociated in solution, more will be the conductance.

Formula	Total ions dissociated
$[Co(NH_3)_6Cl_2]$	0
$[Co(NH_3)_5Cl_2]$	0
$[Co(NH_3)_6]Cl_3$	4
$[Co(NH_3)_5Cl]Cl$	2

Question 108. Match List-I with List-II. Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
A. XeO_3	I. sp^3d, linear
B. XeF_2	II. sp^3, pyramidal
C. $XeOF_4$	III. sp^3d^2, distorted octahedral
D. XeF_6	IV. sp^3d^3, square pyramidal

(A) A-II, B-I, C-IV, D-III

(B) A-II, B-I, C-III, D-IV

(C) A-IV, B-II, C-I, D-III

(D) A-IV, B-II, C-III, D-I

Explanation: XeO_3 ⇒ 3 B.P. + 1 L.P. = sp^3, pyramidal shape XeF_2 ⇒ 2 B.P. + 3 L.P. = sp^3d, linear shape $XeOF_4$ ⇒ 5 B.P. + 1 L.P. = sp^3d^2, square pyramidal shape XeF_6 ⇒ 6 B.P. + 1 L.P. = sp^3d^3, distorted octahedral shape

Question 109.

Match List-I with List-II. Choose the correct answer from the options given below

[4 Marks]

Match **List-I** with **List-II**.

	List-I (Example)		**List-II (Type of Solution)**
A.	Humidity	I.	Solid in solid
B.	Alloys	II.	Liquid in gas
C.	Amalgams	III.	Solid in gas
D.	Smoke	IV.	Liquid in solid

Choose the **correct** answer from the options given below

(A) A-III, B-I, C-IV, D-II

(B) A-III, B-II, C-I, D-IV

(C) A-II, B-IV, C-I, D-III

(D) A-II, B-I, C-IV, D-III

Explanation:

Humidity = Liquid in gas Alloy = Solid in solid Amalgam = Liquid (like Hg) in solid Smoke = Solid particles in gas.

Question 110. The correct order of decreasing basic strength of the given amines is:

[4 Marks]

(A) N-methylaniline > benzenamine > ethanamine > N-ethylethanamine

(B) N-ethylethanamine > ethanamine > benzenamine > N-methylaniline

(C) N-ethylethanamine > ethanamine > N-methylaniline > benzenamine

(D) benzenamine > ethanamine > N-methylaniline > N-ethylethanamine

Explanation: Aliphatic amines are more basic than aromatic amines due to localized lone pair of electrons on nitrogen atom in aliphatic amines. Secondary aliphatic amines are more basic than primary aliphatic amines due to + I effect. Thus, the order of basicity is : N-ethylethanamine > ethanamine > N-methylaniline > benzenamine

Question 111.

Among the following choose the ones with equal number of atoms. A. 212 g of Na_2CO_3(s) [molar mass = 106 g] B. 248 g of Na_2O(s) [molar mass = 62 g] C. 240 g of NaOH(s) [molar mass = 40 g] D.

12 g of $H_2(g)$ [molar mass = 2 g] E. 220 g of $CO_2(g)$ [molar mass = 44 g] Choose the correct answer from the options given below:

[4 Marks]

(A) A, B and D only

(B) B, D and E only

(C) B,C and D only

(D) A, B and C only

Explanation:

Number of atoms = Atomicity × Number of moles × N_A For (A), Number of atoms = 6 × (212/106) × N_A = 12 N_A For (B), Number of atoms = 3 × (248/62) × N_A = 12 N_A For (C), Number of atoms = 3 × (240/40) × N_A = 18 N_A

For (D), Number of atoms = 2 × (12/2) × NA=12 N_A For (E), Number of atoms = 3 × (220/44) × N_A = 15 N_A

Thus, (A), (B) and (D) have the same number of atoms.

Question 112. Match List-I with List-II. Choose the correct answer from the options given below:

[4 Marks]

List-I (Name of the Vitamin)	List-II (Deficiency Disease)
A. Vitamin B_{12}	I. Cheilosis
B. Vitamin D	II. Convulsions
C. Vitamin B_2	III. Rickets
D. Vitamin B_6	IV. Pernicious anaemia

(A) A-I, B-III, C-II, D-IV

(B) A-IV, B-III, C-I, D-II

(C) A-II, B-III, C-I, D-IV

(D) A-IV, B-III, C-II, D-I

Explanation: Vitamin B_{12}: Deficiency causes pernicious anaemia. Vitamin D: Deficiency causes rickets in bones. Vitamin B_2: Deficiency causes cheilosis. Vitamin B_6: Deficiency causes convulsions.

Question 113.

The correct order of decreasing acidity of the following aliphatic acids is:

[4 Marks]

(A) $CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_2CCOOH > HCOOH$

(B) $(CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH > HCOOH$

(C) $HCOOH > CH_3COOH > (CH_3)_3CHCOOH > (CH_3)_3CCOOH$

(D) $HCOOH > (CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH$

Explanation:

The acidic strength increases with –I effect or decreases with +I effect. Thus, the presence of $–CH_3$ groups decreases the acidity. Therefore, HCOOH is the most acidic and $(CH_3)_3CCOOH$ is the least acidic.

Question 114.

Given below are two statement :

Statement-I: Ferromagnetism is considered as an extreme form of paramagnetism.

Statement-II: The number of unpaired electrons in a Cr^{2+} ion (Z = 24) is the same as that of a Nd^{3+} ion (Z = 60). In the light of the above statements,

choose the correct answer from the options given below:

[4 Marks]

(A) Both Statement I and Statement II are true

(B) Statement I is false but Statement II is true

(C) Both Statement I and Statement II are false

(D) Statement I is true but Statement II is false

Explanation:

Ferromagnetism is considered as an extreme form of paramagnetism due to greater number of unpaired electrons and stronger pull towards a magnetic field. Thus, statement I is true.

Thus, statement II is false:

$Cr^{3+} : 3d^4$

$\Rightarrow$

1	1	1	1	

$Nd^{3+} : 4f^3$

$\Rightarrow$

1	1	1				

Question 115. Match List-I with List-II. Choose the correct answer from the options given below:

[4 Marks]

	List-I (Mixture)		**List-II (Method of Separation)**
A.	$CHCl_3 + C_6H_5NH_2$	I.	Distillation under reduced pressure
B.	Crude oil in petroleum industry	II.	Steam distillation
C.	Glycerol from spent-lye	III.	Fractional distillation
D.	Aniline-water	IV.	Simple distillation

(A) A-IV,B-III, C-I, D-II

(B) A-III, B-IV, C-I, D-II

(C) A-IV, B-III, C-II, D-I

(D) A-III, B-IV, C-II, D-I

Explanation: $CHCl_3$ (61°C) + $C_6H_5NH_2$ (184°C) ⇒ Simple distillation due to the high difference in boiling points. Crude oil ⇒ Fractional distillation Glycerol (decomposes at high temperatures due to its high boiling point) + spent lye ⇒ Distillation under reduced pressure Aniline + water (aniline is steam volatile at higher temperatures) ⇒ Steam distillation.

Question 116.

For the reaction A(g) ⇌ 2B(g) the backward reaction rate constant is higher than the forward reaction rate constant by a factor of 2500, at 1000 K. [Given: R = 0.0831 L atm $mol^{-1}K^{-1}$] K_p for the reaction at 1000 K is

[4 Marks]

(A) 2.077×10^5

(B) 0.021

(C) 0.033

(D) 83.1

Explanation:

K_C = K_f/K_b = K_f/2500K_f = 1/2500 ⇒ K_p = K_C(RT)^Δ^{ng} ;(Δn_g = 2-1 = 1) = (1/2500)(0.0831 × $1000)^1$ = 0.033

Question 117.

Given below are two statements :

Statement-I: Benzenediazonium salt is prepared by the reaction of aniline with nitrous acid at 273–278 K. It decomposes easily in the dry state.

Statement-II: Insertion of iodine into the benzene ring is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI. In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Both Statement I and Statement II are correct

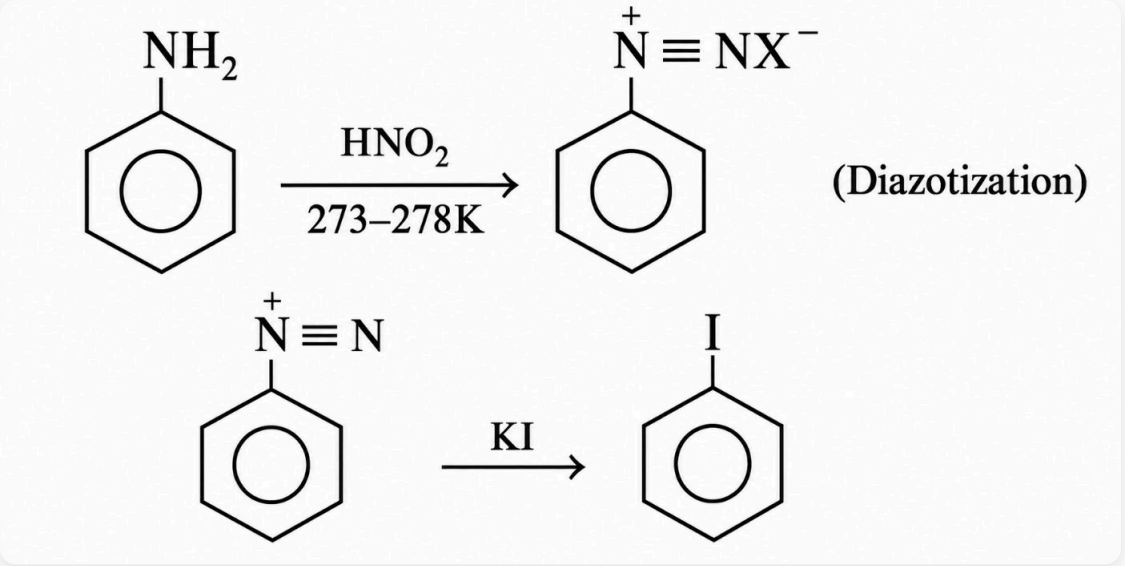
(B) Both Statement I and Statement II are incorrect

(C) Statement I is correct but Statement II is incorrect

(D) Statement I is incorrect but Statement II is correct

Explanation:

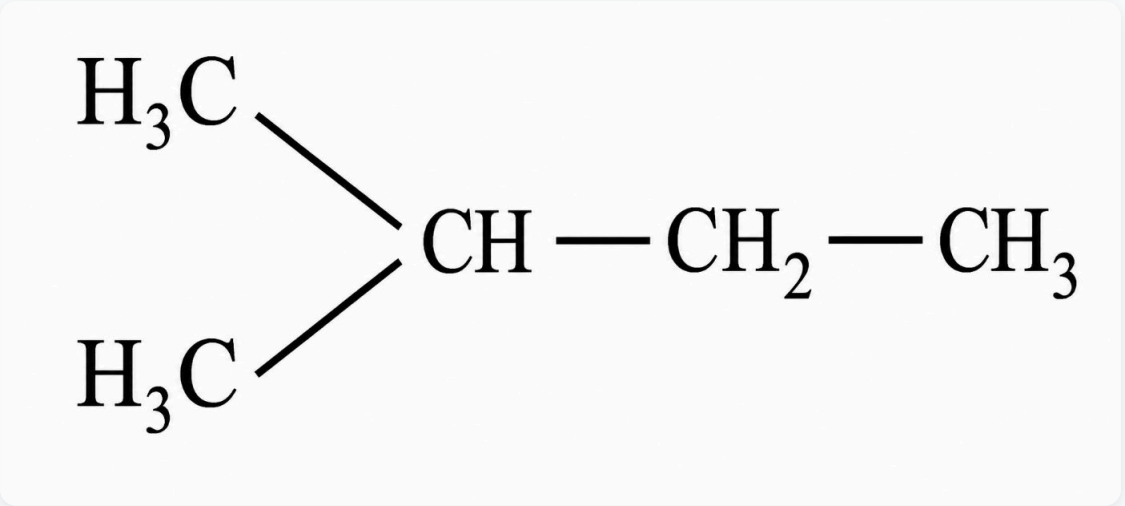
Both statements are correct as diazotization is the method of preparation of benzenediazonium salt, and iodobenzene is prepared by the reaction of benzenediazonium salt with KI instead of direct iodination of benzene.



Question 118.

How many products (including stereoisomers) are expected from monochlorination of the following compound ?

[4 Marks]



(A) 6

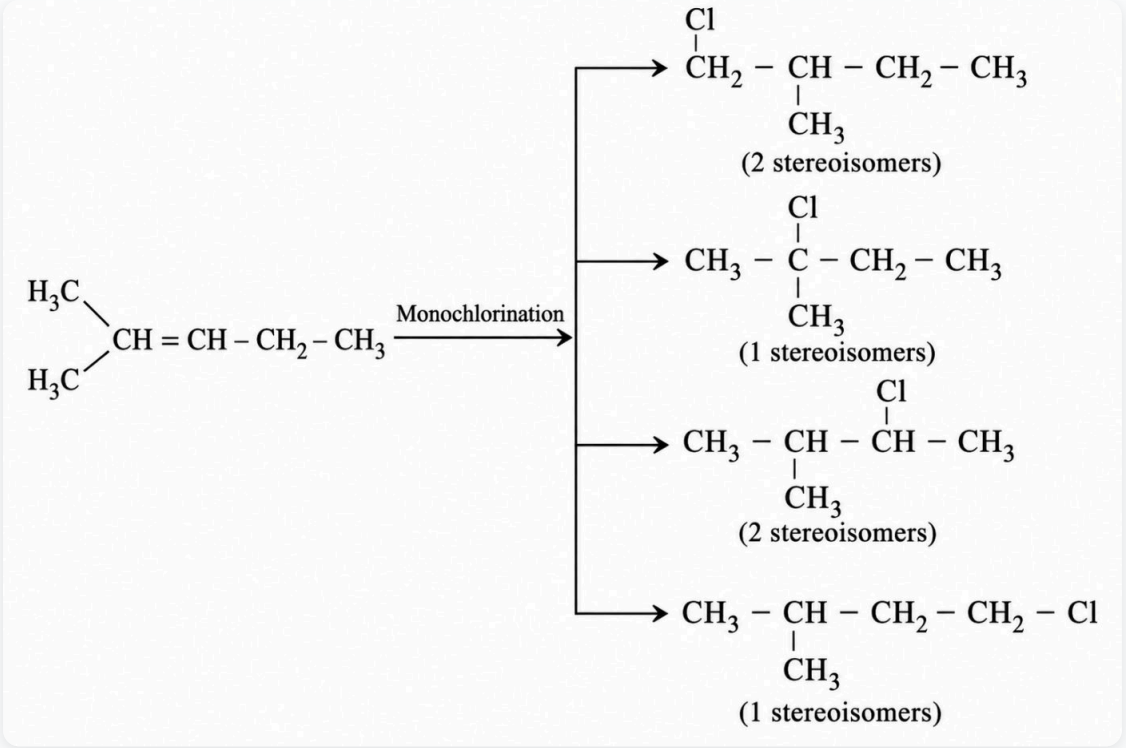
(B) 3

(C) 2

(D) 5

Explanation:

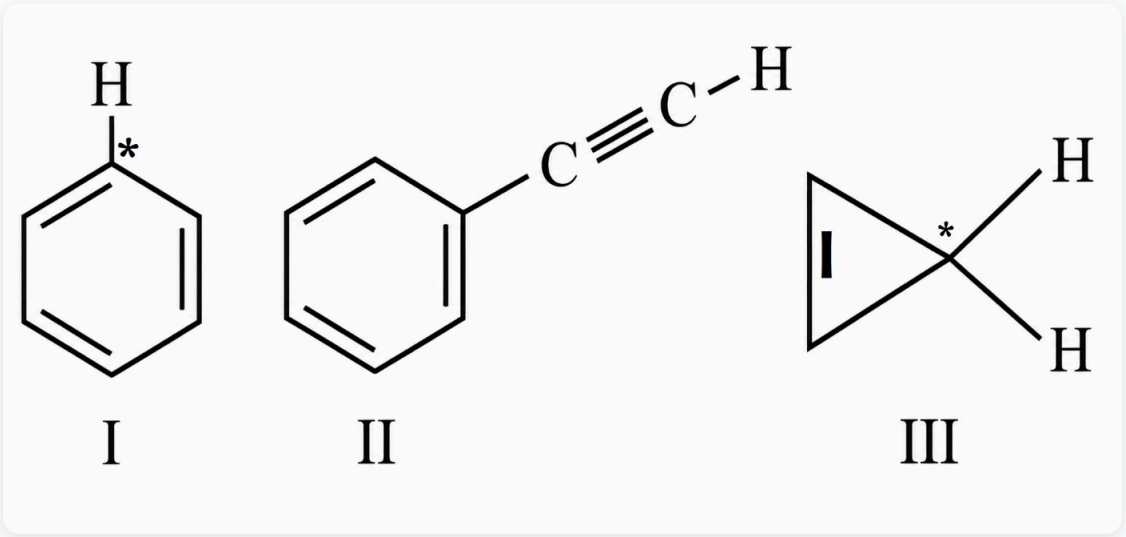
Thus, total of six stereoisomers.



Question 119.

Among the given compound I-III, the correct order of bond dissociation energy of C-H bond marked with * is :

[4 Marks]



(A) II > I > III

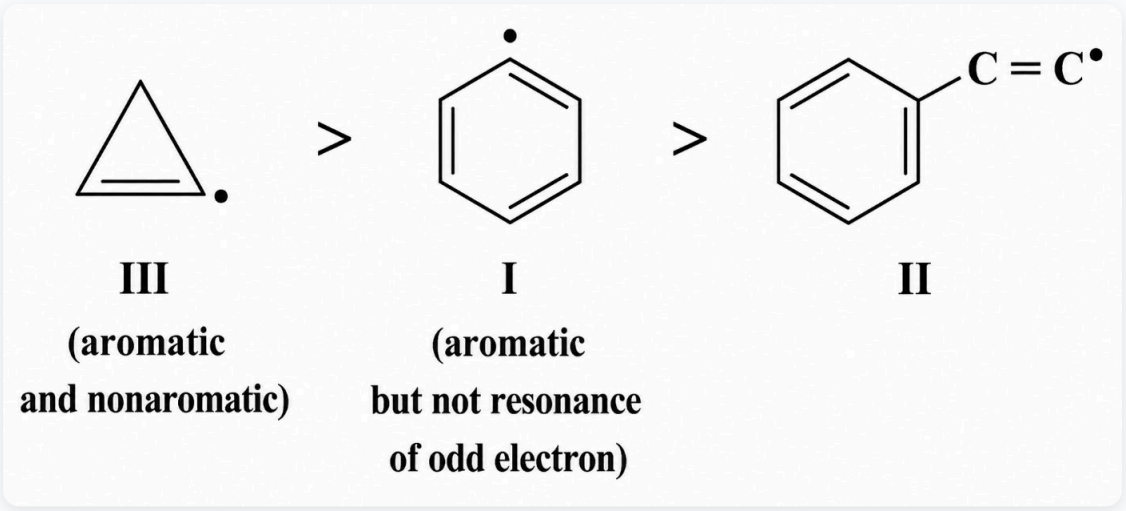
(B) I > II > III

(C) III > II > I

(D) II > III > I

Explanation:

Bond dissociation energy will be higher for less stable species (free radical) formed after the dissociation of the C-H bond. The stability order is :



Question 120. Which of the following aqueous solution will exhibit highest boiling point?

[4 Marks]

(A) 0.01 M Na_2SO_4

(B) 0.01 M Urea

(C) 0.01 M KNO_3

(D) 0.015 M $C_6H_{12}O_6$

Explanation: $\Delta T_b = iK_b m$ Thus, higher the value of i, greater the ΔT_b and higher the T_b. Thus, 0.01 M (analogous to molality, will also give the number of particles) of Na_2SO_4 will have i = 3 and the highest T_b.

Question 121. Match List-I with List-II. Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
A. Haber process	I. Fe catalyst
B. Wacker oxidation	II. $PdCl_2$
C. Wilkinson catalyst	III. $[PPh_3]_3RhCl$
D. Ziegler catalyst	IV. $TiCl_4$ with $Al(CH_3)_3$

(A) A-II, B-III, C-I, D-IV

(B) A-I, B-II, C-IV, D-III

(C) A-I, B-II, C-III, D-IV

(D) A-I, B-IV, C-III, D-II

Explanation: Haber's process = Fe Wacker's process = $PdCl_2$ Wilkinson's catalyst = [(PPh3)3RhCl] [(PPh_3)_3RhCl][(PPh3)3RhCl] Ziegler–Natta catalyst = $TiCl_4 + Al(CH_3)_3$

Question 122.

5 moles of liquid X and 10 moles of liquid Y make a solution having a vapour pressure of 70 torr. The vapour pressures of pure X and Y are 63 torr and 78 torr respectively. Which of the following is true regarding the described solution?

[4 Marks]

(A) The solution has volume greater than the sum of individual volumes.

(B) The solution shows negative deviation.

(C) The solution shows positive deviation.

(D) The solution is ideal.

Explanation:

For X

$n_X = 5$

$P_X^0 = 63$

For Y

$n_Y = 10$

$P_Y^0 = 78$

$$P_S(\text{calc.}) = P_X^0 X_X + P_Y^0 X_Y$$

$$= \frac{63 \times 5}{15} + \frac{78 \times 10}{15}$$

$$= 21 + 52$$

$$= 73$$

where,

n_X = no. of moles of X

n_Y = no. of moles of Y

P_X^0 = vapour pressure of pure X

P_Y^0 = vapour pressure of pure Y

X_X = mole fraction of X

$$X_X = \frac{n_X}{n_X + n_Y}$$

X_Y = mole fraction of Y

$$X_Y = \frac{n_y}{n_X + n_y}$$

P_S(calc.) = Pressure of calculated solution

P_S(obs.) = Pressure of observed solution

P_S(obs.) = 70 torr (Given in the question)

As, $P_S(\text{obs.}) < P_S(\text{calc.})$

Thus ΔV = −ve

Hence, the solution shows negative deviation.

Question 123.

Sugar ‘X’ A. is found in honey. B. is a keto sugar. C. exists in α and β-anomeric forms. D. is laevorotatory. ‘X’ is:

[4 Marks]

(A) Sucrose

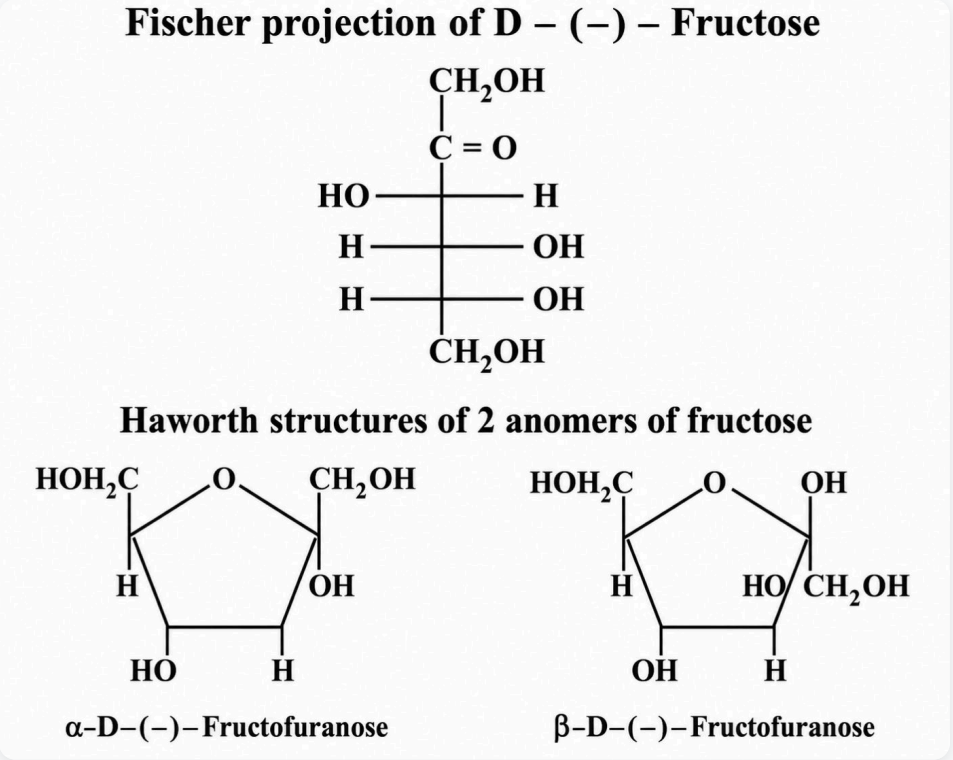
(B) Maltose

(C) D-Glucose

(D) D-Fructose

Explanation:

D-Fructose is a ketohexose sugar that exists in α and β anomeric forms. It is a laevorotatory compound and is found in honey.



Question 124. In the light of the above statements, choose the correct answer from the options given below :

[4 Marks]

Assertion (A):  undergoes S_N2 reaction faster than 

Reason (R): Iodine is a better leaving group because of its large size.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false

(D) A is false but R is true

Explanation: The rate of S_N2 reaction ∝ leaving tendency of the leaving group. Because iodine is a good leaving group due to its large size, which stabilises the I^- ion.

Question 125.

The standard heat of formation, in kcal / mol^{-1}, of Ba^{2+} is: {Given: Standard heat of formation of SO_4^{2-} ion (aq) = −216 kcal mol ; Standard heat of crystallisation of $BaSO_4$(s) = −4.5 kcal /mol ; Standard heat of formation of $BaSO_4$(s) = −349 kcal / mol }

[4 Marks]

(A) −133.0

(B) +133.0

(C) +220.5

(D) −128.5

Explanation:

$$Ba^{+2}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4;\ \Delta H_r = \Delta C_{rys}(BaSO_4) = -4.5 \text{ kJ cal mol}^{-1}$$

$$\downarrow \qquad \downarrow \qquad \downarrow$$

$$\Delta H_f(Ba^{+2}) \quad \Delta H_f(SO_4^{2-}) \quad \Delta H_f(BaSO_4)$$

$$\downarrow \qquad \downarrow \qquad \downarrow$$

$$= -216 \text{ K cal mol}^{-1} \quad = -349 \text{ K cal mol}^{-1}$$

$$\text{As, } \Delta H_r = \sum_i a_i \Delta H_f \text{ (Products)} - \sum_i b_i \Delta H_f \text{ (Reactants)}$$

where, ΔH_r = enthalpy of reaction

ΔH_f = enthalpy of formation

a_i = coefficients of products

b_i = coefficients of reactants

$$\Delta H_{crys}(BaSO_4) = \Delta H_f(BaSO_4) - [\Delta H_f(Ba^{+2}) + \Delta H_f(SO_4^{2-})]$$

$$= -4.5 \text{ kcal/mol} = [-349 \text{ Kcal/mol}] - [\Delta H_f(Ba^{+2}) + (-216) \text{ Kcal/mol}]$$

$$= -4.5 \text{ kcal/mol} = [-349 \text{ Kcal/mol}] - [-216 \text{ Kcal/mol}]$$

$$\therefore \Delta H_f(Ba^{+2}) = -128.5 \text{ Kcal/mol}$$

Question 126.

Total number of possible isomers (both structural as well as stereoisomers) of cyclic ethers of molecular formula C_4H_8O is :

[4 Marks]

(A) 10

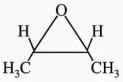
(B) 11

(C) 6

(D) 7

Explanation:

As the molecular formula is C_4H_8O and as given in the question that C_4H_8O is cyclic ether, ∴ The possible ring structures along with the possible isomers are:

		Stereoisomer	Structural isomer
(i)		× (As no chiral centre)	✓ 1 isomer
(ii)		× (As no chiral centre)	✓ 1 isomer
(iii)		× (As no chiral centre)	✓ 1 isomer
(iv)	 ★ = chiral carbon	× 2 isomers (As 1 chiral centre so, $2^n = 2^1 = 2$)	✓
(v)	 ★ = chiral carbon	× 2 isomers (As 1 chiral centre so, $2^n = 2^1 = 2$)	✓
(vi)	 (meso compound)	× As 2 chiral centres are there but still it is not optically active due to presence of plane of symmetry Hence, a meso compound	✓ 1 isomer
(vii)	 ★ = chiral carbon	✓ As 2 chiral centres hence, $2^{n-1} = 2^{2-1} = 2^1$ so, 2 isomers	×
	Therefore, total isomers = 1 + 1 + 1 + 2 + 2 + 1 + 2 = 10		

Question 127.

Identify the correct orders against the property mentioned

(A) $H_2O > NH_3 > CHCl_3$ — dipole moment

(B) $XeF_4 > XeO_3 > XeF_2$ — number of lone pairs on central atom

(C) O–H > C–H > N–O — bond length

(D) $N_2 > O_2 > H_2$ — bond enthalpy

Choose the correct options given below:

[4 Marks]

(A) A, D only

(B) B, C only

(C) A, C only

(D) B, D only

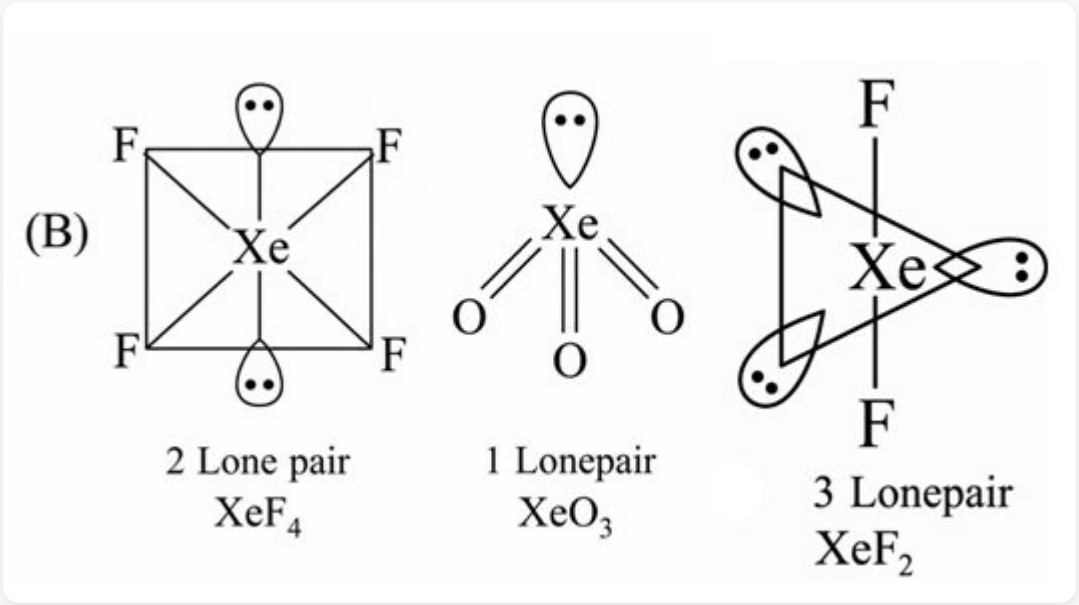
Explanation:

(A) $H_2O > NH_3 > CHCl_3$

(C) O−H > C−H > N−O According to the size of the element.

(D) $N_2 > O_2 > H_2$ N≡N, O=O, H−H

Thus, (A) and (D) are correct statements.



Question 128.

Higher yield of NO in $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ can be obtained at [ΔH of the reaction = + 180.7 kJ mol^{-1}] A. higher temperature B. lower temperature C. higher concentration of N_2 D. higher concentration of O_2 Choose the correct answer from the options given below:

[4 Marks]

(A) A, C, D only

(B) B, C, D only

(C) B, C only

(D) A, D only

Explanation:

$N_2(g) + O_2 \rightleftharpoons 2NO$

$\Delta H = = + 180.7\ kJ\ mol^{-1}$

(A) As temperature increases, the reaction shifts in the forward direction because the reaction is endothermic.

(B) As temperature decreases, the reaction shifts backward because the reaction is endothermic.

(C) As $[N_2]\uparrow \Rightarrow$ the reaction shifts forward.

(D) As $[O_2]\uparrow \Rightarrow$ the reaction shifts forward.

Question 129.

If the rate constant of a reaction is 0.03 s^{-1}, how much time does it take for 7.2 mol L^{-1} concentration of the reactant to get reduced to 0.9 mol L^{-1}? (Given : log2 = 0.301)

[4 Marks]

(A) 210 s

(B) 21.0 s

(C) 23.1 s

(D) 69.3 s

Explanation:

k = 0.03 s^{-1} (First-order reaction) where, k = rate constant A_0 = initial concentration of reactant A_t = concentration of reactant at time t

t = half-life

A_0 =7.2 mol L^{-1} A_t = 0.9 mol L^{-1}

$7.2 \rightarrow t_{1'2} \rightarrow 3.6 \text{ — } t_{1'2} \rightarrow 1.8 \text{ — } t_{1'2} \rightarrow 0.9$

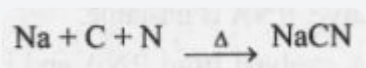
$t = 3t_{1'2} = 3 \times 0.693/0.03 = 69.3\ s$

Question 130.

Which one of the following reactions does NOT belong to “Lassaigne’s test”?

[4 Marks]

(A)



(B)

$$2Na + S \xrightarrow[\Delta]{} Na_2S$$

(C)

$$Na + X \xrightarrow[\Delta]{} + NaX$$

(D)

$$2CuO + C \xrightarrow[\Delta]{} 2Cu + CO_2$$

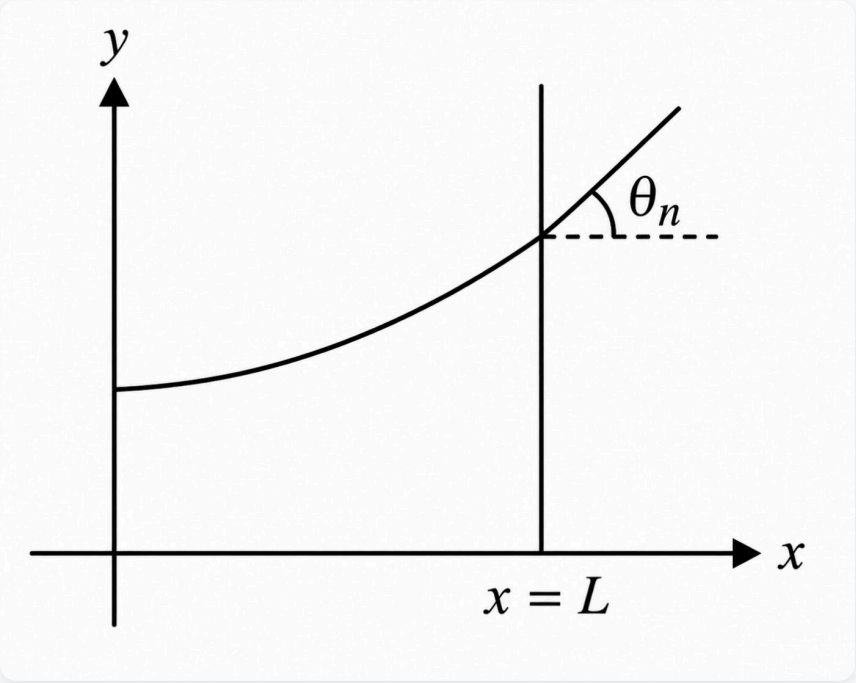
Explanation:

$2CuO + C \xrightarrow{\Delta} 2Cu + CO_2$ Lassaigne's test is used to detect the presence of Nitrogen, Halogen, Sulphur, and Phosphorus. Option is the detection of carbon. It is the Liebig method.

Question 131.

Consider a water tank shown in the figure. It has one wall at x = L and can be taken to be very wide in the z direction. When filled with a liquid of surface tension S and density ρ, the liquid surface makes angle θ_0 ($\theta_0 \ll 1$) with the x-axis at x = L. If y(x) is the height of the surface then the equation for y(x) is: (take θ(x) = sinθ(x) = tanθ(x) = dy/dx, g is the acceleration due to gravity)

[4 Marks]



(A) $d^2y/dx^2 = \rho g/S\ y$

(B) $d^2y/dx^2 = \rho g/S\ x$

(C) $dy/dx = \sqrt{(\rho g/S)}\ x$

(D) $d^2y/dx^2 = \sqrt{(\rho g/S)}$

Explanation:

At horizontal level, $P_A = P_B = P_0$

Along vertical level, $P_C = P_0 - \rho gy$

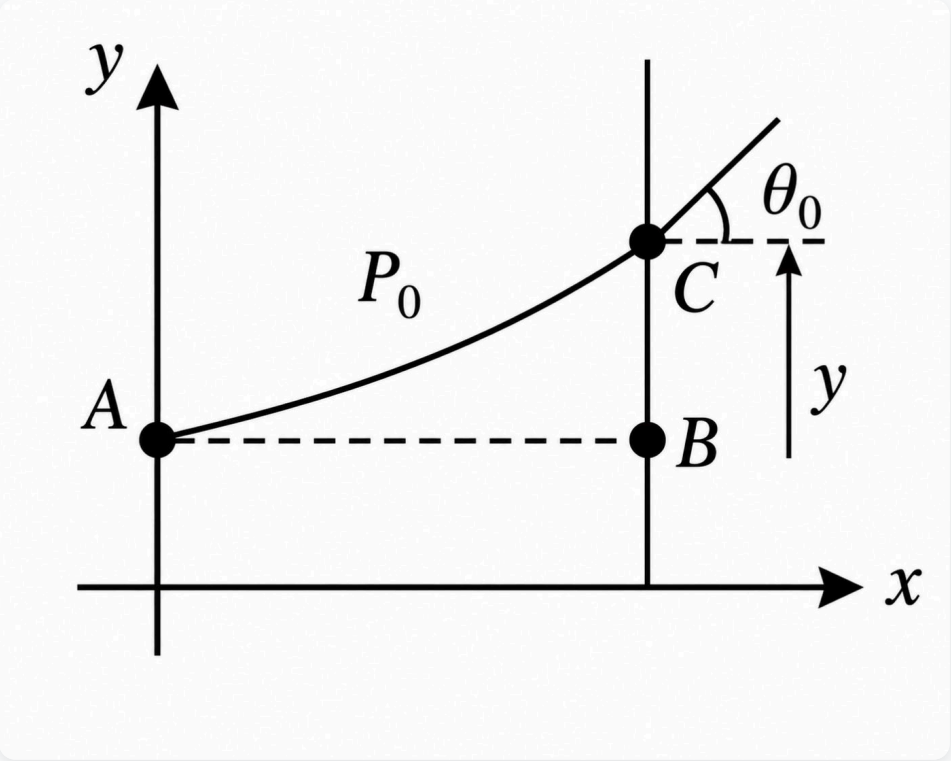
Also, $P_C = P_0 - S/R \therefore \rho gy = S/R$ ...(i)

The radius of curvature is $R = \{1+(dy/dx)^2\}^{3/2} / d^2y/dx^2$

dy/dx is very small $\therefore dy/dx = 0$ $R = 1/d^2y/dx^2 \therefore d^2y/dx^2 = 1/R$ ...(ii) From eq (i) and (ii),

$\rho gy = S\, d^2y/dx^2$

$d^2y/dx^2 = \rho gy/S$



Question 132. A microscope has an objective of focal length 2 cm, eyepiece of focal length 4 cm and the tube length of 40 cm. If the distance of distinct vision of eye is 25 cm, then the magnification of the microscope is:

[4 Marks]

(A) 100

(B) 125

(C) 150

(D) 250

Explanation: For microscope, f_o = 2 cm f_e = 4 cm L = 40 cm D = 25 cm For the condition of normal adjustment, Magnification, m = $L/f_o \times D/f_e$ = 40/2 × 25/4 =125

Question 133.

An electron (mass 9×10^{-31} kg and charge 1.6×10^{-19}) moving with speed c/100 (c = speed of light) is injected into a magnetic field □□ of magnitude 9×10^{-4} T perpendicular to its direction of motion. We wish to apply a uniform electric field □□ together with the magnetic field so that the electron does not deflect from its path. Then (speed of light c = 3×10^8 m s^{-1})

[4 Marks]

(A) □□ is parallel to □□ and its magnitude is 27 x 10^2 V m^{-1}

(B) □□ is perpendicular to □□ and its magnitude is 27 x 10^2 V m^{-1}

(C) □□ is perpendicular to □□ and its magnitude is 27 x 10^4 V m^{-1}

(D) □□ is parallel to □□ and its magnitude is 27 x 10^4 V m^{-1}

Explanation:

For electron to be undeflected, $□□_e = -□□_m \Rightarrow eE = e\ v\ B \sin\theta \therefore E = c/100 \times 9 \times 10^{-4} \sin 90° = 27 \times 10$ V/m

Question 134.

There are two inclined surfaces of equal length (L) and same angle of inclination 45° with the horizontal. One of them is rough and the other is perfectly smooth. A given body takes 2 times as much time to slide down the rough surface than on the smooth surface. The coefficient of kinetic friction (μ_k) between the object and the rough surface is close to:

[4 Marks]

(A) 0.40

(B) 0.25

(C) 0.75

(D) 0.5

Explanation:

The distance travelled on inclined plane is

$L = 1/2\ at^2 \Rightarrow a \propto 1/t^2 \Rightarrow t \propto a$

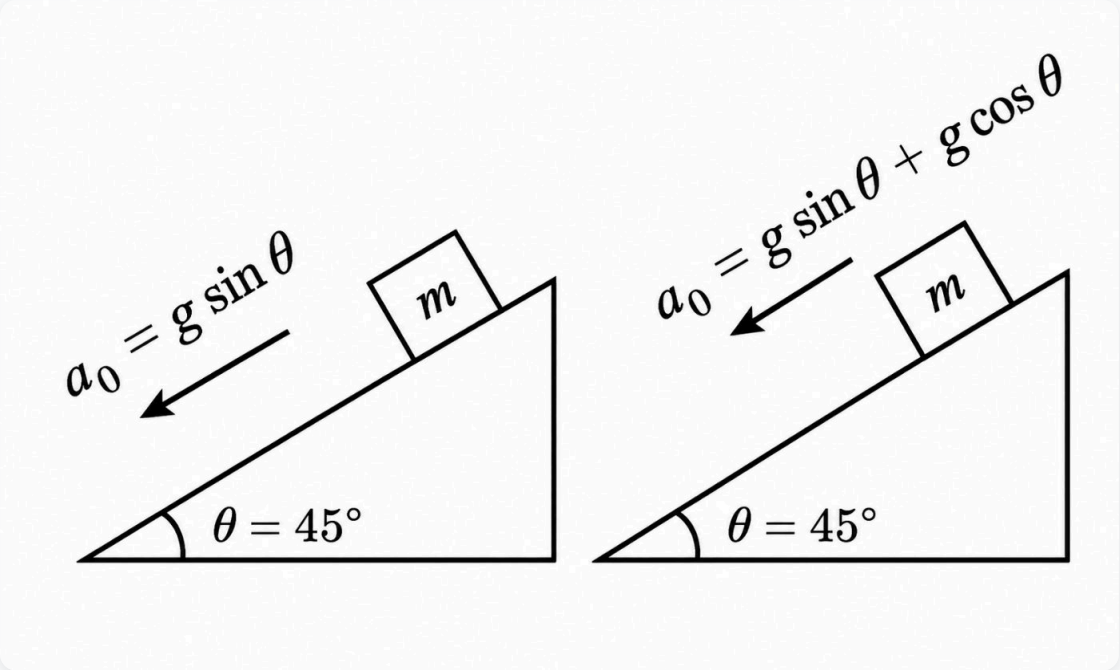
$\Rightarrow (t_S/t_R)^2 = a_R/a_S$

⇒ $(1/2)^2 = g \sin \theta - \mu_k g \cos \theta / g \sin \theta$

⇒ $1/4 = \sin 45° - \mu_k \cos 45° / \sin 45°$

⇒ $1/4 = (1/\sqrt{2})/(1/\sqrt{2}) (1 - \mu_k /1)$

⇒ $1/4 = 1 - \mu_k \Rightarrow \mu_k = 1 - 1/4 = 3/4 = 0.75$



Question 135.

The kinetic energies of two similar cars A and B are 100 J and 225 J respectively. On applying brakes, car A stops after 1000 m and car B stops after 1500 m. If F_A and F_B are the forces applied by the brakes on cars A and B, respectively, then the ratio F_A/F_B is:

[4 Marks]

(A) 1/3

(B) 1/2

(C) 2/3

(D) 3/2

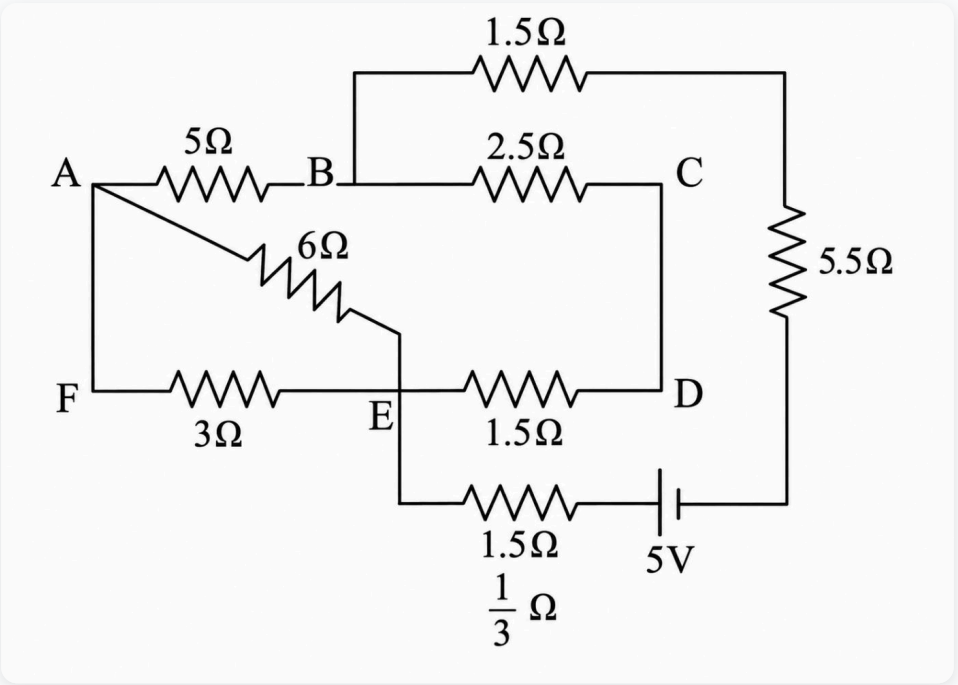
Explanation:

By work–energy theorem, W.D. = Δ KE (Δ KE)_A/(Δ KE)_B = (WD)_A/(WD)_B = - F_AS_A/-F_BS_B ⇒ - 100/ -225 = F_A(1000)/ -F_B(1500) ⇒ F_A/F_B = 2/3

Question 136.

The current passing through the battery in the given circuit,is:

[4 Marks]



(A) 0.5 A

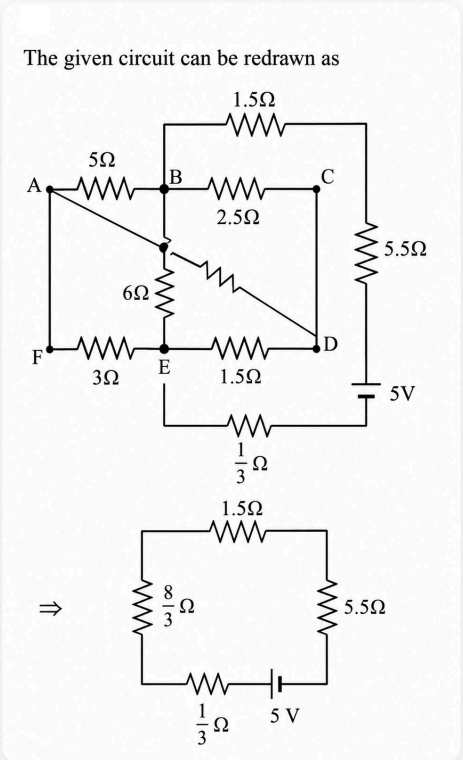
(B) 2.0 A

(C) 1.5 A

(D) 2.5 A

Explanation:

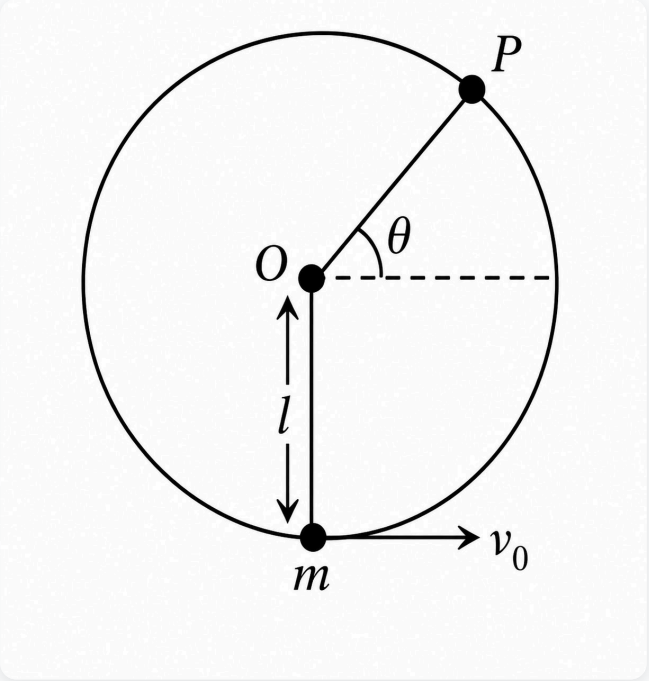
∴ The current passing through the battery is i = V/R_eq = 5/(1/3 + 8/3 + 1.5 + 5.5) = 5/10 = 0.5 A



Question 137.

A bob of heavy mass m is suspended by a light string of length l. The bob is given a horizontal velocity v_0 as shown in the figure. If the string gets slack at some point P, making an angle θ from the horizontal, the ratio of the speed v of the bob at point P to its initial speed v_0 is:

[4 Marks]



(A) $(\sin\theta)^{1/2}$

(B) $(\sin\theta/ 2+3\sin\theta)^{1/2}$

(C) $(\cos\theta/ 2+3\sin\theta)^{1/2}$

(D) $(1/2+3\sin\theta)^{1/2}$

Explanation:

By mechanical energy conservation, $1/2\ mv_0^2 = mgl(1+\sin\theta) + 1/2\ mv_p^2$ ....(i)

At point P,

$T_p = + mg\sin\theta = mv_p^2/l$

Here, $T_p = 0$

$mg\sin\theta = mv_p^2/l \Rightarrow mv_p^2 = mgl\sin\theta$

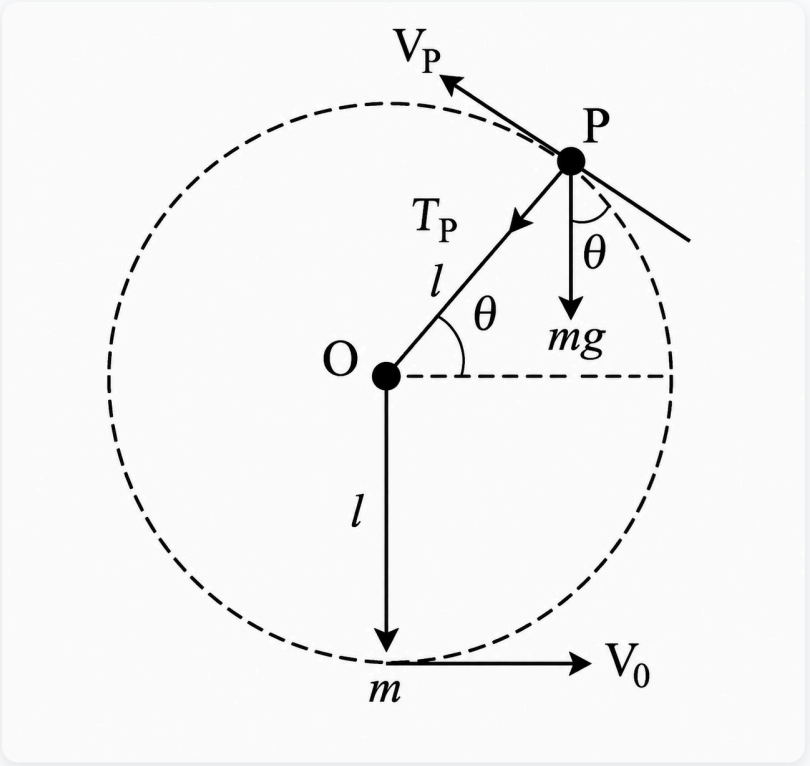
$\therefore v_p = \sqrt{gl\sin\theta}$

From equations (i) & (ii),

$1/2mv_0^2 = mgl(1 + \sin\theta) + 1/2\ mgl\sin\theta$

$v_0^2 = 2gl(1 + \sin\theta) + gl\sin\theta$

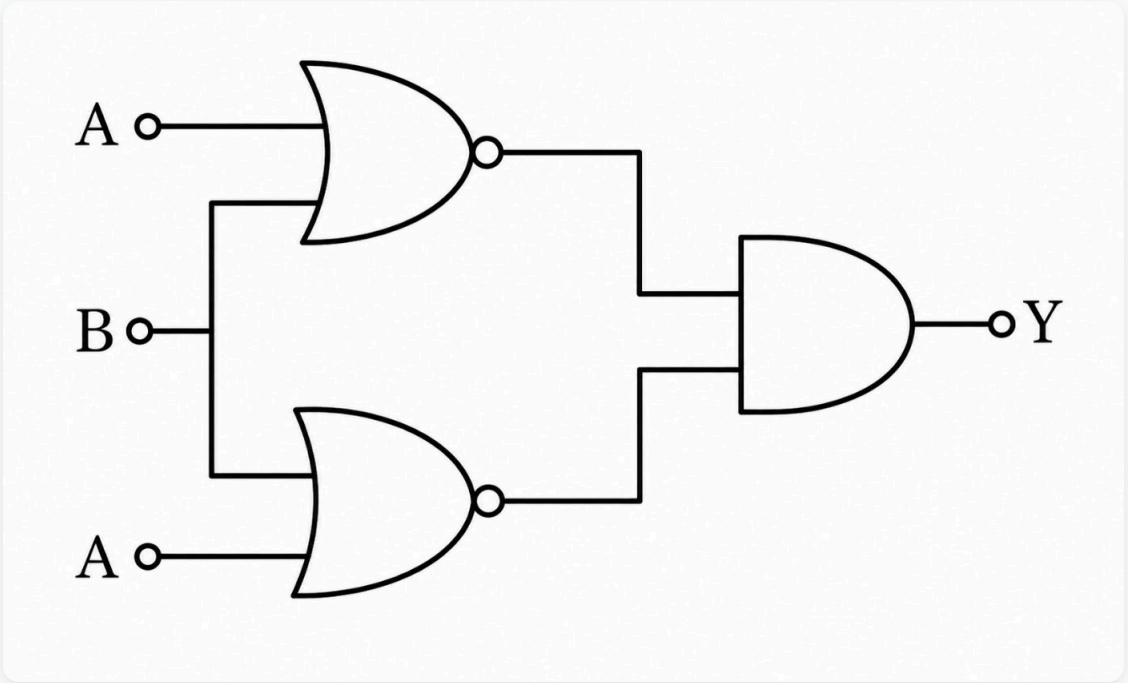
$\Rightarrow v_0 = \sqrt{(2gl + 3gl\sin\theta)}$ $\therefore v_p/v_0 = \sqrt{(\sin\theta/\ 2+3\sin\theta)}$



Question 138.

The output (Y) of the given logic implementation is similar to the output of an/a _____ gate.

[4 Marks]



(A) OR

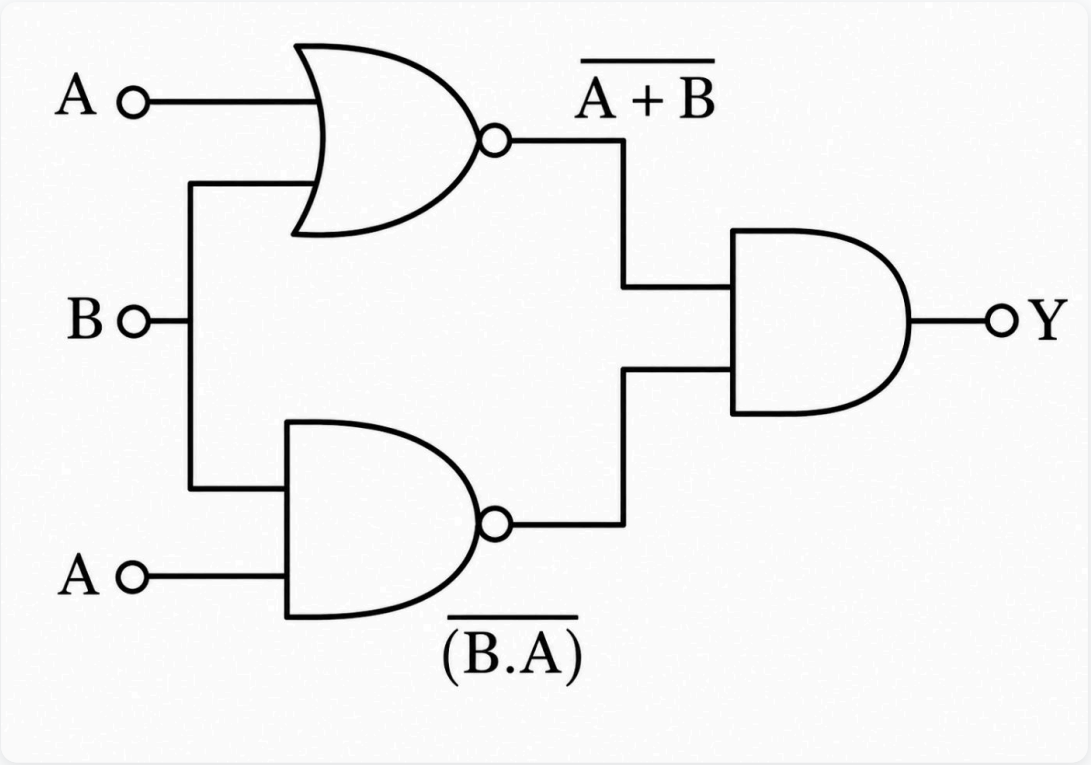
(B) NOR

(C) NAND

(D) AND

Explanation:

The output of the logic circuit is Y= $(\overline{A}+\overline{B}).(\overline{A}+\overline{B}) = \overline{A}.\overline{B}.(\overline{A}+\overline{B}) = \overline{A}.\overline{B}.\overline{A} + \overline{A}.\overline{B}.\overline{B} = \overline{A}.\overline{B} + \overline{A}.\overline{B} = \overline{A}.\overline{B} = (\overline{A}+\overline{B})$ So, the given circuit behaves as a NOR gate.



Question 139.

The electric field in a plane electromagnetic wave is given by $E_z = 60 \cos(5x + 1.5 \times 10^9 t)$ V/m Then expression for the corresponding magnetic field is (here subscripts denote the direction of the field):

[4 Marks]

(A) $B_z = 60 \cos(5x + 1.5 \times 10^9 t)$ T

(B) $B_y = 60 \sin(5x + 1.5 \times 10^9 t)$ T

(C) $B_x = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t)$ T

(D) $B_y = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t)$ T

Explanation:

Given, $E_0 = 60$ V/m, $\omega = 1.5 \times 10^9$ rad/s, $k = 5$ m^{-1}

$c = \omega/k = 1.5 \times 10^9/5 = 3 \times 10^8$ m/s

$B_0 = E_0/c = 60/3 \times 10^2 = 20 \times 10^{-8} = 2 \times 10^{-7}$ T $\therefore B_y = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t)$ T

Question 140.

A ball of mass 0.5 kg is dropped from a height of 40 m. The ball hits the ground and rises to a height of 10 m. The impulse imparted to the ball during its collision with the ground is (Take g = 9.8 m/s²)

[4 Marks]

(A) 84 Ns

(B) 0

(C) 21 Ns

(D) 7 Ns

Explanation:

Initial velocity, $v_1 = -\sqrt{2gh_1} = -\sqrt{(2 \times 9.8 \times 10)} = -28$ m/s

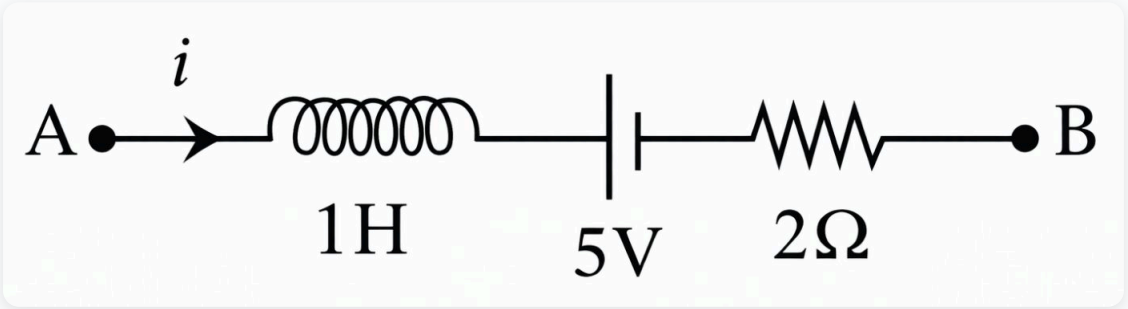
Final velocity, $v_2 = \sqrt{2gh_2} = \sqrt{(2 \times 9.8 \times 10)} = 14$ m/s

$\therefore$ Impulse, $I = m(v_2 - v_1) = 0.5[14-(-28)] = 0.5 \times 42 = 21$ Ns

Question 141.

AB is a part of an electrical circuit (see figure). The potential difference "V_A−V_B" at the instant when current i = 2 A and is increasing at a rate of 1 A/s is:

[4 Marks]



(A) 5 volt

(B) 10 volt

(C) 9 volt

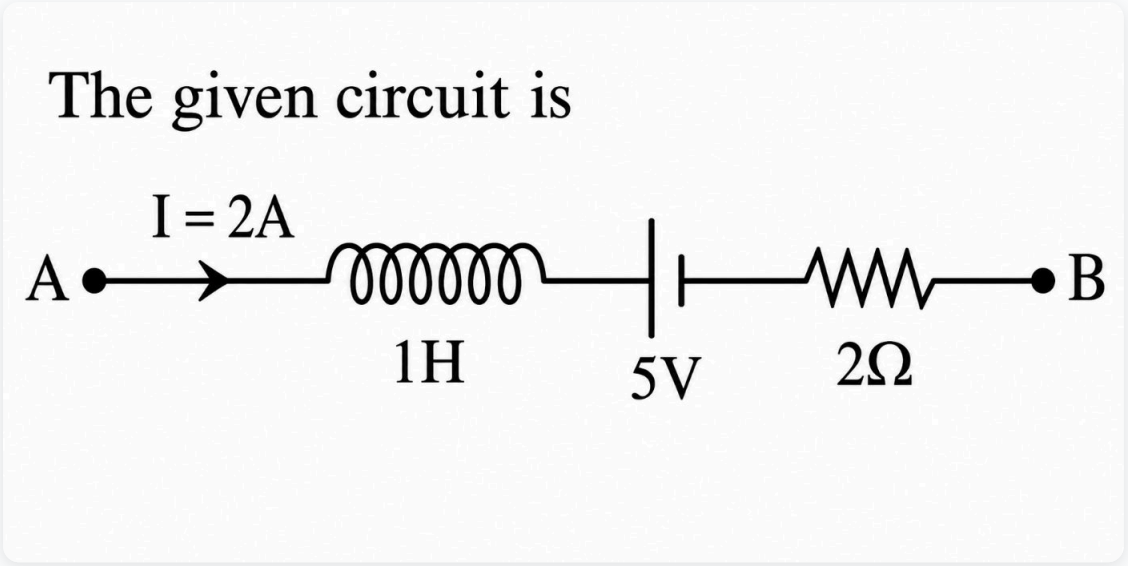
(D) 6 volt

Explanation:

By KVL between points A and B, V_A - LdI/dt - 5 -IR = V_B

$V_A - V_B = LdI/dt + 5 + I R$ Here ,I 2A, dl /dt =1 A/S

$V_A - V_B = 1 \times 1 + 5 + 2 \times 2 = 10$ V



Question 142. In a certain camera, a combination of four similar thin convex lenses are arranged axially in contact. Then the power of the combination and the total magnification in comparison to the power (p) and magnification (m) for each lens will be, respectively

[4 Marks]

(A) 4 p and 4 m

(B) p^4 and 4 m

(C) p^4 and m^4

(D) 4 p and m^4

Explanation: For combination of lens, $P_{net} = P_1+P_2+P_3+P_4 = P+P+P+P = 4P$ ∴ Total magnification, $m_{net} = m \times m \times m \times m = m^4$

Question 143. A 2 amp current is flowing through two different small circular copper coils having radii ratio 1 : 2. The ratio of their respective magnetic moments will be

[4 Marks]

(A) 1 : 4

(B) 1 : 2

(C) 2 : 1

(D) 2 : 1

Explanation: Magnetic moment, $M = I(A) = I(\pi r^2) \Rightarrow M \propto r^2$ $M_1/M_2 = (r_1/r_2)^2 = (1/2)^2 = 1/4$

Question 144.

An oxygen cylinder of volume 30 litre has 18.20 moles of oxygen. After some oxygen is withdrawn from the cylinder, its gauge pressure drops to 11 atmospheric pressure at temperature 27°C. The mass of the oxygen withdrawn from the cylinder is nearly equal to: [Given, R = 100/12 J $mol^{-1}K^{-1}$ and molecular mass of O_2 = 32; 1 atm pressure = 1.01 × 10^5 N/m]

[4 Marks]

(A) 0.116 kg

(B) 0.156 kg

(C) 0.144 kg

(D) 0.125 kg

Explanation:

Given, V = 30 L = 30 × 10^{-3} m^3, n_i = 18.20 moles, P_f = 12 atm T = 27°C = 300 K, M_O_2 = 32 kg ∴ Final moles of O_2 is n_f = P_fV/RT = (1.2 × 1.01 × 10^5 × 30 × 10^{-3})/(100/12)× 300 = 14.544 moles ∴ Δn = n_i - n_f = 18.2 - 14.544 = 3.656 moles ∴ Mass removed, Δm = (Δn)(M_O_2) = 3.656 × 32/100 kg = 0.116 kg

Question 145. In some appropriate units, time (t) and position (x) relation of a moving particle is given by $t = x^2 + x$. The acceleration of the particle is

[4 Marks]

(A) $-2/(2x+1)^3$

(B) $-2/(x+2)^3$

(C) $+2/(x+1)^3$

(D) +2/2x+1

Explanation: Give, $t = x^2 + x \Rightarrow dt/dx = d/dx(x^2 + x) \Rightarrow 1/v = 2x+1 \Rightarrow v = (2x+1)^{-1}$ ∴ Acceleration, $a = vdv/dx = (2x+1)^{-1}[-1(2x+1)^{-2}\times 2] = -1(2x+1)^{-3} \times 2 = -2(2x+1)^{-3} = -2/(2x+1)^3$

Question 146. To an AC power supply of 220 V at 50 Hz, a resistor of 20 Ω, a capacitor of reactance 25 Ω and an inductor of reactance 45 Ω are connected in series. The corresponding current in the circuit and the phase angle between the current and the voltage is, respectively:

[4 Marks]

(A) 7.8 A and 30°

(B) 7.8 A and 45°

(C) 15.6 A and 30°

(D) 15.6 A and 45°

Explanation: In AC circuit, $X_C = 25\ \Omega$, $X_L = 45\ \Omega \therefore Z = \sqrt{[R^2 + (X_L - X_C)^2]} = \sqrt{[20^2 + (45-25)^2]} = 20\sqrt{2}\ \Omega \therefore I_{rms} = V_{rms}/z = 220/20\sqrt{2} = 11/\sqrt{2} = 7.8$ A Also, $\tan\Phi = (X_L - X_C)/R = (45-25)/20 = 20/20 = 1 \therefore \Phi = 45°$

Question 147. The Sun rotates around its centre once in 27 days. What will be the period of revolution if the Sun were to expand to twice its present radius without any external influence? Assume the Sun to be a sphere of uniform density.

[4 Marks]

(A) 100 days

(B) 105 days

(C) 115 days

(D) 108 days

Explanation: The MOI is $\Rightarrow I \propto r^2 \Rightarrow I_2 = 4I_1$ $T_1 = 27$ days By Angular momentum conservation, $I_1\omega_1 = I_2\omega_2 \Rightarrow I_1\omega_1 = (4I_1)\omega_2 \therefore \omega_2 = \omega_1/4$ Also, $T = 2\pi/\omega \Rightarrow T \propto 1/\omega \therefore T_2 = 4T_1 = 4 \times 27 = 108$ days

Question 148.

A model for quantized motion of an electron in a uniform magnetic field B states that the flux passing through the orbit of the electron is n(h/e) where n is an integer, h is Planck's constant and e is the magnitude of electron's charge. According to the model, the magnetic moment of an electron in its lowest energy state will be (m is the mass of the electron)

[4 Marks]

(A) heB/2πM

(B) he/2πm

(C) heB/πm

(D) he/πm

Explanation:

Magnetic moment, $M = IA = I(\pi r^2)$

$\therefore M = (ev/2\pi r)(\pi r^2)$ ...(i)

Given flux $= B.(\pi r^2) = h(h/e)$

⇒ $r^2 = h/B\pi e$ .....(ii)

(∵ n = 1)

And when charge moving in external magnetic field then

r = mv/qB

⇒ v/r = eB/m ....(iii)

(∵ q = e)

From equation (i), (ii) and (iii),

$M = (ev/2\pi r)(\pi r^2)$

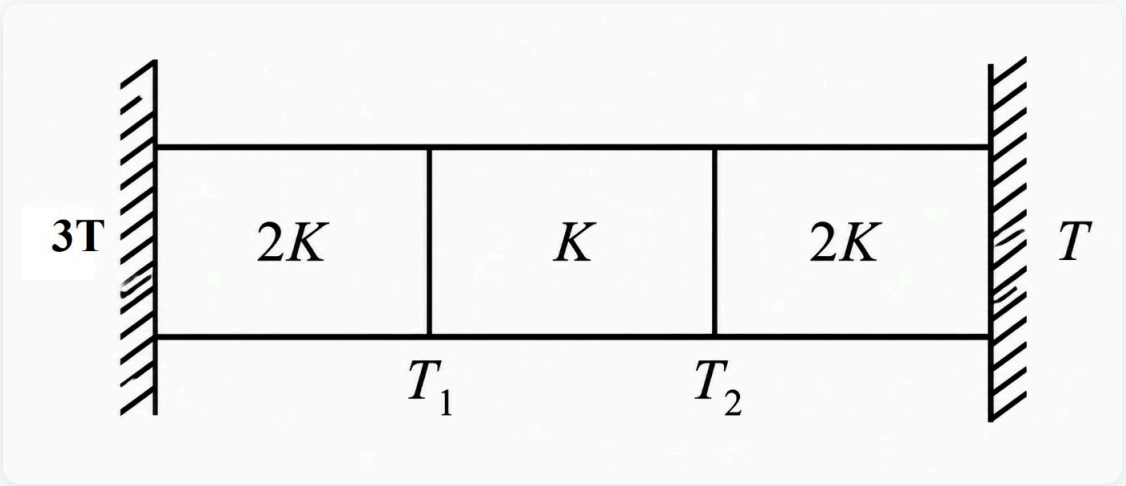
$= ev/2\pi(eB/m)\pi(h/B\pi e)$

$= eh/2\pi m$

Question 149.

Three identical heat-conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity 2K while that in the middle has thermal conductivity K. The left end of the combination is maintained at temperature 3T and the right end at T. The rods are thermally insulated from outside. In steady state, the temperature at the left junction is T_1 and that at the right junction is T_2. The ratio T_1/T_2 is

[4 Marks]



(A) 4/3

(B) 5/3

(C) 3/2

(D) 5/4

Explanation:

At steady state, dQ/dt = constant

$\therefore (dQ/dt)_1 = (dQ/dt)_2 = (dQ/dt)_3$

$2KA(3T - T_1)/L = KA(T_1 - T_2)/L = 2KA(T_2 - T)/L$

$\Rightarrow 6T = 2T_1 = T_1 - T_2 = 2T_2 - 2T$

$\Rightarrow 6T - 2T_1 = T_1 - T_2$

$\therefore 6T + T_2 = 3T_1$ ....(i)

Also, $T_1 - T_2 = 2T_2 - 2T$

$\therefore 2T - 3T_2 = - T_1$ ...(ii)

From equations (i) and (ii),

$10\ T_2 = 6T_1$

$\therefore T_1/T_2 = 5/3$

Question 150.

The plates of a parallel plate capacitor are separated by d. Two slabs of different dielectric constant K_1 and K_2 with thickness 3/8 d and d/2, respectively are inserted in the capacitor. Due to this, the capacitance becomes two times larger than when there is nothing between the plates. (If $K_1 = 1.25\ K_2$), the value of K_1 is :

[4 Marks]

(A) 1.33

(B) 1.60

(C) 2.33

(D) 2.66

Explanation:

The capacitance of capacitor without dielectric is

$$C_1 = \frac{\varepsilon_0 A}{d}$$

The capacitance of capacitor with dielectric is

$$C_2 = \frac{\varepsilon_0 A}{\frac{3d}{8K_1} + \frac{d}{2K_2} + \left(d - \frac{3d}{8} - \frac{d}{2}\right)}$$

$$= \frac{\varepsilon_0 A}{\frac{3}{8K_1} + \frac{1}{2K_2} + \frac{1}{8}}$$

$$= \frac{\varepsilon_0 A}{\frac{3}{8K_1} + \frac{1}{2\left(\frac{4}{5}K_1\right)} + \frac{1}{8}}$$

Given, $C_2 = 2C_1$

$$\frac{\frac{\varepsilon_0 A}{d}}{\frac{3}{8K_1} + \frac{1}{2\left(\frac{4}{5}K_1\right)} + \frac{1}{8}} = \frac{2\varepsilon_0 A}{d}$$

$$\Rightarrow \frac{1}{\frac{3}{8K_1} + \frac{5}{8K_1} + \frac{1}{8}} = 2$$

$$\Rightarrow \frac{1}{\frac{1}{K_1} + \frac{1}{8}} = 2$$

$$\Rightarrow \frac{1}{K_1} + \frac{1}{8} = \frac{1}{2}$$

$$\Rightarrow K_1 = \frac{8}{3} = 2.66$$

Question 151.

Two cities X and Y are connected by a regular bus service with a bus leaving in either direction every T min. A girl is driving scooty with a speed of 60 km/h in the direction X to Y notices that a bus goes past her every 30 minutes in the direction of her motion, and every 10 minutes in the opposite direction. Choose the correct option for the period of the bus . service and the speed (assumed constant) of the buses.

[4 Marks]

(A) 15 min, 120 km/h

(B) 25 min, 100 km/h

(C) 9 min, 40 km/h

(D) 10 min, 90 km/h

Explanation:

Given, t_1 = 30 min = 1/2 hr t_2 = 10 min = 1/6 hr V_B = Speed of Bus V_S = Speed of scooty (girl) As, bus and scooty moves same distance d between points X and Y. ∴ d = (V_B - V_S)t_1 = (V_B + V_S)t_2 ⇒ (V_B - 60)1/2 = (V_B +60)1/6 ⇒ 3V_B - 180 = V_B +60 ⇒ 2V_B = 240 ∴ V_B = 120 km/h Distance, d = (V_B - V_S)t_1 = (120 - 60)1/2 = 30 KM ∴ t = d/V_B = 30/120 = 1/4 = 15 min

Question 152.

A uniform rod of mass 20 kg and length 5 m leans against a smooth vertical wall making an angle of 60° with it. The other end rests on a rough horizontal floor. The friction force that the floor exerts on the rod is (take g = 10 m/s²)

[4 Marks]

(A) 200 √3 N

(B) 200 N

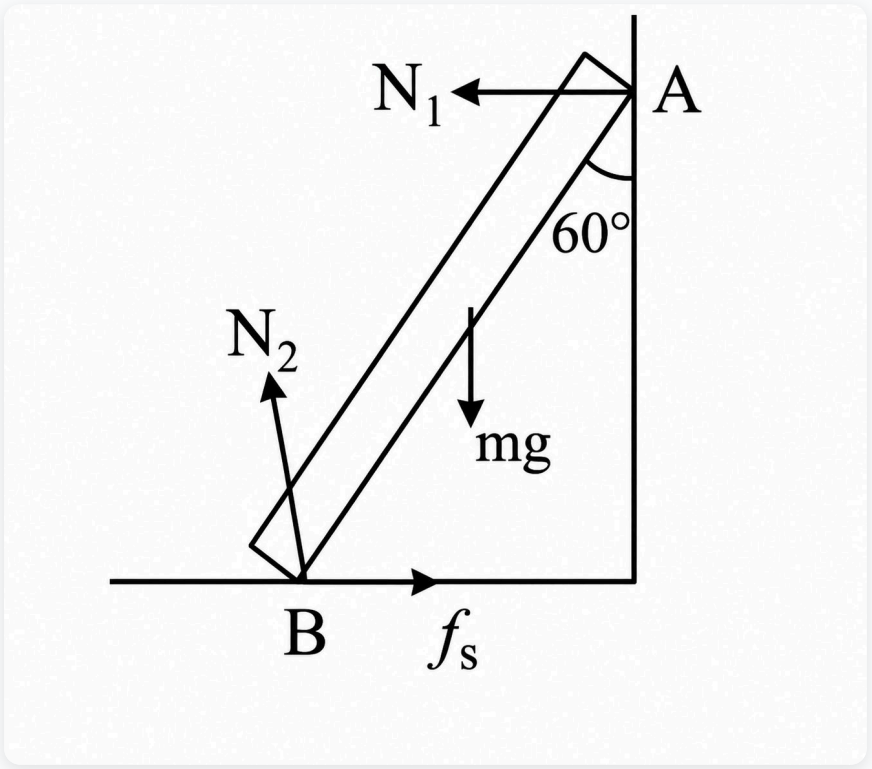
(C) 100 N

(D) 100 √3 N

Explanation:

The FBD of the rod is

$N_2 = mg = 200N$ $\Sigma\tau_A = 0 \Rightarrow f_s\ L\cos 60° + mg\ L/2 \sin 60° = N_2 L \sin 60° \Rightarrow f_s(1/2) + 200(1/2)\sqrt{3}/2 = 200\sqrt{3}/2 \therefore f_s = 100\sqrt{3}\ N$



Question 153.

A balloon is made of a material of surface tension S and its inflation outlet (from where gas is filled in it) has a small area A. It is filled with a gas of density ρ and takes a spherical shape of radius R. When the gas is allowed to flow freely out of it, its radius changes from R to 0 (zero) in time T. If the speed v(r) of gas coming out of the balloon depends on r as r^a and $T \propto S^{\alpha} A^{\beta} \rho^{\gamma} R^{\delta}$ then

[4 Marks]

(A) a = 1/2, α = -1/2, β = −1, γ = -1/2, δ = 5/2

(B) a = 1/2, α = 1/2, β = −1, γ = +1, δ = 3/2

(C) a = 1/2, α = 1-/2, β = −1, γ = 1/2, δ = 7/2

(D) a = 1/2, α = 1/2, β = −1/2, γ = 1/2, δ = 7/2

Explanation:

Writing the dimensions of each and every term T(Time) = $[T_1]$ S (Surface Tension) = F/l = $[M^1l^1T^{-2}]/[L^1]$ = $[M^1T^{-2}]$ A (Area) = $[L^{-2}]$ ρ (density) = $[M^1L^{-3}]$ R (Radius) = $[L^1]$ Putting dacu all dimensions on the both side of equation and comparing T ∝ S^α A^β ρ^γ R^δ $[M^0L^0T^0]$ = $[MT^{-2}][L^2]^\beta$ $[ML^{-3}]^\gamma$ $[L]^\delta$ $[M^0L^0T^0]$ = [M^α+γ, $L^{2\beta + \delta -3\gamma}$, T ^-2α ⇒ -2α = 1 α + δ = 0 ⇒ α = -1/2 γ = -α = 1/2 2β + γ - 3γ = 0 2β + δ - 3(1/2) = 0 ⇒ 2β + δ - 3/2

Question 154.

Consider the diameter of a spherical object being measured with the help of a Vernier calipers. Suppose its 10 Vernier Scale Divisions (V.S.D.) are equal to its 9 Main Scale Divisions (M.S.D.). The least division in the Main Scale is 0.1 cm and the zero of V.S. is at x = 0.1 cm when the jaws of Vernier calipers are closed. If the main scale reading for the diameter is M = 5 cm and the number of coinciding vernier division is 8, the measured diameter after zero error correction is,

[4 Marks]

(A) 5.00 cm

(B) 5.08 cm

(C) 5.18 cm

(D) 4.98 cm

Explanation:

Least count of main scale 10 V.S.D. = 9 M.S.D. Given, 1 M.S.D. = 0.1 cm

Positive zero error = 0.1 cm (Given)

1 V.S.D.= 0.9 M.S.D.

1 V.S.D.=0.9×0.1 cm

V.S.D.=0.09 cm

L.C. = 1 M.S.D.− 1 V.S.D. = (0.1−0.09) cm = 0.01 cm

Total reading = 5.08 cm

Apply zero error correction: (5.08−0.1) cm = 4.98 cm

Question 155.

A parallel plate capacitor made of circular plates is being charged such that the surface charge density on its plates is increasing at a constant rate with time. The magnetic field arising due to displacement current is:

[4 Marks]

(A) constant between the plates and zero outside the plates

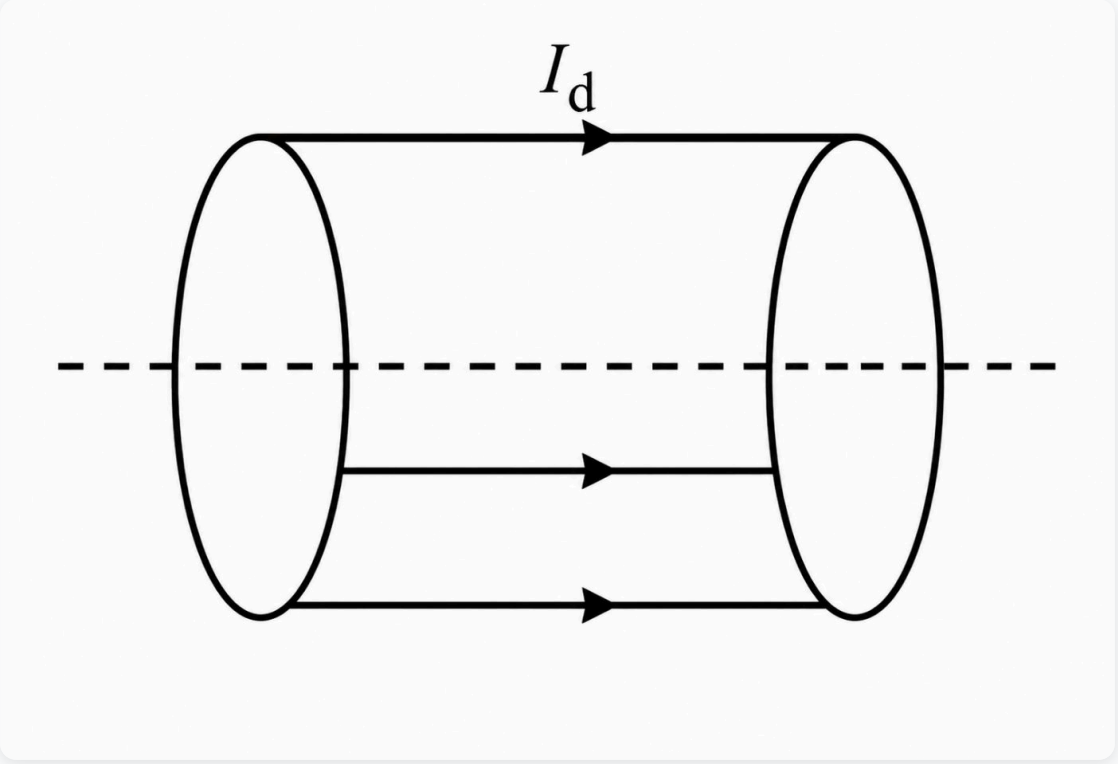
(B) zero at all places

(C) non-zero everywhere with maximum at the imaginary cylindrical surface connecting peripheries of the plates

(D) zero between the plates and non-zero outside

Explanation:

When a capacitor is charging, the changing electric field between the plates produces a displacement current I_d given by $I_d = \varepsilon_0 d\Phi_e/dt = \varepsilon_0 d/dt(EA\cos°)$ $I_d = \varepsilon_0$ AdE/dt The electric field, $(E) = \sigma/\varepsilon_0$; $I_d = \varepsilon_0$ A d/dt (σ/ε_0) I_d = A(dσ/dt) = constant The magnetic field (B) is non-zero both inside and outside. It peaks at =R (the periphery)



Question 156.

An unpolarized light beam travelling in air is incident on a medium of refractive index 1.73 at Brewster's angle. Then

[4 Marks]

(A) both reflected and transmitted light are perfectly polarized with angles of reflection and refraction close to 60° and 30°, respectively

(B) transmitted light is completely polarized with angle of refraction close to 30°

(C) reflected light is completely polarized and the angle of reflection is close to 60°

(D) reflected light is partially polarized and the angle of reflection is close to 30°

Explanation:

Given: n = 1.73 At Brewester's angle θ_B, the reflected light is completely polarized, and the reflected and refracted rays are at 90° to each other. tan θ_B = n ⇒ θ_B = tan t (l.73.) θ_B = 60° Using law of reflection i_p = r = 60°

Question 157.

Two identical charged conducting spheres A and B have their centres separated by a certain distance. Charge on each sphere is q and the force of repulsion between them is F. A third identical uncharged conducting sphere is brought in contact with sphere A first and then with B and finally removed from both. New force of repulsion between spheres A and B (Radii of A and B are negligible compared to the distance of separation so that for calculating force between them they can be considered as point charges) is best given as :

[4 Marks]

(A) 2F/3

(B) 3F/5

(C) 3F/8

(D) F/2

Explanation:

3F/8

Initial force

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



After touching :

Sphere C touches A

Both are identical charge, redistribute equally

$$Q'_A = \frac{q}{2}, \qquad Q'_C = \frac{q}{2}$$

Now C (with $\frac{q}{2}$) touches B (which has q)

$$\text{Total charge} = q + \frac{q}{2} = \frac{3}{2}q$$

Equal distribution :

$$Q'_A = \frac{3}{4}q, \qquad Q'_C = \frac{3}{4}q$$

On touching :

$$F' = \frac{k\left(\frac{Q}{2}\right)\left(\frac{3Q}{4}\right)}{r^2}$$

$$F' = \frac{3F}{8}$$

Question 158.

A container has two chambers of volumes V_1 =2 litres and V_2 =3 litres separated by a partition made of a thermal insulator. The chambers contains n_1 =5 and n_2 = 4 moles of ideal gas at pressures p_1 = 1 atm and p_2 = 2 atm, respectively. When the partition is removed, the mixture attains an equilibrium pressure of :

[4 Marks]

(A) 1.3 atm

(B) 1.6 atm

(C) 1.4 atm

(D) 1.8 atm

Explanation:

Given, V_1 =2 L, n_1 =5 mol, p_1 =1 atm V_2 =3 L, n_2 = 4 mol, p_2 = 2 atm Using the principle of total pressure after mixing P_final = $P_1V_1+P_2V_2$ / V_1+V_2 P_final = 1×2+2×3 / 2+3 = 2+6 / 5 = 8/5

P_final = 1.6 atm

Question 159.

A particle of mass m is moving around the origin with a constant force F pulling it towards the origin. If Bohr model is used to describe its motion, the radius r of the n^{th} orbit and the particle's speed v in the orbit depend on n as

[4 Marks]

(A) $r \propto n^{4/3}$; $v \propto n^{1/3}$

(B) $r \propto n^{1/3}$; $v \propto n^{2/3}$

(C) $r \propto n^{1/3}$; $v \propto n^{1/3}$

(D) $r \propto n^{2/3}$; $v \propto n^{1/3}$

Explanation:

$mv^2/r = F$ (centripetal force) $\Rightarrow v^2 = Fr/m$ ...(i) Bohr's quantization condition $mvr = nh/2\pi \Rightarrow v = nh/2\pi mr$ (ii) From equation (i), $mr(nh/2\pi mr)^2 = F \Rightarrow n^2h^2/4\pi^2mF = r^3 \Rightarrow r^3 \propto n^2 \Rightarrow r \propto n^{2/3}$ From equation (ii) $v \propto n/r \propto n/n^{2/3} \Rightarrow v \propto n^{1/3}$

Question 160. The radius of Martian orbit around the Sun is about 4 times the radius of the orbit of Mercury. The Martian year is 687 Earth days. Then which of the following is the length of 1 year on Mercury ?

[4 Marks]

(A) 88 earth days

(B) 225 earth days

(C) 124 earth days

(D) 172 earth days

Explanation: Applying Kepler's third law : Given : $R_{martian} = 4R_mercury$ Orbital period of mars = 687 Earth days $T_mercury/T_{martian} = (r__mercury/r_{martian})^{3/2} = (1/4)^{3/2} = 1/8$ $T_mercury = T_{martian}/8 = 687/8 = 85.875$ days ≈ 88

Question 161.

A body weighs 48 N on the surface of the earth. The gravitational force experienced by the body due to the earth at a height equal to one-third the radius of the earth from its surface is :

[4 Marks]

(A) 36 N

(B) 32 N

(C) 27 N

(D) 16 N

Explanation:

Given : weight of the body on surface of the earth = 48 N

$W' = mg' = mg\,(R/R+h)^2 \therefore g' = g(R/R+h)^2 = 48(R/R+R/3)^2 = 48 \times 9/16 = 27$ N

Question 162. A wire of resistance R is cut into 8 equal pieces. From these pieces two equivalent resistances are made by adding four of these together in parallel. Then these two sets are added in series. The net effective resistance of the combination is:

[4 Marks]

(A) R/64

(B) R/16

(C) R/32

(D) R/8

Explanation: Resistance of each part = R/8 R_eq = 1/4(R/8) + 1/4(R/8) = R/16

Question 163.

De-Broglie wavelength of an electron orbiting in the n = 2 state of hydrogen atom is close to (Given Bohr radius = 0.052 nm)

[4 Marks]

(A) 2.67nm

(B) 1.67nm

(C) 0.067 nm

(D) 0.67 nm

Explanation:

Given n = 2, Z = 1 for hydrogen atom

$2\pi r = n\lambda$

$2\pi \times (0.052\, n^2/Z) = n\lambda$

$\therefore r = 0.052\, h^2/z$

$\lambda = 0.67$ nm

Question 164.

An electric dipole with dipole moment 5×10^{-6} C m is aligned with the direction of a uniform electric field of magnitude 4×10^{5} N/C. The dipole is then rotated through an angle of 60° with respect to the electric field. The change in the potential energy of the dipole is:

[4 Marks]

(A) 1.5 J

(B) 1.2 J

(C) 1.0 J

(D) 0.8 J

Explanation:

Given, (Dipole moment) p =5 × 10^{-6} Cm (Electric Field) E = 4 × 10^{5} N/C $\theta_d = 0°$ $\theta_f = 60°$

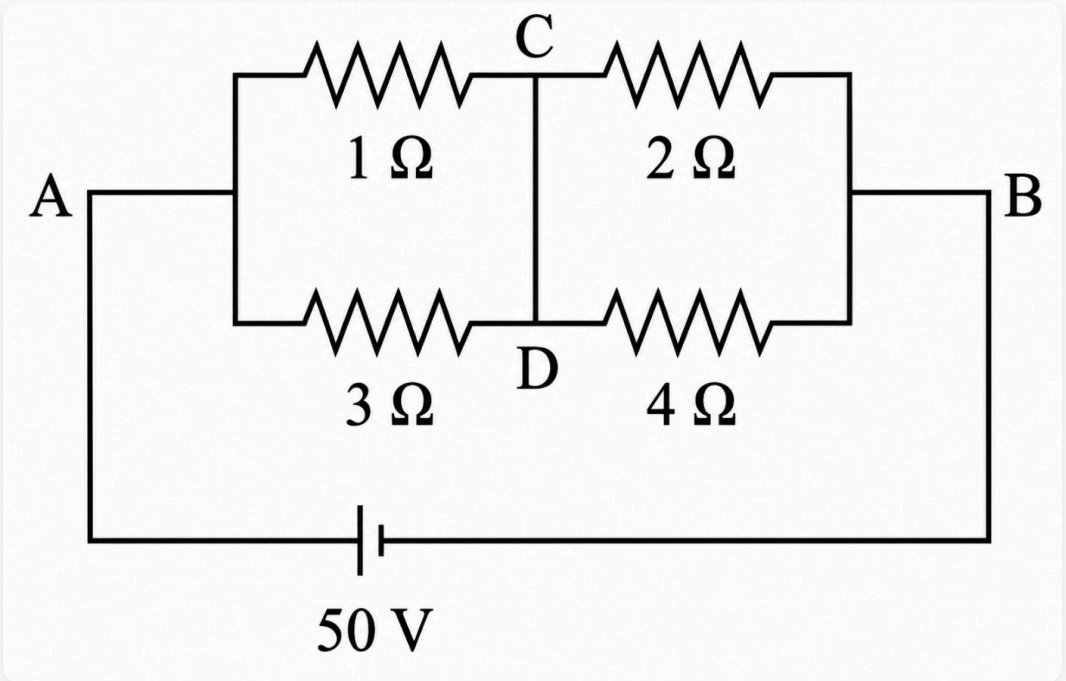
$\Delta U = U_f - U_1$ (CHange in p.E.)

$= - pE\cos\theta_1 - (-pE\cos\theta_q) \Rightarrow pE(\cos\theta_1 - \cos\theta_f) \Rightarrow 5 \times 10^{-6} \times 4 \times 10^{5} (1 - 1/2) = 1J$

Question 165.

A constant voltage of 50 V is maintained between the points A and B of the circuit shown in the figure. The current through the branch CD of the circuit is:

[4 Marks]



(A) 2.0 A

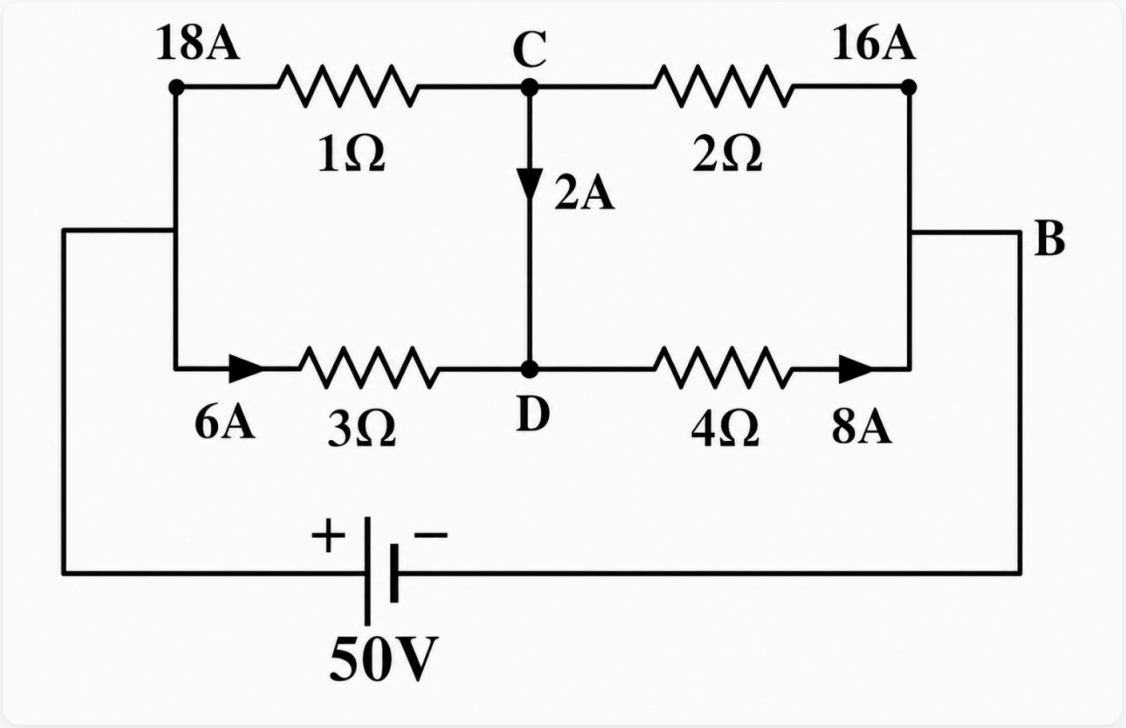
(B) 1.5 A

(C) 2.5 A

(D) 3.0 A

Explanation:

Voltage across 1 Ω = 18 V, Voltage across 2 Ω = 32 V Applying Kirchhoff's Current Law (KCL): Current in branch CD = 18 − 16 = 2 A



Question 166.

A photon and an electron (mass m) have the same energy E. The ratio (λ_{photon}/λ_electron) of their de-Broglie wavelengths is (c is the speed of light):

[4 Marks]

(A) c√(2m/E)

(B) 1/c(E/2m)

(C) c√(2mE)

(D) √(E/2m)

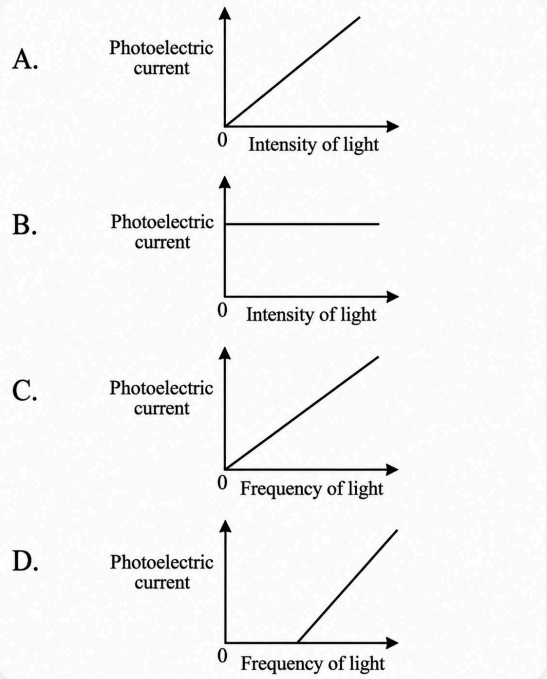
Explanation:

Photon & electron will have same energy E

E(photon) = hc/λ and E(electron) = h/√(2m/E) λ_{photon}/λ_electron = hc/E/ h/√(2mE) = c√(2m/E)

Question 167. Which of the following options represent the variation of photoelectric current with property of light shown on the x-axis?

[4 Marks]



(A) A only

(B) A and C

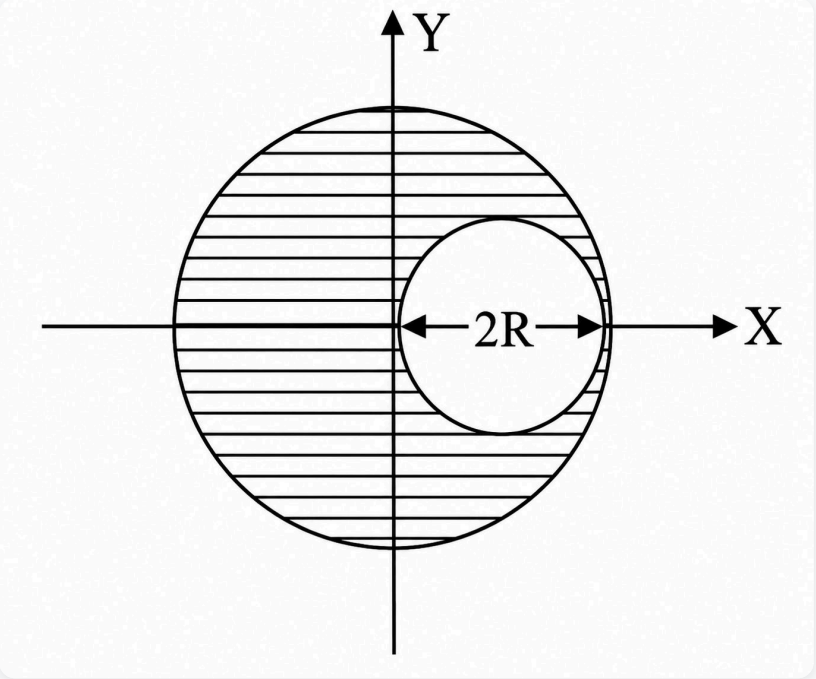
(C) A and D .

(D) B and C

Explanation: Photoelectric current (i) ∝ intensity remaining are not correct.

Question 168. A sphere of radius R is cut from a larger solid sphere of radius 2R as shown in the figure. The ratio of the moment of inertia of the smaller sphere to that of the rest part of the sphere about the Y-axis is :

[4 Marks]



(A) 7/8

(B) 7/40

(C) 7/57

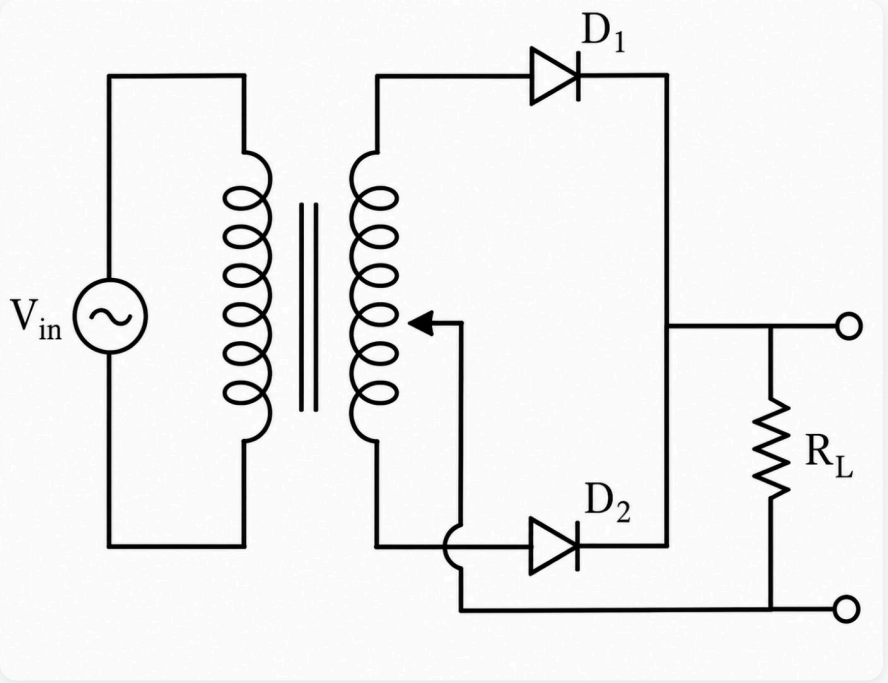
(D) 7/64

Explanation: MoI of remaining part = MoI of larger solid sphere - MoI of smaller sphere (Larger sphere) = I_1 = 2/5 M(2R)² (Smaller sphere) = I_2 = 2/5 mr² + md² = 2/5(M/8)R² + M/8(R)² = 7MR²/40 (Remaining part of sphere) I = I_1- I_2 = 8MR²/5 - 7MR²/40 = 57/40 MR² I_2/I = 7/57

Question 169.

A full wave rectifier circuit with diodes (D_1) and (D_2) is shown in the figure. If input supply voltage V_{in} =220 sin (100 π t) volt, then at t = 15 msec

[4 Marks]



(A) D_1 is forward biased, D_2 is reverse biased

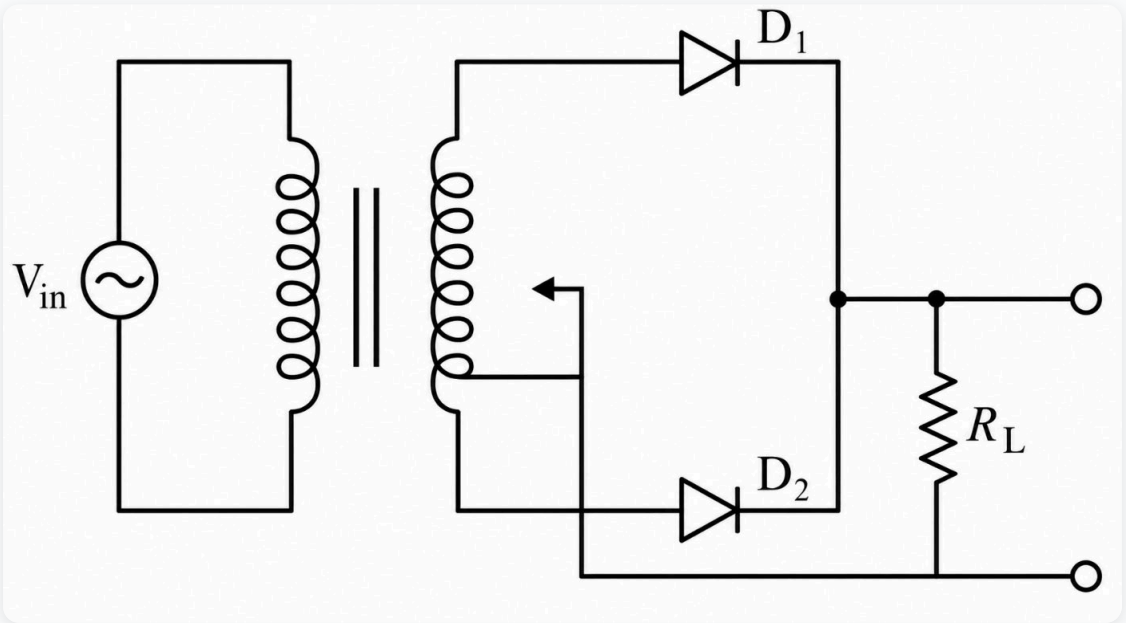
(B) D_1 is reverse biased, D_2 is forward biased

(C) D_1 and D_2 both are forward biased

(D) D_1 and D_2 both are reverse biased

Explanation:

Given: =15 msec putting it in given equation V_{in} = 220 sin (100 π × 15 × 10^{-3}) = 220 sin (3π/2) = -220 V Hence, diode D_1 will be in reverse bias and D_2 will be in forward bias.



Question 170.

Two gases A and B are filled at the same pressure in separate cylinders with movable pistons of radius r_A and r_B, respectively. On supplying an equal amount of heat to both the systems reversibly

under constant pressure, the pistons of gas A and B are displaced by 16 cm and 9 cm, respectively. If the change in their internal energy is the St e same, then the ratio r_A/r_B is equal to

[4 Marks]

(A) √3/2

(B) 2/√3

(C) 4/3

(D) 3/4

Explanation:

According to question Pressure is constant $P_A = P_B$ $\Delta U_A = Q - W_A$ $\Delta U_B = Q - W_B$ Given $\Delta U_A = \Delta U_B$, So $W_A = W_B$ $P_A\Delta V_A = P_B\Delta V_B$

$(\pi r^2_A)x_B = (\pi r^2_B)x_A$ $r_A/r_B = \sqrt{(x_B/x_A)} = \sqrt{(9/16)} = 3/4$

Question 171.

A physical quantity P is related to four observations a, b, c and d as follows: $P = a^3b^2/c\sqrt{d}$

The percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 4% respectively. The percentage error in the quantity P is

[4 Marks]

(A) 13%

(B) 2%

(C) 15%

(D) 10%

Explanation:

Given, $a^3b^2c^{-1}d^{-1/2}$

$(\Delta P/P \times 100) = (3\Delta a/a + 2\Delta b/b + 1\Delta c/c + 1/2.\ 3\Delta d/d) \times 100 = 3(1\%) + 2(3\%) + 1(2\%) + 1/2(4\%) = 13\%$

Question 172.

The intensity of transmitted light when a polaroid sheet, placed between two crossed polaroids at 22.5° from the polatization axis of one of the polaroid, is (I_0 is the intensity of polarised light after passing through the first polaroid):

[4 Marks]

(A) $I_0/16$

(B) $I_0/8$

(C) $I_0/2$

(D) $I_0/4$

Explanation:

$I_0/8$

Question 173.

Two identical point masses P and Q, suspended from two separate massless springs of spring constants k_1 and k_2, respectively, oscillate vertically. If their maximum speeds A are the same, the ratio (A_Q/A_P) of the amplitude A_Q of mass Q to the amplitude A_P of mass P is :

[4 Marks]

(A) $\sqrt{(k_2/k_1)}$

(B) $\sqrt{(k_1/k_2)}$

(C) k_1/k_2

(D) k_2/k_1

Explanation:

Given m_P = m_Q Also $(V_{max})_P = (V_{max})_Q$

Also $(V_{max})_P = A_Q\omega_Q$

$\because v = A\omega$

$\therefore A_P \sqrt{(k_1/m_P)} = A_Q \sqrt{(k_2/m_Q)}$

[$\because \omega = \sqrt{(k/m)}$]

$\therefore A_Q/A_P = \sqrt{(k_1/k_2)}$

Question 174. A pipe open at both ends has a fundamental frequency f in air. The pipe is now dipped vertically in a water drum to half of its length. The fundamental frequency of the air column is now equal to :

[4 Marks]

(A) f/2

(B) f

(C) 3f/2

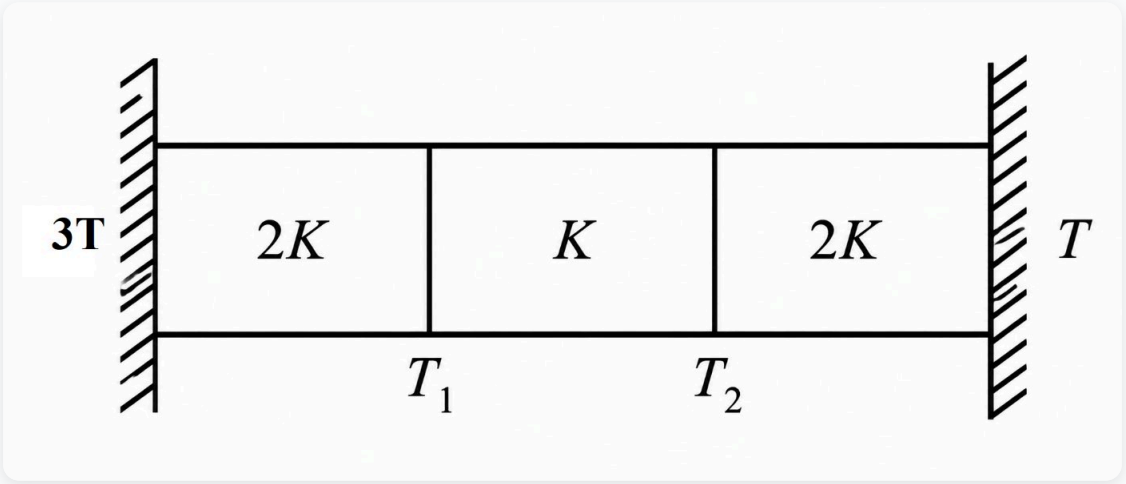
(D) 2f

Explanation: For open pipe, Fundamental frequency f = V/2l When half of its length is dipped in water, Now its fundamental frequency f' = V/4(l/2) ⇒ f' = V/2l ⇒ f' = f

Question 175.

Three identical heat-conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity 2K while that in the middle has thermal conductivity K. The left end of the combination is maintained at temperature 3T and the right end at T. The rods are thermally insulated from outside. In steady state, the temperature at the left junction is T_1 and that at the right junction is T_2. The ratio T_1/T_2 is

[4 Marks]



(A) 4/3

(B) 5/3

(C) 5/4

(D) 3/2

Explanation:

At steady state, dQ/dt = constant

$\therefore (dQ/dt)_1 = (dQ/dt)_2 = (dQ/dt)_3$

$2KA(3T - T_1)/L = KA(T_1 - T_2)/L = 2KA(T_2 - T)/L$

$\Rightarrow 6T = 2T_1 = T_1 - T_2 = 2T_2 - 2T$

$\Rightarrow 6T - 2T_1 = T_1 - T_2$

$\therefore 6T + T_2 = 3T_1$ ....(i)

Also, $T_1 - T_2 = 2T_2 - 2T$

$\therefore 2T - 3T_2 = - T_1$ ...(ii)

From equations (i) and (ii),

$10\ T_2 = 6T_1$

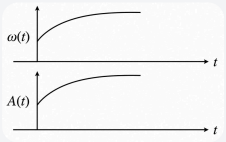
$\therefore T_1/T_2 = 5/3$

Question 176.

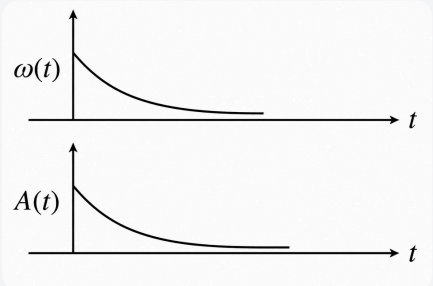
In an oscillating spring mass system, a spring is connected to a box filled with sand. As the box oscillates, sand leaks slowly out of the box vertically so that the average frequency ω (t) and average amplitude A(t) of the system change with time t. Which one of the following options schematically depicts these changes correctly?

[4 Marks]

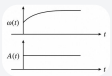
(A)



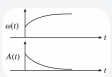
(B)



(C)



(D)

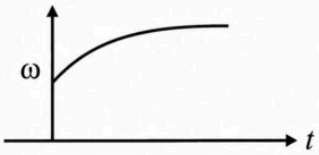


Answer:

The angular frequency of spring-mass system is

$$\omega = \sqrt{\frac{k}{m}} \Rightarrow \omega \propto \frac{1}{\sqrt{m}}$$

$\therefore\ m \downarrow \Rightarrow \omega \uparrow$



Also, $E = \frac{1}{2}kA^2 = \frac{1}{2}m\omega^2 A^2$

As, the part of sand being removed,

$\therefore$ Energy and amplitude of SHM decreases



Question 177.

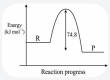
$C(s) + 2H_2(g) \rightarrow CH_4(g)$; $\Delta H = -74.8\ kJ\ mol^{-1}$

Which of the following diagrams gives an accurate representation of the above reaction?

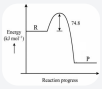
[R = reactants, P = products]

[4 Marks]

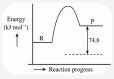
(A)



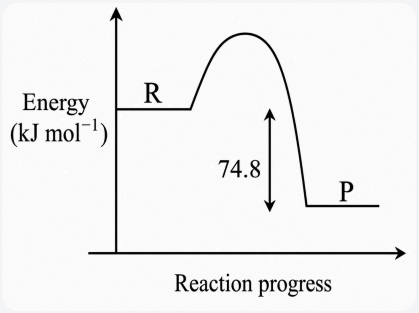
(B)



(C)



(D)



Explanation:

ΔH = H_Products−H_Reactants= Negative

⇒ H_Products < H_Reactants

Therefore, the energy of the reactants will be higher than that of the products.

Question 178.

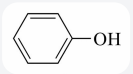
Which one of the following compounds does not decolourize bromine water ?

[4 Marks]

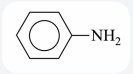
(A)



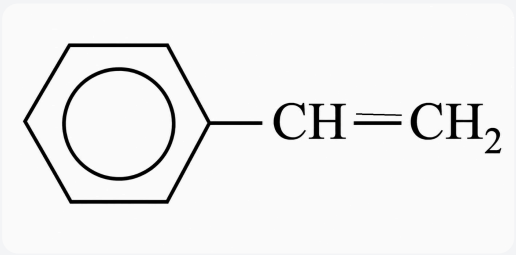
(B)



(C)



(D)



Explanation:

Bromine water decolourizes in compounds which have **C=C bonds** or with functional groups that react with it.

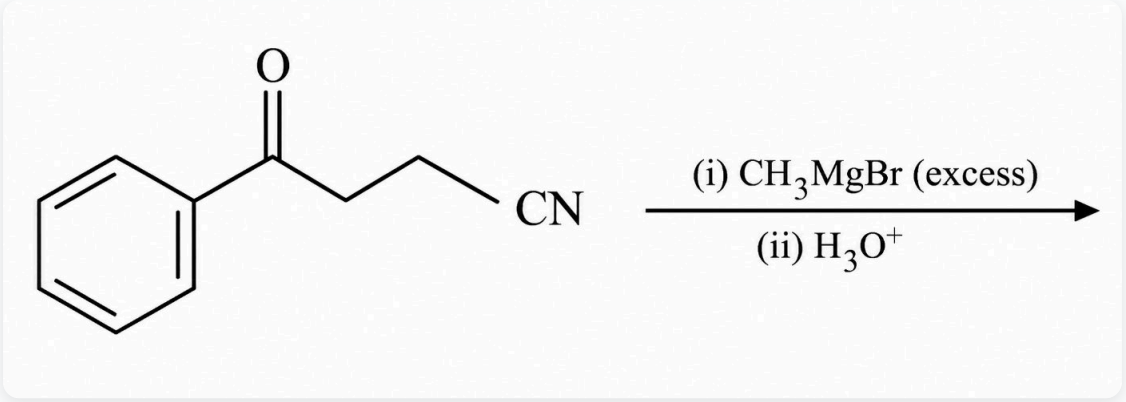
Br_2–H_2O does not react with cyclohexane.

Phenol and aniline give **tri-substituted products** with **Br_2–H_2O**.

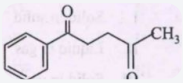
Question 179.

The major product of the following reaction is

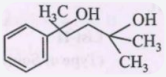
[4 Marks]



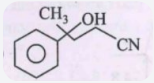
(A)



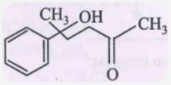
(B)



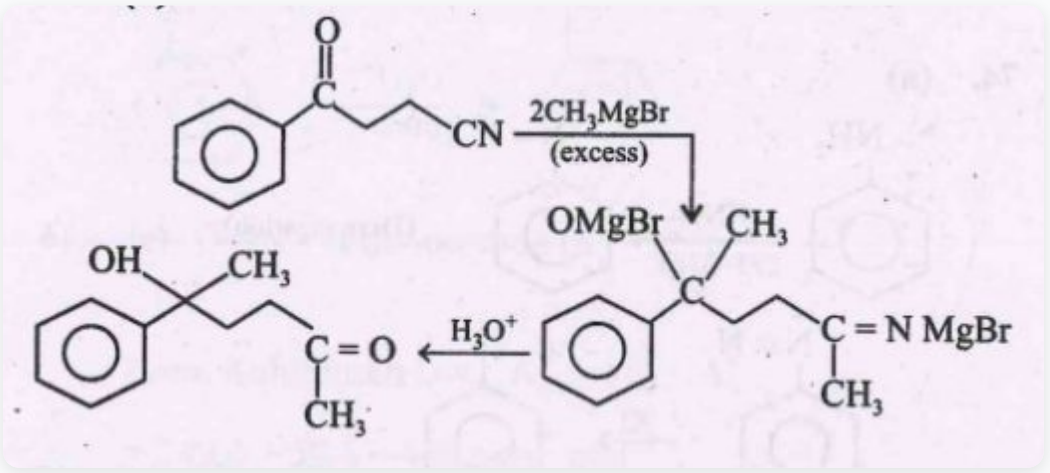
(C)



(D)



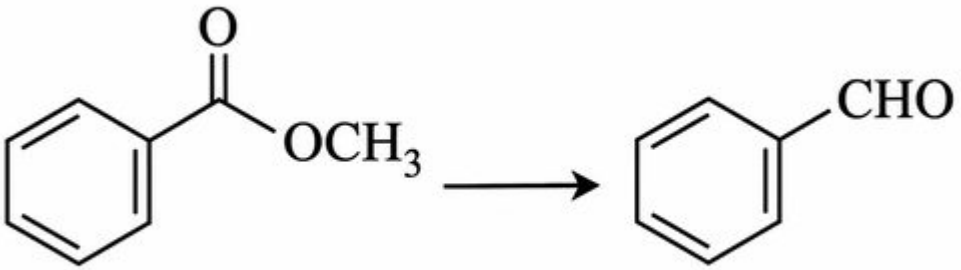
Explanation:



Question 180.

Identify the suitable reagent for the following conversion

[4 Marks]



(A) (i) $LiAlH_4$, (ii) H^+/H_2O

(B) (i) $AlH(iBu)_2$, (ii) H_2O

(C) H_2 / Pd–$BaSO_4$

(D) (i) $NaBH_4$, (ii) H^+/H_2O

Explanation:

DIBAL- H ⇒ It is Diisobutyl aluminium hydride which is a reducing agent with the formula $AIH(iBu)_2$ and the structure is



DIBAL – H reduces esters to aldehydes in the presence of water (H_2O)

