NEET-UG EXAMINATION PAPER-2016

(Solved)

Time allowed : 3 hours | Maximum Marks : 720

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.

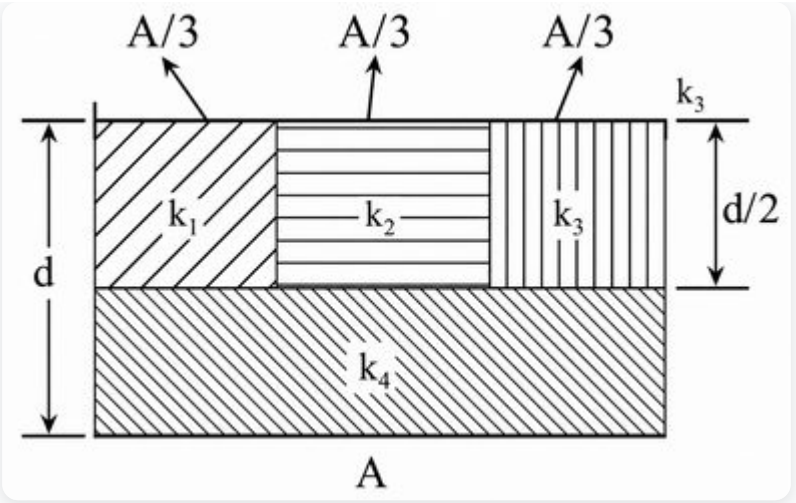
v. Use of calculator is NOT allowed.

Section A

Question 1.

A parallel plate capacitor of area A, plate separation d and capacitance Cis filled with four dielectric materials having dielectric constants k_1, k_2, k_3 and k_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by:-

[4 Marks]



(A) $1/k= [(1/k_1)+(1/k_2)+(1+k_3)] + 3/2k_4$

(B) $2/k= (3/k_1+k_2+k_3) + 1/k_4$

(C) $k= 2/3 (k_1+k_2+k_3)+ 2k_4$

(D) $k= k_1+k_2+k_3 + 3k_4$

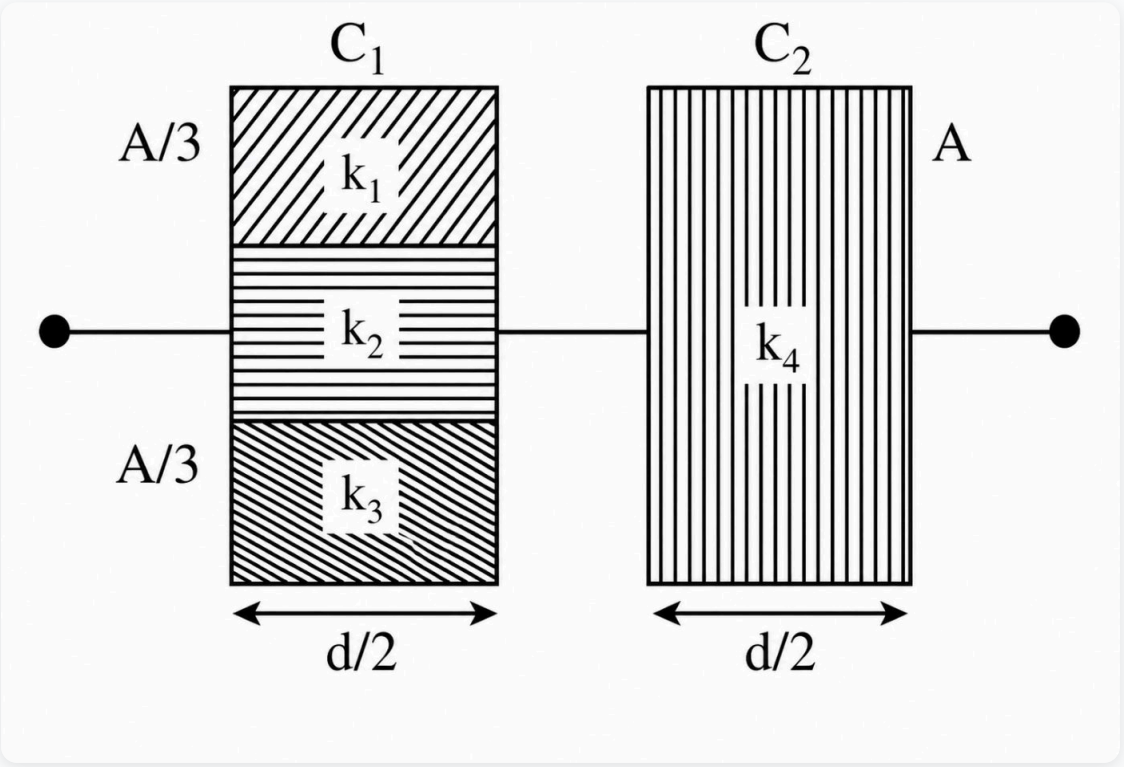
Explanation:

We can redraw the circuit as

$1/C + 1/C_1+C_2$

$d/A\in_0 k = 1/(A/3\in_0) (k_1+k_2+k_3 /d/2) + 1/(A\in_0 K_4/D/2)$

$\Rightarrow 2/k = 3/k_1+k_2+k_3 + 1/k_4$



Question 2.

Which one of the following generates new genetic combinations leading to variation?

[4 Marks]

(A) Nucellar polyembryony

(B) Vegetative reproduction

(C) Parthenogenesis

(D) Sexual reproduction

Explanation:

Sexual reproduction involves two gametes, male and female gametes. By the process of meiosis, crossing over takes place between non-sister chromatids. This recombination results in the exchange of genetic material that leads to variation in progeny.

Question 3.

Match column-I with column-II and select the correct option using the codes given below:

[4 Marks]

Column-I		Column-II	
(A)	Pistils fused together	(i)	Gametogenesis
(B)	Formation of gametes	(ii)	Pistillate
(C)	Hyphae of higher Ascomycetes	(iii)	Syncarpous
(D)	Unisexual female flower	(iv)	Dikaryotic

(A) A-iii B- i C-iv D-ii

(B) A-iv B- iii C-i D-ii

(C) A-i B- ii C-iv D-iii

(D) A-ii B- i C-iv D-iii

Explanation:

(A) Pistils fused together – Syncarpous (B) Formation of gametes – Gametogenesis (C) Hyphae of higher ascomycetes – Dikaryotic (D) Unisexual female flower – Pistillate

Question 4.

In majority of angiosperms

[4 Marks]

(A) there are numerous antipodal cells

(B) egg has a filiform apparatus

(C) a small central cell is present in the embryo sac

(D) reduction division occurs in the megaspore mother cells

Explanation:

The reduction division takes place in megaspore mother cell i.e. female gametophyte. It divides by the process of meiosis and produces 4 haploid megaspores, in which one megaspore produces embryo sac, consisting of 8 nuclei by the process of mitosis and 3 cells degenerate.

Question 5.

Pollination in water hyacinth and water lily is brought about by the agency of

[4 Marks]

(A) insects or wind

(B) bats

(C) water

(D) birds

Explanation:

In the case of aquatic plants, water hyacinth and water lily are pollinated by both biotic factor-insects and abiotic factor-wind.

Question 6.

The ovule of an angiosperm is technically equivalent to

[4 Marks]

(A) megasporophyll

(B) megasporangium

(C) megaspore

(D) megaspore mother cell

Explanation:

Ovules are initially composed of diploid cells and megasporangium. Meiotic division occurs in both to give rise to functional female gametes.

Question 7.

Taylor conducted the experiment to prove semiconservative mode of chromosome replication on

[4 Marks]

(A) Vicia faba

(B) Vinca rosea

(C) E. coli

(D) Drosophila melanogaster

Explanation:

This was the experiment conducted by Taylor in 1969 on the root tip cells of *Vicia faba*. He used radioactive thymine (treating agent) to label the DNA, later it was grown in the normal medium. In the 1st generation, both the chromatids were labelled while in the second generation one chromatid of each chromosome was labelled and the other chromatid was normal. It proved the semiconservative model of chromosome replication.

Question 8.

The mechanism that causes a gene to move from one linkage group to another is called

[4 Marks]

(A) Translocation

(B) Crossing-over

(C) Duplication

(D) Inversion

Explanation:

Translocation is the mechanism that causes genes to move from one linkage group to another.

Question 9.

The equivalent of a structural gene is

[4 Marks]

(A) Operon

(B) Recon

(C) Cistron

(D) Muton

Explanation:

Cistron is a part of DNA or RNA that shows a specific polypeptide for specific behaviour, and a gene also codes for a specific character or trait. So, it is equivalent to structural gene.

Question 10.

A true breeding plant is

[4 Marks]

(A) one that is able to breed on its own

(B) produced due to cross-pollination among unrelated plants

(C) near homozygous and produces offspring of its own kind

(D) always homozygous recessive in its genetic constitution

Explanation:

These are the type of plants which after self-fertilization produces offspring of its own kind.

Question 11.

Which of the following rRNAs acts as structural RNA as well as ribozyme in bacteria?

[4 Marks]

(A) 18 S rRNA

(B) 5 S rRNA

(C) 23 S rRNA

(D) 5.8 S rRNA

Explanation:

23S rRNA is also known as 25S rRNA, which is a

ribozyme that carries aminoacetyl transferase activity which occurs in ribosomes specially in prokaryotes. Hence, it acts as structural RNA in bacteria.

Question 12.

Stirred-tank bioreactors have been designed for

[4 Marks]

(A) purification of product

(B) addition of preservatives to the product

(C) availability of oxygen throughout the process

(D) ensuring anaerobic conditions in the culture vessel

Explanation:

Stirred tank bioreactor have been designed to eliminate the hazardous volatile organic materials like benzene, toluene, xylene and also for the oxygen transfer.

Oxygen transfer is an important factor for sewage treatment, and to meet the need of microorganism.

Question 13.

A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using

[4 Marks]

(A) Ligase

(B) Polymerase-III

(C) Taq polymerase

(D) Eco RI

Explanation:

DNA ligase is responsible for joining two individual fragments of double stranded DNA by forming phosphodiester bond between them. These acts as molecular glue.

Question 14.

Which of the following is not a component of downstream processing?

[4 Marks]

(A) Preservation

(B) Purification

(C) Expression

(D) Separation

Explanation:

Downstream processing refers to the recovery and purification of biosynthetic products, particularly pharmaceuticals, fermentation both which includes preservation, separation, and purification.

Question 15.

Which of the following restriction enzymes produces blunt ends?

[4 Marks]

(A) Hind III

(B) Sal I

(C) Xho I

(D) Eco RV

Explanation:

EcoRV is used as a restriction enzyme, which first recognizes palindromic 6-base DNA sequence 5'GAT/ATE3' and it vertically, its complementary sequence will be 3'CTA/TAG-5'. Like this, blunt ends are formed.

Question 16.

Which kind of therapy was given in 1990 to a four-year-old girl with Adenosine Deaminase (ADA) deficiency?

[4 Marks]

(A) Gene therapy

(B) Chemotherapy

(C) Radiation therapy

(D) Immunotherapy

Explanation:

It was the first gene therapy conducted on a four-year-old girl patient on 14th September. She was suffering from the deficiency of ADA, which is a genetic disease. WBC were taken out from her body and normal gene were incorporated into her body, which are responsible for making ADA.

Question 17.

How many hot spots of biodiversity in the world have been identified till date by Norman Myers?

[4 Marks]

(A) 43

(B) 34

(C) 17

(D) 25

Explanation:

34 hotspots of biodiversity are there in the world, which have been identified till date by Norman Myers. About 86% of hotspots are destroyed; 2.3% are left on earth.

Question 18.

The primary producers of the deep-sea hydrothermal vent ecosystem are

[4 Marks]

(A) Blue-green algae

(B) Coral reefs

(C) Green algae

(D) Chemosynthetic bacteria

Explanation:

The primary producers of the deep-sea hydrothermal vent ecosystem are chemosynthetic bacteria. These organisms use inorganic molecules as a source of energy and convert them into organic substances. All organisms present in the vent are dependent on primary producers.

Question 19.

Which of the following is correct for r-selected species?

[4 Marks]

(A) Small number of progeny with small size

(B) Small number of progeny with large size

(C) Large number of progeny with large size

(D) Large number of progeny with small size

Explanation:

R-selected species have maximum rate of population and have relatively low probability to survive till adulthood.

Question 20.

If '+' sign is assigned to beneficial interaction, '–' sign to detrimental and '0' sign to neutral interaction, then the population interaction represented by '+ +' refers to

[4 Marks]

(A) Commensalism

(B) Parasitism

(C) Amensalism

(D) Mutualism

Explanation:

Here, '+' shows that the population is benefited by interaction of organism, '-' shows harmful interaction and '0' shows the population is not affected. If the interaction is '+', '-', it refers to parasitism. In this interaction one is benefited.

Question 21.

Which of the following is correctly matched?

[4 Marks]

(A) Age pyramid – Hydrophytes

(B) Aerenchyma – Opuntia

(C) Stratification – Population

(D) Parthenium hysterophorus – Threat to biodiversity

Explanation:

These are also known as congress grass or carrot

weed or gajarghas, is a deadly weeds which infest crops in rapid manner and covers the surrounding. This feature of parthenium hysterophorus caused threat for biodiversity.

Question 22.

Red list contains data or information on

[4 Marks]

(A) plants whose products are in international trade

(B) all economically important plants

(C) marine vertebrates only

(D) threatened species

Explanation:

Red lists contains the information of threatened species, 41% of amphibians, 33% of reef-building corals, 30% of conifers, 25% of mammals and 13% of birds are threatened.

Question 23.

Which one of the following is wrong for fungi?

[4 Marks]

(A) They are heterotrophic

(B) They are both unicellular and multicellular

(C) They are eukaryotic

(D) All fungi possess a purely cellulosic cell wall

Explanation:

The cell wall of fungi contains chitin, glucan and proteins, do not contain cellulose. Plant cell wall contains cellulose.

Question 24.

Methanogens belong to

[4 Marks]

(A) Dinoflagellates

(B) Slime moulds

(C) Eubacteria

(D) Archaebacteria

Explanation:

These are the micro-organisms that produces methane as by-product in anoxic condition and belongs to Archaebacteria.

Question 25.

Select the wrong statement:

[4 Marks]

(A) Diatoms are chief producers in the oceans

(B) Diatoms are microscopic and float passively in water

(C) The walls of diatoms are easily destructible

(D) 'Diatomaceous earth' is formed by the cell walls of diatoms

Explanation:

The wall of the diatoms contains silica, which makes it indistructible.

Question 26.

The label of a herbarium sheet does not carry information on

[4 Marks]

(A) local names

(B) height of the plant

(C) name of collector

(D) date of collection

Explanation:

Herbarium is the collection of dried plant, which provides a basic resource for the study of systematic botany and research.

Question 27.

Conifers are adapted to tolerate extreme environmental conditions because of

[4 Marks]

(A) superficial stomata

(B) broad hardy leaves

(C) thick cuticle

(D) presence of vessels

Explanation:

Conifers are adapted to tolerate extreme environmental conditions because of thick waxy cuticle.

Question 28.

Which one of the following statements is wrong?

[4 Marks]

(A) Algin is obtained from red algae, and carrageenan from brown algae.

(B) Algae increase the level of dissolved oxygen in the immediate environment

(C) Agar-agar is obtained from Gelidium and Gracilaria

(D) Laminaria and Sargassum are used as food

Explanation:

Algin is obtained from brown algae while carrageenan is obtained from red algae.

Question 29.

The term ‘polyadelphous’ is related to

[4 Marks]

(A) Androecium

(B) Gynoecium

(C) Corolla

(D) Calyx

Explanation:

Polydelphous is related with androecium, i.e. stamen, which consists of united filaments arranged in groups or bundles.

Question 30.

How many plants among Indigofera, Sesbania, Salvia, Allium, Aloe, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers?

[4 Marks]

(A) Three

(B) Four

(C) Six

(D) Five

Explanation:

Mustard, radish and turnip have didynamous condition, belong to Brassicaceae family and are characteristic of Brassicaceae family.

Question 31.

Radial symmetry is found in the flowers of

[4 Marks]

(A) Brassica

(B) Trifolium

(C) Cassia

(D) Pisum

Explanation:

Radial symmetry is found in the flowers of Brassica.

Question 32.

Free-central placentation is found in

[4 Marks]

(A) Dianthus

(B) Argemone

(C) Brassica

(D) Citrus

Explanation:

In these plants, there is absence of septum and ovules are formed on the central axis.

Question 33.

Cortex is the region found between

[4 Marks]

(A) pericycle and endodermis

(B) epidermis and stele

(C) endodermis and pith

(D) endodermis and vascular bundle

Explanation:

Cortex is a type of ground tissue present between the epidermis and stele. It is enclosed by the innermost layer of cortex, and epidermis is the uppermost layer of the cortex.

Question 34.

The balloon-shaped structures called tyloses

[4 Marks]

(A) are extensions of xylem parenchyma cells into vessels

(B) characterize the sapwood

(C) originate in the lumen of vessels

(D) are linked to the ascent of sap through xylem vessels

Explanation:

The balloon-shaped structure grows on parenchyma cells of xylem vessels of secondary heartwood, in order to protect the plant under extreme conditions like drought.

Question 35.

A non-proteinaceous enzyme is

[4 Marks]

(A) Lysozyme

(B) Ribozymes

(C) Ligase

(D) Deoxyribonuclease

Explanation:

Ribozyme are the catalytic RNAs, which acts like a protein enzymes, in which they help in joining amino-acids to form a protein molecules.

Question 36.

Select the mismatch :-

[4 Marks]

(A) Large central vacoules - Animal cells

(B) Gas vacuoles-Green bacteria

(C) Methanogens-Prokaryotes

(D) Protists-Eukaryotes

Explanation:

Largecentral vacuoles are present in plant cells.

Question 37.

Select the wrong statement

[4 Marks]

(A) Pilli and fimbriae are mainly involved in motility of bacterial cells

(B) Bacterial cell wall is made up of peptidoglycan.

(C) Mycoplasma is a wall-less microorganism

(D) Cyanobacteria lack flagellated cells.

Explanation:

Pilli and fimbriae are mainly involved in motility of bacterial cells

Question 38.

A cell organelle containing hydrolytic enzymes is

[4 Marks]

(A) Lysosome

(B) Microsome

(C) Mesosome

(D) Ribosome

Explanation:

Lysosomes are small vesicles, contain hydrolytic enzymes or digestive enzymes which act in acidic medium. They devour foreign proteins, toxic substances, dead cells etc. from the body and act as a natural defence of the body.

Question 39.

During cell growth, DNA synthesis takes place in

[4 Marks]

(A) S phase

(B) G_1 phase

(C) G_2 phase

(D) M phase

Explanation:

Cell cycle consists Interphase. G_1 phase, S-phase and G_2 phase. In S-phase the DNA replication occurs.

Question 40.

Which of the following biomolecules is common to respiration-mediated breakdown of fats, carbohydrates and proteins?

[4 Marks]

(A) Acetyl CoA

(B) Fructose 1,6-bisphosphate

(C) Pyruvic acid

(D) Glucose-6-phosphate

Explanation:

Acetyl COA is produced during the glycolysis of carbohydrates and β — oxidation of fats. After this, enters in citric acid cycle in mitochondrion and reacts with oxaloacetate to form citrate. Acetyl - COA serves as a substrates for lysine and histones.

Question 41.

A few drops of sap were collected by cutting across a plant stem by a suitable method. The sap was tested chemically. Which one of the following test results indicates that it is phloem sap?

[4 Marks]

(A) Alkaline

(B) Acidic

(C) Absence of sugar

(D) Lowrefractive index

Explanation:

The sap of phloem cells contains maximum level of K^+ and Mg^{+2} ions. High level of K^+ ions makes phloem cells slightly alkaline i.e. pH—(7.2-8.5).

Question 42.

You are given a tissue with its potential for differentiation in an artificial culture. Which of the following pairs of hormones would you add to the medium to secure shoots as well as roots?

[4 Marks]

(A) Gibberellin and abscisic acid

(B) Auxin and abscisic acid

(C) IAA and gibberellin

(D) Auxin and cytokinin

Explanation:

Auxin and cytokinin interaction regulates the formation and maintenance of root and shoot meristem.

Question 43.

Phytochrome is a

[4 Marks]

(A) Glycoprotein

(B) Lipoprotein

(C) Flavoprotein

(D) Chromoprotein

Explanation:

Phytochromes are the type of chromoproteins, which gets activated by exposure of plants by red light and regulates the photoperiodism.

Question 44.

Which is essential for the growth of root tip?

[4 Marks]

(A) Zn

(B) Fe

(C) Ca

(D) Mn

Explanation:

Calcium plays an important role in cell elongation and cell division. Its deficiency can cause stunted growth of plant.

Question 45.

The process which makes major difference between C_3 and C_4 plants is

[4 Marks]

(A) Photorespiration

(B) Calvin cycle

(C) Respiration

(D) Glycolysis

Explanation:

Photorespiration is at high rate in C_3 plants while in C_4 plant it is less and negligible.

Question 46.

Which one of the following statements is not correct?

[4 Marks]

(A) In potato, banana and ginger, the plantlets arise from the internodes present in the modified stem.

(B) Water hyacinth, growing in the standing water, drains oxygen from water that leads to the death of fishes.

(C) Microscopic, motile asexual reproductive structures are called zoospores.

(D) Offspring produced by the asexual reproduction are called clone.

Explanation:

Potato, banana and ginger are arised from underground stem by the process of vegetative propagation.

Question 47.

The part of nephron involved in active reabsorption of sodium is

[4 Marks]

(A) Descending limb of Henle's loop

(B) Distal convoluted tubule

(C) Bowman's capsule

(D) Proximal convoluted tubule

Explanation:

Loop of Henle is a U-shaped tube that consists of an ascending and descending limb. Its primary role is to concentrate the salts in the interstitium, the tissue surrounding the loop. Descending limb are thin walled and permeable to water but impermeable to salt and thus only indirectly contributes to the concentration of the interstitium. The ascending limbs are thick walled and impermeable to water. It actively reabsorbs the remaining 2.5% of the filtered K^+ and some amounts of Cl^-, some Na^+ is also reabsorbed by diffusion due to electrostatic attraction of reabsorbed Cl^-.

Question 48.

Which of the following is hormone releasing IUD?

[4 Marks]

(A) Lippes loop

(B) Cu7

(C) LNG-20

(D) Multiload 375

Explanation:

LNG-20 i.e Levonorgestrel-20 releases hormones directly into the uterus and absorbed through endometrium.

Question 49.

Which of the following is incorrect regarding vasectomy?

[4 Marks]

(A) No sperm occurs in epididymis

(B) Vasa deferentia is cut and tied

(C) Irreversible sterility

(D) No sperm occurs in seminal fluid

Explanation:

After vasectomy, sperms are formed continuously in testicles but their movements are blocked at the site of vas deferens and sperms goes through the epididymus and dies.

Question 50.

Embryo with more than 16 blastomeres formed due to in vitro fertilization is transferred into

[4 Marks]

(A) Uterus

(B) Fallopian tube

(C) Cervix

(D) Fimbriae

Explanation:

Its a IVF technique i.e. In "vitro fertilization", eggs are fertilized by sperm outside and then these fertilized eggs are cultured for 2-3 days in lab on growth medium and later injected directly into the uterus.

Question 51.

Which of the following depicts the correct pathway of transport of sperms?

[4 Marks]

(A) Efferent ductules → Rete testis → Vas deferens → Epididymis

(B) Rete testis → Vas deferens → Efferent ductules → Epididymis

(C) Rete testis → Efferent ductules → Epididymis → Vas deferens

(D) Rete testis → Epididymis → Efferent ductules → Vas deferens

Explanation:

The sperms are formed inside tubules and passed outside the testis through tubuli recti, rete testis and vasa efferentia, which opens into highly convoluted structure epididymis and then from epididymis sperms transferred into vas deferens.

Question 52.

Match Column-I with Column-II and select the correct option using the codes given below :-

[4 Marks]

Column I	Column II
A. Mons pubis	i Embryo formation
B Antrum	ii Sperm
C Trophectoderm	iii Female external genitalia
D Nebenkern	iV Graafian follicle

(A) A-iii B-iv C-ii D-i

(B) A-i B-iv C-iii D-ii

(C) A-iii B-iv C-i D-ii

(D) A-iii B-i C-iv D-ii

Explanation:

Mons pubis – Female external genelia (B) Antrum – Graafian follicle (C) Trophectoderm – Embryo formation (D) Nebenkern – Sperm

Question 53.

Several hormones like hCG, hPL, estrogen, progesterone are produced by

[4 Marks]

(A) Placenta

(B) Ovary

(C) Pituitary

(D) Fallopian tube

Explanation:

hCG i.e. human chorionic gonadotropin, hPL i.e. human placental lactogen, progesterone and estrogen are produced by placenta during pregnancy. hCG helps in the maintenance of corpus luteum, hPL stimulates mammary gland growth and lactation, estrogen causes thickening of endometrium and progesterone secreted by corpus luteum maintains endometrium for implantation of blastocyst.

Question 54.

If a colour-blind man marries a woman who is homozygous for normal colour vision, the probability of their son being colour-blind is

[4 Marks]

(A) 0.75

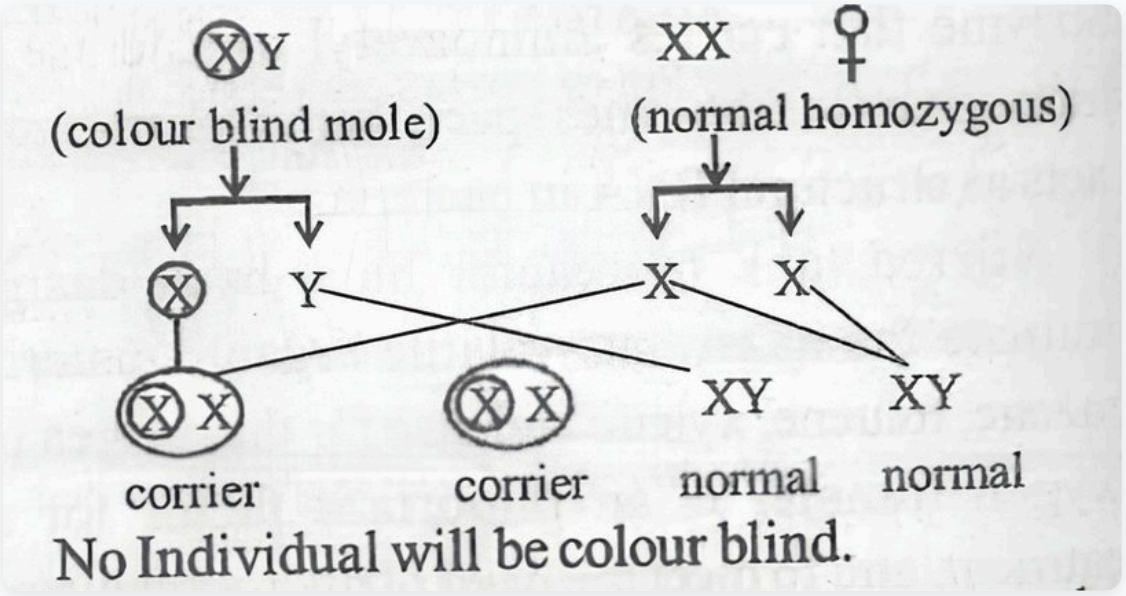
(B) 1

(C) 0

(D) 0.5

Explanation:

.



Question 55.

Genetic drift operates in

[4 Marks]

(A) non-reproductive population

(B) slow reproductive population

(C) small isolated population

(D) large isolated population

Explanation:

Genetic drift operates in small isolated population. It means the variation in the frequency of different genotypes of small population.

Question 56.

In Hardy-Weinberg equation, the frequency of heterozygous individual is represented by

[4 Marks]

(A) 2pq

(B) p^2

(C) q^2

(D) p^2

Explanation:

$p^2+2pq+q^2=1$ is the equation of Hardy-Weinberg equilibrium. In this equation p^2 represents the frequency of individuals who are homozygous for one allele, 2pq is the frequency of heterozygous individuals, and q^2 represents the frequency of individuals who are homozygous for another allele.

Question 57.

The chronological order of human evolution from early to the recent is

[4 Marks]

(A) Australopithecus → Homo habilis → Ramapithecus → Homo erectus

(B) Ramapithecus → Australopithecus → Homo habilis → Homo erectus

(C) Australopithecus → Ramapithecus → Homo habilis → Homo erectus

(D) Ramapithecus → Homo habilis → Australopithecus → Homo erectus

Explanation:

Ramapithecus with 350 cc brain capacity were discovered in Shivalik hills in H.P., they were more ape-like. In between 350–450 cc, Australopithecus were discovered from Africa, called Tuang baby. In between 600–700 cc, Homo habilis were known as the first tool makers — that was the beginning of the human phase. In between 800–1200 cc, Homo erectus were discovered as Java man, Peking man, and Atlantic man. Around 1500 cc, Homo sapiens evolved, known as modern man.

Question 58.

Which of the following is the correct sequence of events in the origin of life?

I. Formation of protobionts

II. Synthesis of organic monomers

III. Synthesis of organic polymers

IV. Formation of DNA-based genetic systems

[4 Marks]

(A) II, III, I, IV

(B) II, III, IV, I

(C) I, II, III, IV

(D) I, III, II, IV

Explanation:

At first earth contained NH_3, H_2O, H_2, CH_4. The atmosphere was reducing, i.e. there was no free oxygen. When earth cooled, the primitive inorganic molecules interacted and combined with one another to synthesize organic monomers. After that these organic monomers combined to form complex polymers. These polymers aggregated to form precursors of first life as coacervates i.e. protobionts, and after protobionts, first life originated as prokaryotes.

Question 59.

A molecule that can act as a genetic material must fulfill the traits given below, except

[4 Marks]

(A) it should be able to express itself in the form of ‘Mendelian characters’

(B) it should be able to generate its replica

(C) it should provide the scope for slow changes that are required for evolution

(D) it should be unstable structurally and chemically

Explanation:

Genetic material should be structurally and chemically stable.

Question 60.

DNA-dependent RNA polymerase catalyzes transcription on one strand of the DNA which is called the

[4 Marks]

(A) Template strand

(B) Coding strand

(C) Antistrand

(D) Alpha strand

Explanation:

Template strand is the sequence of DNA which is going to direct the synthesis of mRNA.

Question 61.

Interspecific hybridization is the mating of

[4 Marks]

(A) More closely related individuals within same breed for 4–6 generations

(B) Superior males and females of different breeds

(C) Animals within same breed without having common ancestors

(D) Two different related species

Explanation:

It is a process of hybridization in which two different related species are mated to produce offspring with traits of both parents.

Question 62.

Which of the following is correct regarding AIDS causative agent HIV?

[4 Marks]

(A) HIV is unenveloped retrovirus.

(B) HIV does not escape but attacks the acquired immune response.

(C) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase.

(D) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase.

Explanation:

HIV is enveloped retro-virus having 2-strands of single stranded RNA with reverse transcriptase enzyme.

Question 63.

Among the following edible fishes, which one is a marine fish having rich source of omega-3 fatty acids?

[4 Marks]

(A) Mrigala

(B) Mackerel

(C) Mystus

(D) Mangur

Explanation:

Mackerel is a oil edible fish and rich source of omega-3 fatty acids. It gives 2789 mg omega-3.

Question 64.

Match Column-I with Column-II and select the correct option using the codes given below

[4 Marks]

	Column-I		Column-II
(A)	Citric acid	(i)	Trichoderma
(B)	Cyclosporin A	(ii)	Clostridium
(C)	Statins	(iii)	Aspergillus
(D)	Butyric acid	(iv)	Monascus

(A) A-i B-iv C-ii D-iii

(B) A-iii B-iv C-i D-ii

(C) A-iii B-i C-ii D-iv

(D) A-iii B-i C-iv D-ii

Explanation:

(A) Citric acid – Aspergillus (B) Cyclosporin A – Trichoderma (C) Statins – Monacus (D) Butyric acid – Clostridium

Question 65.

Biochemical Oxygen Demand (BOD) may not be a good index for pollution for water bodies receiving effluents from

[4 Marks]

(A) Petroleum industry

(B) Sugar industry

(C) Dairy industry

(D) Domestic sewage

Explanation:

If the effluents are discharged from petroleum industry, it can create a toxicological effect on aquatic life and even humans. It contains oil, that deplete the level of oxygen in water. It can cause loss of biodiversity, etc.

Question 66.

The principle of competitive exclusion was stated by

[4 Marks]

(A) G.F. Gause

(B) C. Darwin

(C) Verhulst and Pearl

(D) MacArthur

Explanation:

Competitive exclusion principle was stated by G.F. Gause.

Question 67.

Which of the following National Parks is home to the famous musk deer or hangul?

[4 Marks]

(A) Keibul Lamjao National Park, Manipur

(B) Bandhavgarh National Park, Madhya Pradesh

(C) Dachigam National Park, Jammu & Kashmir

(D) Eaglenest Wildlife Sanctuary, Arunachal Pradesh

Explanation:

The famous musk deer or hangul are found in Dachigam National Park, Jammu & Kashmir.

Question 68.

A lake which is rich in organic waste may result in

[4 Marks]

(A) drying of the lake due to algal bloom

(B) increased population of aquatic organisms due to minerals

(C) increased population of fish due to lots of nutrients.

(D) mortality of fish due to lack of oxygen

Explanation:

A lake which is rich in organic waste may result in mortality of fish because increase in the level of organic waste in lake will increase the population of micro-organism in water. As a result, Biological Oxygen Demand will also increase. That becomes fatal aquatic life to respire .

Question 69.

The highest DDT concentration in aquatic food chain shall occur in

[4 Marks]

(A) crab

(B) eel

(C) phytoplankton

(D) seagull

Explanation:

The highest DDT concentration in aquatic food chain will be in seagull. This condition is known as ‘biomagnification.

Question 70.

Which of the following sets of diseases is caused by bacteria?

[4 Marks]

(A) Typhoid and smallpox

(B) Cholera and tetanus

(C) Herpes and influenza

(D) Tetanus and mumps

Explanation:

Tetanus is caused by the clostridium tetani bacterium and cholera by vibrio cholerae.

Question 71.

Match Column-I with Column-II for housefly classification and select the correct option using the codes given below:

[4 Marks]

	Column-I		Column-II
A	Family	(i)	Diptera
B	Order	(ii)	Arthropoda
C	Class	(iii)	Muscidae
D	Phylum	(iv)	Insecta

(A) A-iv B-iii C-ii D-i

(B) A-iv B-ii C-i D-iii

(C) A-iii B-i C-iv D-ii

(D) A-iii B-ii C-iv D-i

Explanation:

(A) Family — Muscidae

(B) Order —Diptera

(C) Class — Insecta

(D) Phylum— Arthropoda

Question 72.

Choose the correct statement.

[4 Marks]

(A) All pisces have gills covered by an operculum.

(B) All reptiles have a three-chambered heart.

(C) All mammals are viviparous.

(D) All cyclostomes do not possess jaws and paired fins.

Explanation:

Not all reptiles have 3-chambered heart, some reptiles like crocodiles have anatomically 4-chambered heart. Generally, reptiles have two atria and one ventricle. All pisces are covered by scales and have gills. Generally, mammals are viviparous but some mammals are oviparous also, e.g. platypus.

Question 73.

Study the four statements (A–D) given below and select the two correct ones out of them: (A) Definition of biological species was given by Ernst Mayr. (B) Photoperiod does not affect reproduction in plants. (C) Binomial nomenclature system was given by R.H. Whittaker. (D) In unicellular organisms, reproduction is synonymous with growth. The two correct statements are

[4 Marks]

(A) C and D

(B) A and B

(C) B and C

(D) A and D

Explanation:

Photoperiod affects the reproduction in plants. It is observed in many tropical species of long-day plants, it prevents the formation of flower buds. There are many temperate plants which have variety of flowering habits, some produce in short days and some in long. Binomial nomenclature was given by Carl Linnaeus (1707–1778).

Question 74.

In male cockroaches, sperms are stored in which part of the reproductive system?

[4 Marks]

(A) Vas deferens

(B) Testes

(C) Seminal vesicles

(D) Mushroom glands

Explanation:

In male cockroaches, sperms are stored in seminal vesicles of reproductive system.

Question 75.

Smooth muscles are

[4 Marks]

(A) Voluntary, multinucleate, cylindrical

(B) Voluntary, spindle-shaped, uninucleate

(C) Involuntary, fusiform, non-striated

(D) Involuntary, cylindrical, striated

Explanation:

Smooth muscles are involuntary, fusiform and non-striated muscular tissue.

Question 76.

Oxidative phosphorylation is

[4 Marks]

(A) Oxidation of phosphate group in ATP.

(B) Formation of ATP by transfer of phosphate group from a substrate to ADP.

(C) Addition of phosphate group to ATP.

(D) Formation of ATP by energy released from electrons removed during substrate oxidation.

Explanation:

Oxidative phosphorylation is formation of ATP by energy released from electrons removed during substrate oxidation.

Question 77.

Which of the following is the least likely to be involved in stabilizing the three-dimensional folding of most proteins?

[4 Marks]

(A) Hydrophobic interaction

(B) Ester bonds

(C) Hydrogen bonds

(D) Electrostatic interaction

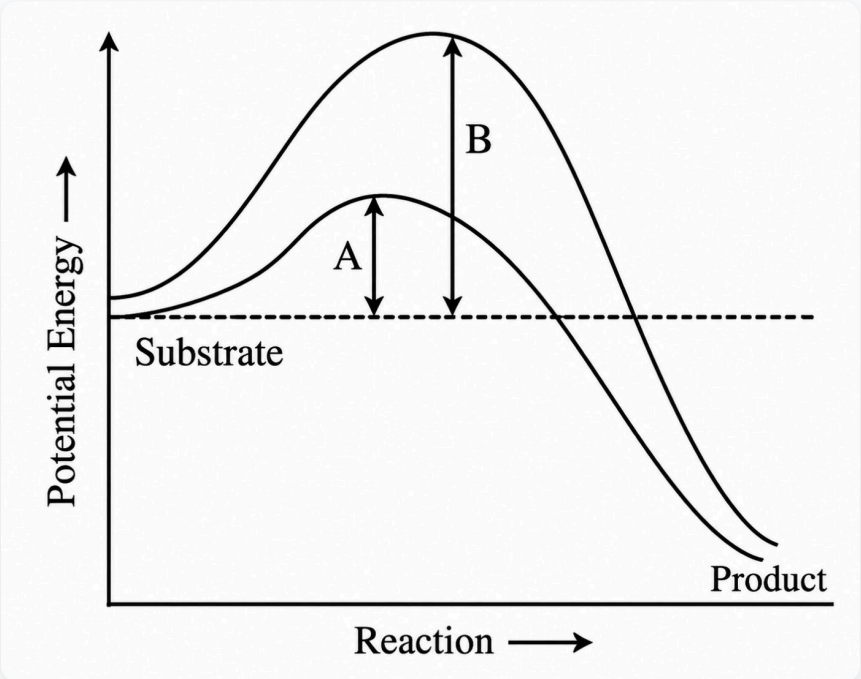
Explanation:

Ester bonds are least involved in stabilization of three-dimensional structure of protein.

Question 78.

Which of the following describes the given graph correctly?

[4 Marks]



(A) Endothermic reaction with energy A in presence of enzyme and B in absence of enzyme

(B) Exothermic reaction with energy A in absence of enzyme and B in presence of enzyme

(C) Exothermic reaction with energy A in presence of enzyme and B in absence of enzyme

(D) Endothermic reaction with energy A in absence of enzyme and B in presence of enzyme

Explanation:

Exothermic reaction is a type of chemical reaction which releases energy in the form of heat and light. It is opposite to endothermic reaction. Graph shows, energy A is released in the presence of enzyme and energy B is released in the absence of enzyme.

Question 79.

When cell has stalled DNA replication fork, which checkpoint should be predominantly activated?

[4 Marks]

(A) M

(B) Both G_1/M and M

(C) G_1/S

(D) G_2/M

Explanation:

G_1/S is a checkpoints that controls the mechanism in eukaryotes cell cycle. This stage is localized at the end of G_1 phase and just before the entry of S-phase.

Question 80.

Match the stages of meiosis in Column-I to their characteristic features in Column-II and select the correct option using the codes given below:

[4 Marks]

Column-I		Column-II	
A	Pachytene	i	Pairing of homologous chromosomes
B	Metaphase-I	ii	Terminalization of chiasmata
C	Diakinesis	iii	Crossing over takes place
D	Zygotene	iv	Chromosomes align at equatorial plate

(A) A-iii B-iv C-ii D-i

(B) A-i B-iv C-ii D-iii

(C) A-iv B-iii C-ii D-i

(D) A-ii B-iv C-iii D-i

Explanation:

(A) Pachytene – Crossing over takes place

(B) Metaphase-I – Chromosome align at equatorial plate

(C) Diakinesis – Terminalization of chiasmata

(D) Zygotene – Pairing of homologous chromosomes

Question 81.

Which hormones do stimulate the production of pancreatic juice and bicarbonate?

[4 Marks]

(A) Cholecystokinin and secretin

(B) Insulin and glucagon

(C) Gastrin and insulin

(D) Angiotensin and epinephrine

Explanation:

The Cholecystokinin and secretin are the hormones produced by the walls of duodenum.

Question 82.

The partial pressure of oxygen in the alveoli of the lungs is

[4 Marks]

(A) more than that in the blood

(B) equal to that in the blood

(C) less than that of carbon dioxide

(D) less than that of the blood

Explanation:

Exchange of gases take place by simple diffusion for maintaining the concentration gradient. In diffusion, the pressure of oxygen in alveoli should be kept at a high level compared to blood, while the pressure of CO_2 in the alveoli should be lower than in blood.

Question 83.

Choose the correct statement.

[4 Marks]

(A) Meissner's corpuscles are thermo receptors.

(B) Receptors do not produce graded potentials.

(C) Photoreceptors in the human eye are depolarized during darkness and become hyperpolarized in response to the light stimulus.

(D) Nociceptors respond to changes in pressure.

Explanation:

Receptor potentials are graded in sensory cells caused by stimuli.

- Nociceptors respond to pain or alert the body to potentially damaging stimuli. These are the sensors of the pain pathway.
- Meissner's corpuscles are mechanoreceptors.

Question 84.

'Graves' disease is caused due to

[4 Marks]

(A) Hyposecretion of thyroid gland

(B) Hypersecretion of adrenal gland

(C) Hypersecretion of thyroid gland

(D) Hyposecretion of adrenal gland

Explanation:

Grave's disease is caused due to the hypersecretion of the thyroid gland.

Question 85.

Name the ion responsible for unmasking of active sites for myosin for cross-bridge activity during muscle contraction.

[4 Marks]

(A) Sodium

(B) Potassium

(C) Magnesium

(D) Calcium

Explanation:

Calcium is responsible for unmasking active sites for cross-bridge activity during muscle contraction.

Question 86.

Name the blood cells, whose reduction in number can cause clotting disorder, leading to excessive loss of blood from the body.

[4 Marks]

(A) Leucocytes

(B) Erythrocytes

(C) Neutrophils

(D) Thrombocytes

Explanation:

Thrombocytes help in haemostasis i.e. in blood coagulation. Their deficiency can cause haemophilia.

Question 87.

Name a peptide hormone which acts mainly on hepatocytes, adipocytes and enhances cellular glucose uptake and utilization.

[4 Marks]

(A) Gastrin

(B) Secretin

(C) Insulin

(D) Glucagon

Explanation:

Insulin uptakes glucose through a transduction pathway from adipose tissue and muscles. It is a peptide hormone which acts mainly on hepatocytes and adipocytes, enhancing cellular glucose uptake and utilization.

Question 88.

Osteoporosis, an age-related disease of skeletal system, may occur due to

[4 Marks]

(A) decreased level of estrogen

(B) accumulation of uric acid leading to inflammation of joints

(C) immune disorder affecting neuro-muscular junction leading to fatigue

(D) high concentration of Ca^{++} and Na^{+}

Explanation:

After menopause in older women, there is a quick drop in the level of estrogen that can cause osteoporosis.

Question 89.

Serum differs from blood in

[4 Marks]

(A) lacking albumins

(B) lacking globulins

(C) lacking clotting factors

(D) lacking antibodies

Explanation:

Serum lacks RBC, WBC, and clotting factors. It contains all the proteins not used in blood clotting.

Question 90.

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because

[4 Marks]

(A) There is a negative intrapleural pressure pulling at the lung walls

(B) There is a negative pressure in the lungs

(C) There is a positive intrapleural pressure

(D) Pressure in the lungs is higher than the atmospheric pressure

Explanation:

Lungs do not collapse because there is a negative intrapleural pressure pulling at the lung walls.

Question 91.

The posterior pituitary gland is not a ‘true’ endocrine gland because

[4 Marks]

(A) it is under the regulation of hypothalamus

(B) it secretes enzymes

(C) it only stores and releases hormones

(D) it is provided with a duct

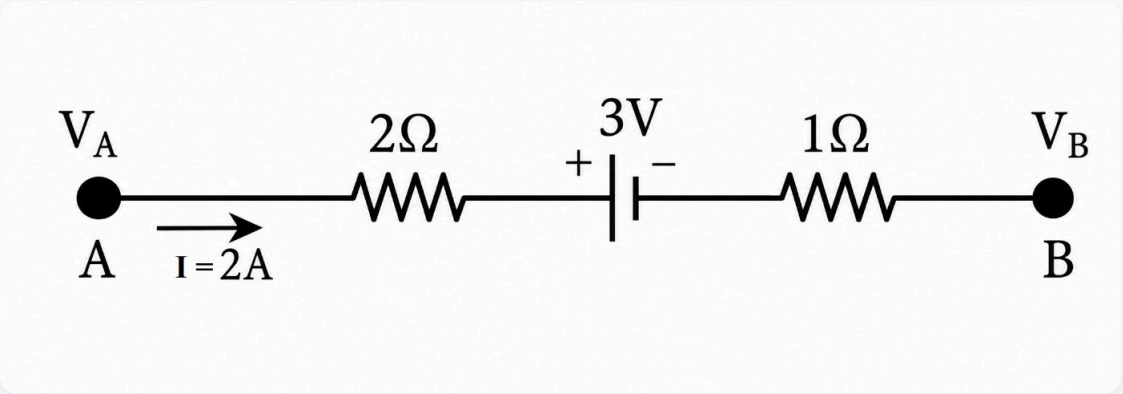
Explanation:

The posterior pituitary gland is not a true endocrine gland because it stores hormones made by the hypothalamus.

Question 92.

The potential difference (V_A - V_B) between the points A and B in the given figure is:

[4 Marks]



(A) +6 V

(B) -3 V

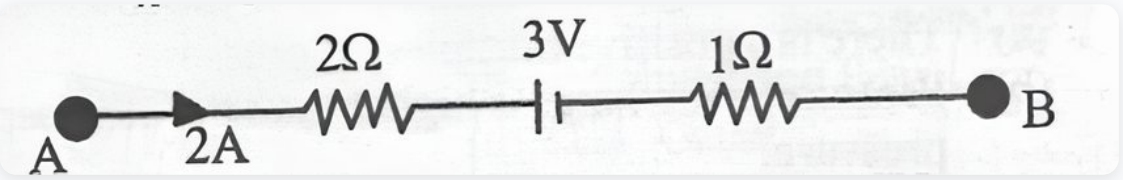
(C) +3 V

(D) +9 V

Explanation:

V_A- V_B = I (R_1+R_2) +3 volts

V_B = V_A - (2×2) -3 -(2×1) ⇒ V_A - V_B = 9V



Question 93.

A filament bulb (500 W, 100 V) is to be used in a 230 V main supply. When a resistance R is connected in series, it works perfectly and the bulb consumes 500 W. The value of R is:

[4 Marks]

(A) 46Ω

(B) 23Ω

(C) 13Ω

(D) 26Ω

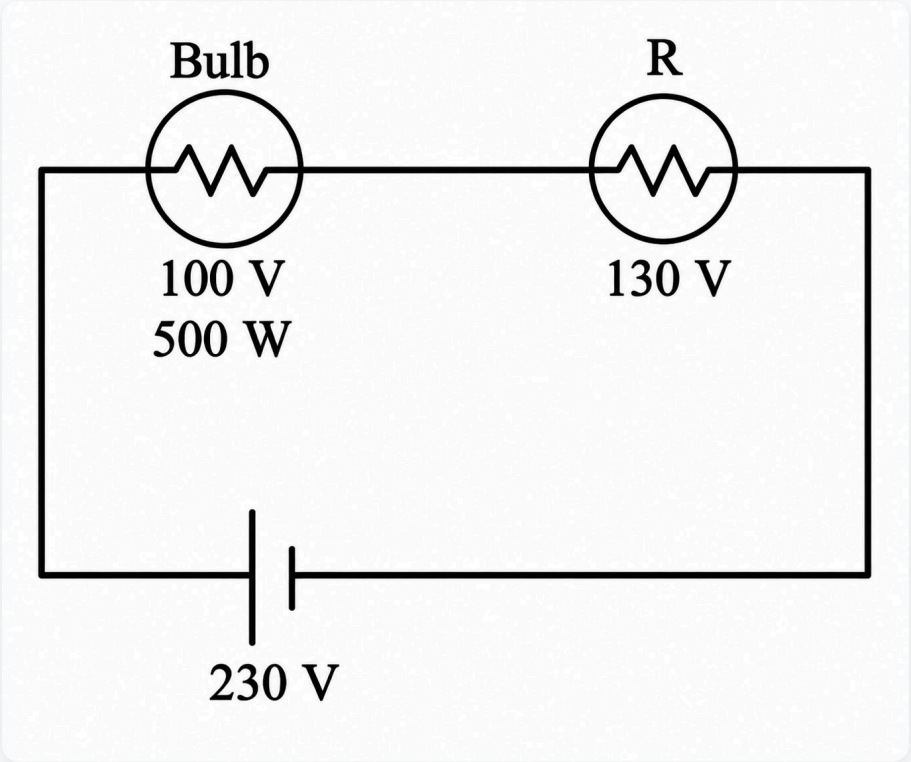
Explanation:

$R_{bulb} = V^2/P = 100^2/500 = 20\Omega$

According to question $R/R_{bulb} = 130/100$

$\Rightarrow R/20=130/100$

$\Rightarrow R = 26\Omega$



Question 94.

A long wire carrying a steady current is bent into a circular loop of one turn. The magnetic field at the centre of the loop is B. It is then bent into a circular coil of n turns. The magnetic field at the centre of this coil of n turns will be:

[4 Marks]

(A) 2nB

(B) $2n^2B$

(C) nB

(D) n^2B

Explanation:

According to question,

$l = 2\pi R = n(2\pi r) \Rightarrow r= R/n$

For one turn, Magnetic field $B = \mu_0 i/2R$ and

For n turn, Magnetic field B'

$= \mu_0 ni/2r \Rightarrow B' = \mu_0 n^2 i/2R = n^2 B$

Question 95.

A bar magnet is hung by a thin cotton thread in a uniform horizontal magnetic field and is in equilibrium state. The energy required to rotate it by 60° is W. Now the torque required to keep the magnet in this new position is:

[4 Marks]

(A) $(2W)/\sqrt{3}$

(B) $(\sqrt{3}W)/2$

(C) $W/\sqrt{3}$

(D) $\sqrt{3}W$

Explanation:

Torque $\tau = PE \sin 60°$ .....(i)

Energy required to rotate

$W = PE(1 - \cos 60°)$ .....(ii)

From (i) and (ii)

$\tau/W = \sqrt{(3/2)}/1/2 \Rightarrow \tau = W\sqrt{3}$

Question 96.

An electron is moving in a circular path under the influence of a transverse magnetic field of 3.57×10^{-2} T. If the value of e/m is 1.76×10^{11} C/kg, the frequency of revolution of the electron is:

[4 Marks]

(A) 6.28 MHz

(B) 1 GHz

(C) 100 MHz

(D) 62.8 MHz

Explanation:

Frequency of revolution of electron is given by,

$f = eB/2\pi m$

$f = (1.76\times10^{11}\times3.57\times10^{-2})/(2\times3.14)$

$f = 1$ GHz

Question 97.

Which of the following combinations should be selected for better tuning of an L–C–R circuit used for communication?

[4 Marks]

(A) R = 15 Ω, L = 3.5 H, C = 30 μF

(B) R = 20 Ω, L = 1.5 H, C = 35 μF

(C) R = 25 Ω, L = 1.5 H, C = 45 μF

(D) R = 25 Ω, L = 2.5 H, C = 45 μF

Explanation:

For better turning, q- factor must be high.

$\therefore$ Q-$\omega_0 L/R = 1\sqrt{LC}\ (L/R) = 1/R\ \sqrt{L/C}$

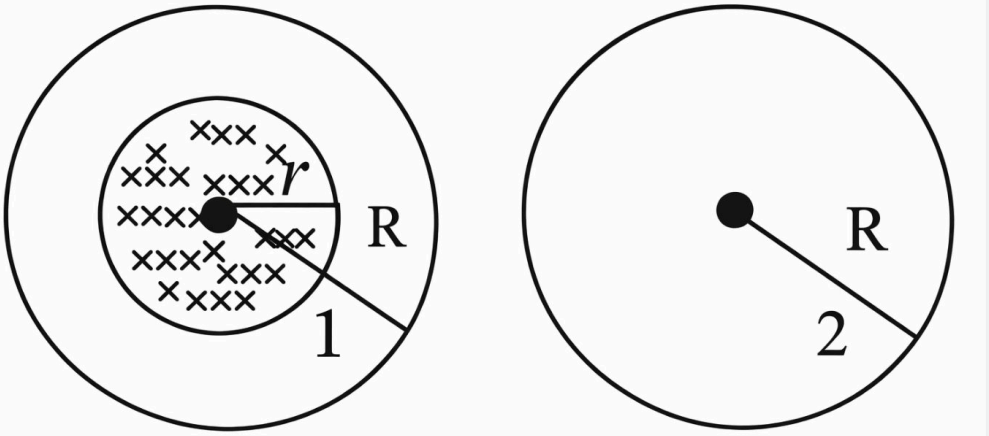
Q· factor α $1/R\sqrt{C}$, and Q α$\sqrt{L}$

so, that R and C should be small and L should be high.

Question 98.

A uniform magnetic field is restricted within a region of radius r. The magnetic field changes with time at a rate $d\bar{B}/dt$. Loop 1 of radius R > r encloses the region r and loop 2 of radius R is outside the region of magnetic field as shown in the figure below. Then the e.m.f. generated is:

[4 Marks]



(A) $(d\bar{B}/dt)\ \square r^2$ in loop 1 and $(d\bar{B}/dt)\ \square r^2$ in loop 2

(B) Zero in loop 1 and zero in loop 2

(C) - $(d\bar{B}/dt)\ \square r^2$ in loop 1 and zero in loop 2

(D) - $(d\bar{B}/dt)\ \square R^2$ in loop 1 and zero in loop 2

Explanation:

.

For Loop 1

$$\varepsilon_{ind} = -A\left(\frac{d\bar{B}}{dt}\right)\cos 0° = -\pi r^2\left(\frac{d\bar{B}}{dt}\right)$$

For Loop 2,

$\varepsilon_{ind} = 0$ as no flux linkage

Question 99.

The potential differences across the resistance, capacitance, and inductance are 80 V, 40 V, and 100 V respectively in an L–C–R circuit. The power factor of this circuit is:

[4 Marks]

(A) 0.8

(B) 0.4

(C) 0.5

(D) 1.0

Explanation:

given that, V_R = 80V, V_C = 40 and V_L = 100V

tanΦ = V_L-V_C/V_R = 100-40/80 = 3/4

or Φ=37°

Power factor = cos Φ = cos37°=4/5 or 0.8

Question 100.

A 100 Ω resistance and a capacitor of 100 Ω reactance are connected in series across a 220 V source. When the capacitor is 50% charged, the peak value of the displacement current is:

[4 Marks]

(A) 11 A

(B) 2.2 A

(C) 11√2

(D) 4.4 A

Explanation:

$(i_d)_{max} = (i_c)_{max} = i_0 = \varepsilon_0/z=220\sqrt{2}/ \sqrt{100^2+100^2}$

$\Rightarrow (i_d)_{max} = 220\sqrt{2}/100\sqrt{2} = 2.2A$

Question 101.

Two identical glass (μ_g = 3/2) equiconvex lenses of focal length f each are kept in contact. The space between the two lenses is filled with water (μ_w = 4/3). The focal length of the combination is:

[4 Marks]

(A) f

(B) 4f/3

(C) 2f

(D) 3f/4

Explanation:

Using Len's Maker's formula $1/f = (\mu-1)(1/R_1-1/R_2)$

Since lenses are equiconvex, $R_1 = -R_2$

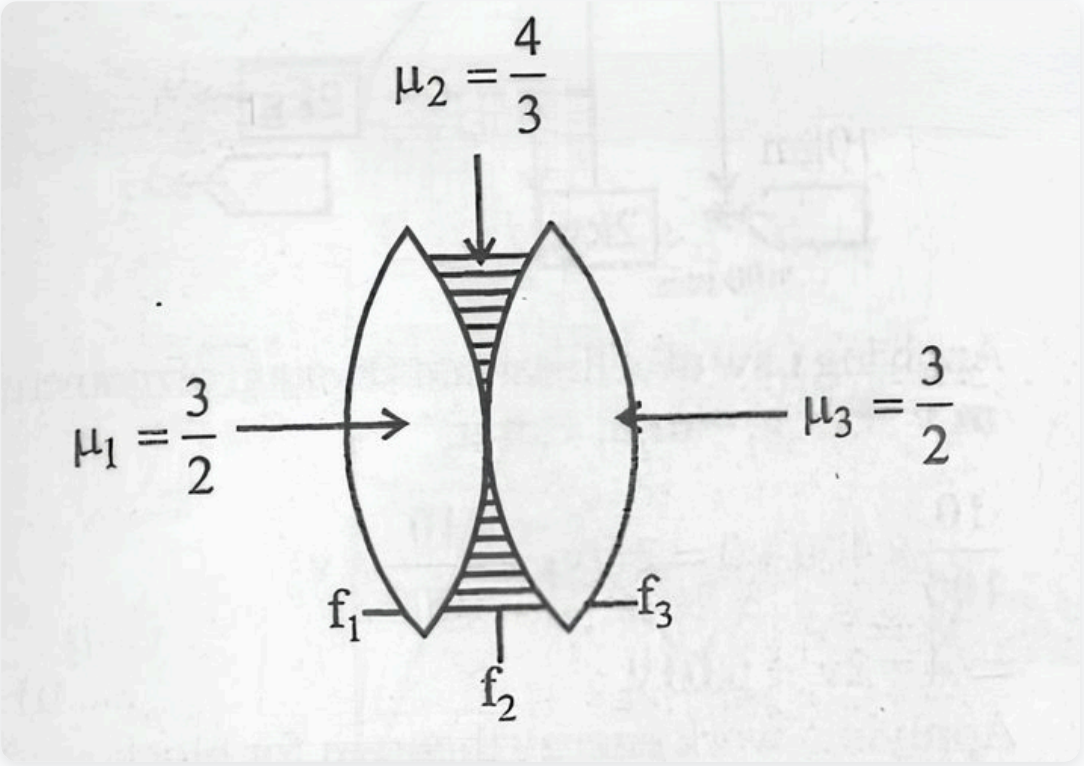
$\therefore f = (R/2)/(\mu-1)$

$f_1 = f_3 = R/2(3/2-1) = R = f$ (given)

$f_2 = -R/2(4/3-1) = -3/2R = -3/2f$

$1/f_{eq} = (1/f_1)+(1/f_2)+(1/f_3) = 1/f + (-2/3f)+1/f$

$\Rightarrow 1/f_{eq} = 4/3f \Rightarrow f_{eq} = 3f/4$



Question 102.

An air bubble in a glass slab with refractive index 1.5 (near normal incidence) is 5 cm deep when viewed from one surface and 3 cm deep when viewed from the opposite face. The thickness (in cm) of the slab is:

[4 Marks]

(A) 12

(B) 8

(C) 16

(D) 10

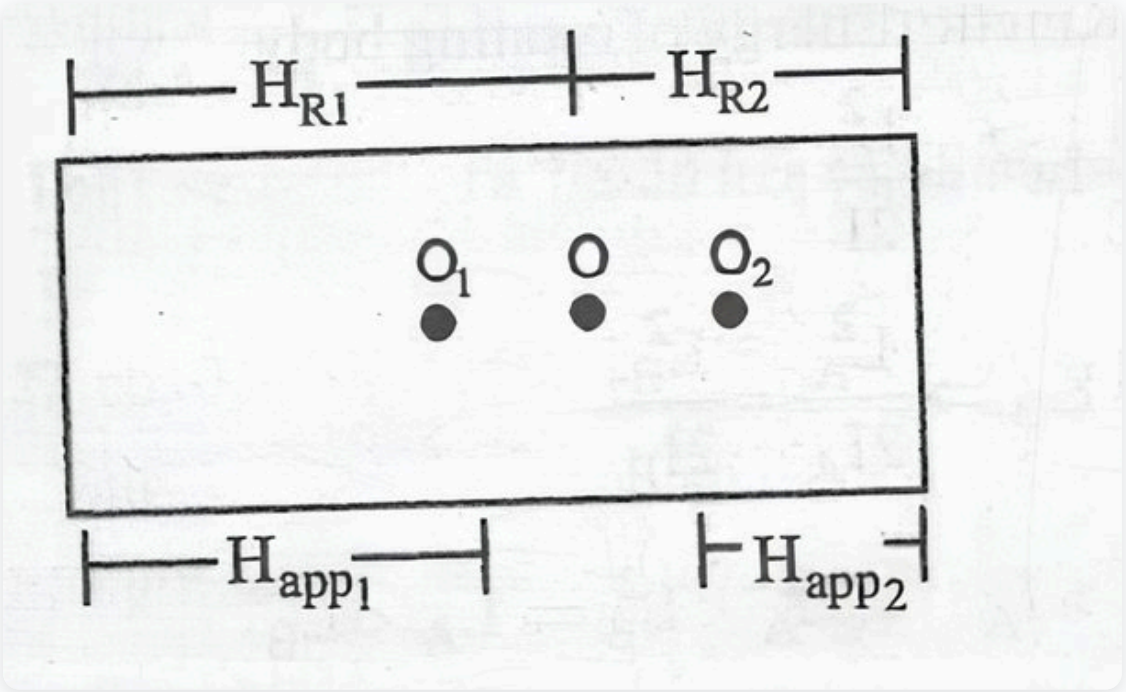
Explanation:

$H_{app} = H_R/\mu g \Rightarrow H_R = \mu_g H_{app}$

So, $H_R_1 = \mu_g H_{app1}$ and $H_R_2 = \mu_g H_{app2}$

thickness = $H_R_1 + H_R_2$

$= \mu_g [H_{app1} + H_{app2}] = 3/2 [5+3] = 3/2 \times 8 = 12cm$



Question 103.

The interference pattern n is obtained with two coherent light sources of intensity ratio n. In the interference pattern, $I_{max} - I_{min} / I_{max} + I_{min}$

will be:

[4 Marks]

(A) $2\sqrt{n}/(n+1)$

(B) $\sqrt{n}/n+1^2$

(C) $2\sqrt{n}/(n+1)^2$

(D) $\sqrt{n}/n+1$

Explanation:

Let us consider, the ration of intesities obtained from

two coherent sources is $I_1/I_2 = n/1$

$(I_{max}) - (I_{min})/ (I_{max}) + (I_{min}) = (\sqrt{I_1} + \sqrt{I_2})^2 - (\sqrt{I_1} - \sqrt{I_2})^2/\sqrt{I_1} + \sqrt{I_2})^2/\sqrt{I_1} - \sqrt{I_2})^2$

$= 4\sqrt{I_1 I_2}/ 2I_1 + I_2$

$= 2\sqrt{I_1/I_2}/(I_1/I_2 + 1) = 2\sqrt{n}/n+1$

Question 104.

A person can see clearly objects only when they lie between 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens the person has to use, will be:

[4 Marks]

(A) convex, +1.5 diopter

(B) concave, –0.2 diopter

(C) concave, –0.25 diopter

(D) convex, +2.25 diopter

Explanation:

To correct myopia far point must go to infinity.

V= -4m, u=-∞, P= ?

P= 1/f = 1/v-1/u = 1/-4-1/8 = 0.25D

Question 105.

A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focal length 60 cm. The aperture is illuminated normally by a parallel beam of wavelength 5×10^{-5} cm. The distance of the first dark band of the diffraction pattern from the centre of the screen is:

[4 Marks]

(A) 0.10 cm

(B) 0.25 cm

(C) 0.20 cm

(D) 0.15 cm

Explanation:

Here, focal length,

f=D=60cm

For first minima,

$y=\lambda D/a = 5\times10^{-7} \times60/2\times10^{-2}\times10^{-2} = 5\times10^{-3}\times60/2$

=0.15cm

Question 106.

Electrons of mass m with de Broglie wavelength λ fall on the target in an X-ray tube. The cutoff wavelength (λ_0) of the emitted X-ray is:

[4 Marks]

(A) $\lambda_0=\lambda$

(B) $\lambda_0=2m^2c^2\lambda^3/h^2$

(C) $\lambda_0=2mc\lambda^2/h$

(D) $\lambda_0=2h/mc$

Explanation:

de-Bronglie wavelength is given by

$\lambda=h/p \Rightarrow p=h/\lambda$

$E=p^2/2m = h^2/2m\lambda^2$

Also in X-ray $E=hc/\lambda_0$

$hc/\lambda_0 = h^2/2m\lambda^2 = \lambda_0 = 2mc\lambda/h$

Question 107.

Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of A relative to C is:

[4 Marks]

(A) –3 V

(B) –1 V

(C) +3 V

(D) +4 V

Explanation:

Einstein Photoelectric Equation

$eV=1/2\ mv^2_{max} = hv = \Phi_0$

According to question,

I case $2 = 5 - \Phi_0 \Rightarrow = 3eV$

II case $eV = 6-3 = 3\ eV \Rightarrow Vs = 3V.$

$\therefore V_AC = -3V$

Question 108.

If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ m. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be:

[4 Marks]

(A) 20/ 7 □

(B) 20 /13 □

(C) 16 /25 □

(D) 9 /16 □

Explanation:

.

As we know, $\frac{1}{\lambda} = R_H Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

Transition : $3 \rightarrow 2 \Rightarrow$ Wavelength λ

Transition : $4 \rightarrow 3 \Rightarrow$ Wavelength $\lambda' = ?$

$$\frac{1}{\lambda} = R_H Z^2 \left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$\frac{1}{\lambda'} = R_H Z^2 \left(\frac{1}{3^2} - \frac{1}{4^2}\right) \Rightarrow \frac{\lambda'}{\lambda} = \frac{20}{7} \Rightarrow \lambda' = \frac{20\lambda}{7}$$

Question 109.

The half-life of a radioactive substance is 30 minutes. The time (in minutes) taken between 40% decay and 85% decay of the same radioactive substance is:

[4 Marks]

(A) 60

(B) 15

(C) 45

(D) 30

Explanation:

Decay 40% → 85%

Remaining 60% → 15%

60% —t½→ 30% —t½→ 15%

t = 2t½ = 60 min

Question 110.

For CE transistor amplifier, the audio signal voltage across the collector resistance of 2kΩ is 4V. If the current amplification factor of the transistor is 100 and the base resistance is 1kΩ, then the input signal voltage is:

[4 Marks]

(A) 30mV

(B) 15mV

(C) 10mV

(D) 20mV

Explanation:

Here, $\beta = 100$; $V_0 = 4V$; $R_i = 10^3\Omega$;

$R_0 = 2\times 10^3\Omega$; $V_i = ?$

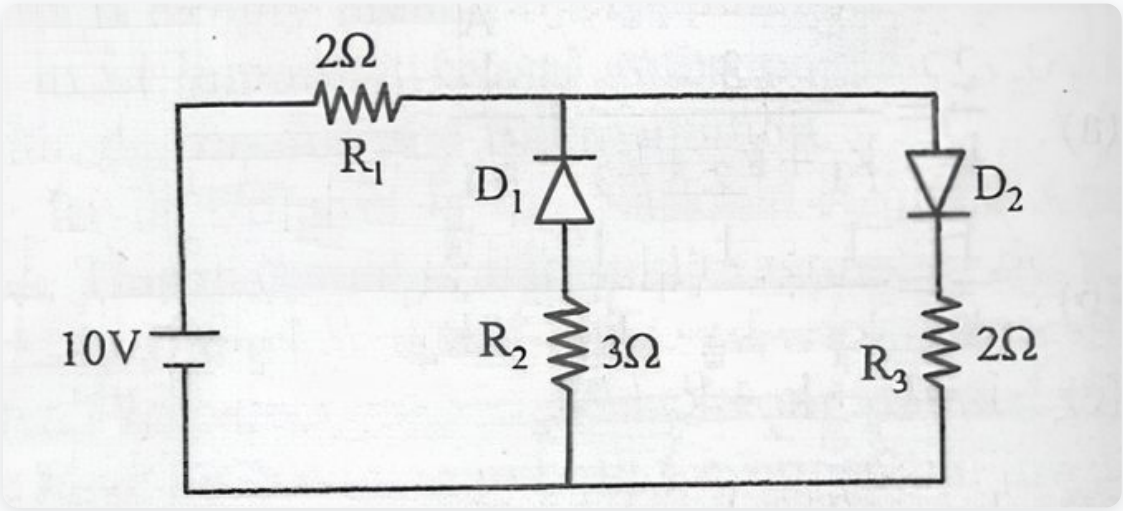
$V_0 / V_i = \beta R_0/R_i \Rightarrow 4/V_i = 100\times 2\times 10^3/10^3$

$\Rightarrow V_i = 20cmV$

Question 111.

The given circuit has two ideal diodes connected as shown in the figure below. The current flowing through the resistance R_1 will be:–

[4 Marks]



(A) 1.43 A

(B) 10.0 A

(C) 2.5 A

(D) 3.13 A

Explanation:

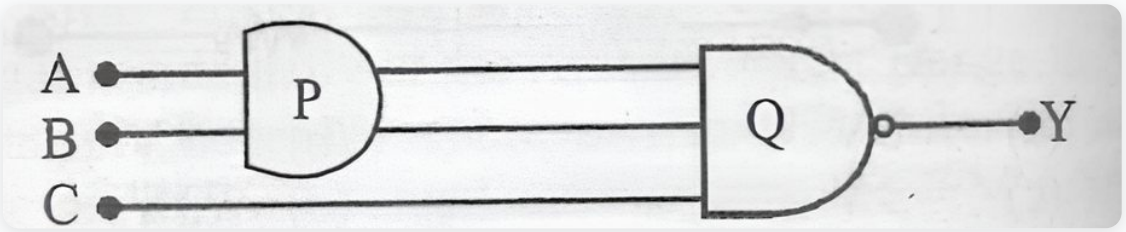
Current will not flow through D_1 as it is reverse biased. Current will flow through cell, R_1 D_2 and R_3.

$\therefore i = 10/2+2 = 2.5$ A

Question 112.

What is the output Y in the following circuit, when all the three inputs A, B, C are first 0 and then 1?

[4 Marks]



(A) 0,1

(B) 0,0

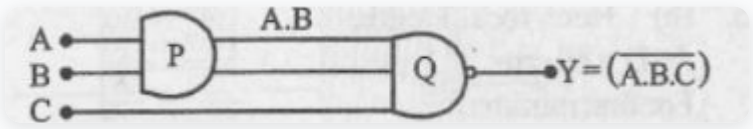
(C) 1,1

(D) 1,0

Explanation:

for A = B = C = 0; y=1

for A = B = C = 1; y=0



Question 113.

Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length?

[4 Marks]

(A) $\sqrt{(hc / G)}$

(B) $\sqrt{(Gc / h^{3/2})}$

(C) $\sqrt{(hG / c^{3/2})}$

(D) $\sqrt{(hG / c^{5/2})}$

Explanation:

.

Let the dimension of length depends on h, G, c as

$$\ell \propto h^x G^y c^z$$

$$M^a L^b T^0 = (ML^2T^{-1})^x (M^{-1}L^3T^{-2})^y (LT^{-1})^z$$

$$= M^{x-y} L^{2x+3y+z} T^{-x-2y-z}$$

Equating :

$$\left.\begin{aligned} x - y &= 0 \\ 2x + 3y + z &= 1 \\ -x - 2y - z &= 0 \end{aligned}\right\} \Rightarrow x = \frac{1}{2}; y = \frac{1}{2}; z = -\frac{3}{2}$$

$$\Rightarrow \ell \propto \frac{\sqrt{hG}}{c^{3/2}}$$

Question 114.

Two cars P and Q start from a point at the same time in a straight line and their positions are represented by $x_1(t) = at + bt^2$ and $x_2(t) = ft - t^2$. At what time do the cars have the same velocity?

[4 Marks]

(A) (a + f) / [2(b − 1)]

(B) (a − f) / (1 + b)

(C) (f − a) / [2(1 + b)]

(D) (a + f) / [2(1 + b)]

Explanation:

Given that

$x_p(t) = at + bt^2$

$v_p = a + 2bt$ $\quad$ $x_Q(t) = ft - t^2$

as $v_p = v_Q$ $\quad$ $v_Q = f - 2t$

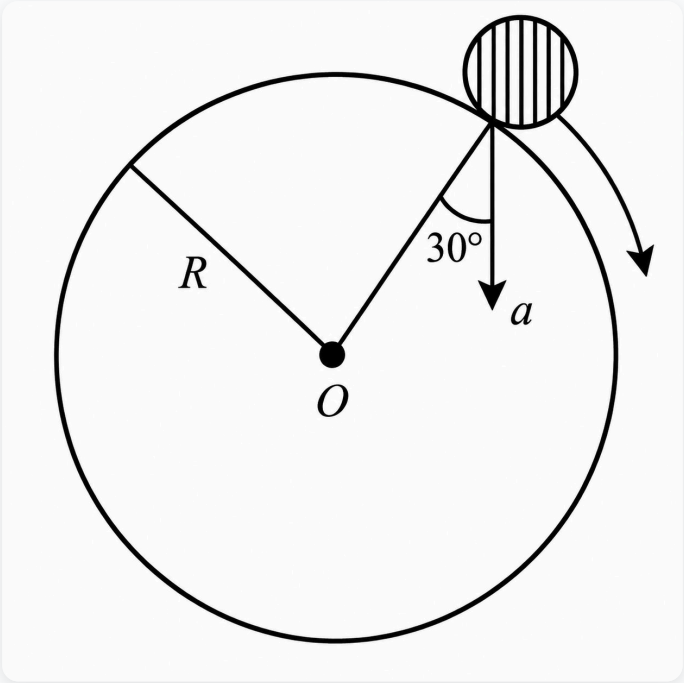
$a + 2bt = f - 2t$

$\Rightarrow t = f - a/2(1+b)$

Question 115.

In the given figure, a = 15 m/s² represents the total acceleration of a particle moving in the clockwise direction in a circle of radius R = 2.5 m at a given instant of time. The speed of the particle is:

[4 Marks]



(A) 5.7 m/s

(B) 6.2 m/s

(C) 4.5 m/s

(D) 5.0 m/s

Explanation:

Centripetal Acceleration

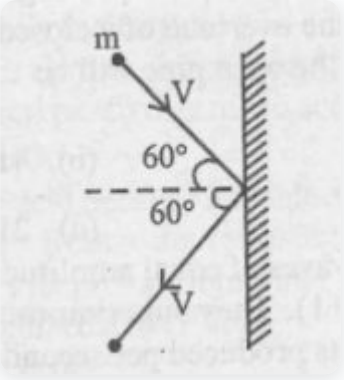
$a \cos 30° = a_c = v^2/R$

$\Rightarrow v^2 = aR \times \sqrt{3}/2 \Rightarrow v^2 = 32.47 \Rightarrow v \approx 5.7 m/s$

Question 116.

A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure below. The value of impulse imparted by the wall on the ball will be:

[4 Marks]



(A) $2mV$

(B) $mV/3$

(C) $mV/2$

(D) mV

Explanation:

.

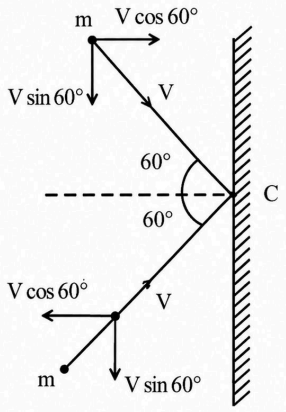
$$\overline{\Delta V} = \overline{V}_f - \overline{V}_i$$

$$= (-V\cos 60^\circ \hat{i} - V\sin 60^\circ \hat{j}) - (V\cos 60^\circ \hat{i} - V\sin 60^\circ \hat{j})$$

$$\overline{\Delta V} = -2V\cos 60^\circ \hat{i}$$

Impulse

$$I = |\overline{\Delta P}| = m|\overline{\Delta V}| = m\left(2V\cos 60^\circ\right) = mV$$



Question 117.

A bullet of mass 10 g moving horizontally with a velocity of 400 m/s strikes a wooden block of mass 2 kg which is suspended by a light inextensible string of length 5 m. As a result, the centre of gravity of the block is found to rise a vertical distance of 10 cm. The speed of the bullet after it emerges out horizontally from the block will be:

[4 Marks]

(A) 120 ms^{-1}

(B) 160 ms^{-1}

(C) 80 ms^{-1}

(D) 100 ms^{-1}

Explanation:

Applying Law of linear conservation of momentum

$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$

$10/100 \times 400 + 0 = 2 \times v_1 + 10/1000 \times v_2$

$\Rightarrow 4 = 2v_1 + 0.01v_2$

Applying work energy theorem of block

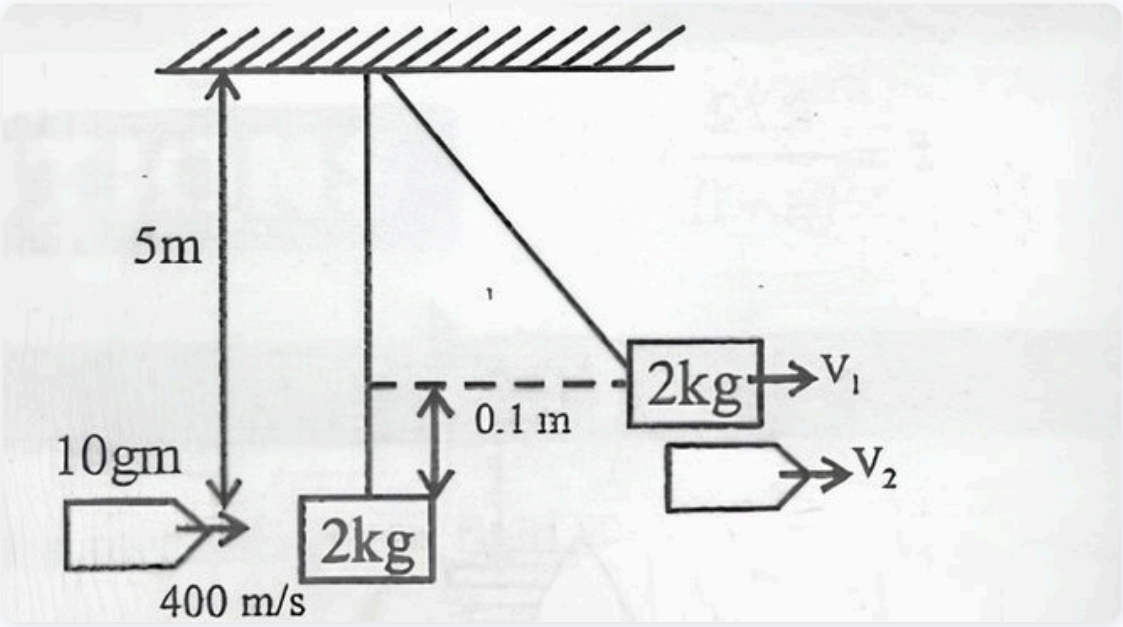
$W = \Delta KE$

$\Rightarrow 2 \times 10 \times 0.1 = 1/2 \times 2 \times v_1^2$

$\Rightarrow v_i = \sqrt{2} = 1.4$ m/s

Putting the value of v_1 in equation (i)

$4 = 2 \times 1.4 + 0.01v_2 \Rightarrow v_2 = 120$ m/s



Question 118.

Two identical balls A and B having velocities of 0.5 m/s and –0.3 m/s respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be:

[4 Marks]

(A) 0.3 m/s and 0.5 m/s

(B) 0.5 m/s and –0.3 m/s

(C) –0.3 m/s and 0.5 m/s

(D) –0.5 m/s and 0.3 m/s

Explanation:

Since both bodies are identical collision is elastic.

Therefore velocities will be interchanged after collision.

v_A= -0.3m/s and v_B = 0.5 m/s

Question 119.

A particle moves from a point (–2î+ 5j) to (4ĵ + 3k) when a force of (4î + 3ĵ) N is applied. How much work has been done by the force?

[4 Marks]

(A) 5 J

(B) 8 J

(C) 2 J

(D) 11 J

Explanation:

Work done by a force

$W = \bar{F}.\bar{s} = (4\hat{i} + 3\hat{j}).[2\hat{i} - \hat{j} + 3k] = 8-3 = 5J$

Question 120.

Two rotating bodies A and B of masses m and 2m with moments of inertia I_A and I_B (I_B > I_A) have equal kinetic energy of rotation. If L_a and L_β be their angular momenta respectively, then: –

[4 Marks]

(A) L_A = 2L_B

(B) L_A > L_B

(C) $L_A = L_B/2$

(D) $L_B > L_A$

Explanation:

Kinetic Energy of rotating body

$K = 1/2\ Iw^2 = L^2/2I$

$K_A = K_B \Rightarrow L_A^2/2I_A = L_B^2/2I_B$

$\therefore I_B > I_A$

$\therefore L A^2 < L^2 B \Rightarrow L_A < L_B$

Question 121.

A solid sphere of mass *m* and radius *R* is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation (E_{sphere} / E_cylinder) will be:

[4 Marks]

(A) 2 : 3

(B) 1 : 5

(C) 1 : 4

(D) 3 : 1

Explanation:

Kinetic energy of rotational motion = $1/2\ I\omega^2$

$E_{sphere} = 1/2I_s\omega^2 = 1/2 \times 2/5\ MR^2 \times\omega^2$

$E_cylinder = 1/2I_c(2\omega)^2 = 1/2 \times MR^2 \times 4\omega^2$

E_{sphere} / E_cylinder = 1/5

Question 122.

A light rod of length ℓ has two masses m_1 and m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is:

[4 Marks]

(A) $(m_1 + m_2)\ \ell^2$

(B) $((m_1 + m_2) / (m_1 m_2))\ \ell^2$

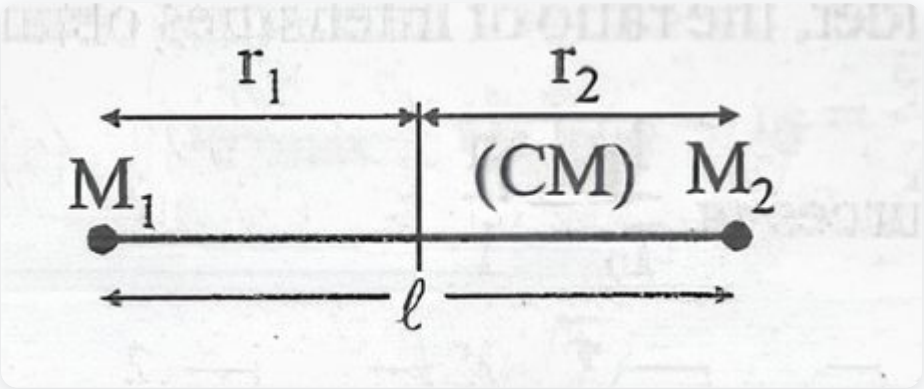
(C) $\sqrt{(m_1 m_2)}\ \ell^2$

(D) $(m_1 m_2 / (m_1 + m_2))\ \ell^2$

Explanation:

$r_1 = m_2\ell / m_1+m_2$, $r_2 = m_1\ell/m_1+m_2$

$I_cm = m_1 r_1^2 + m_2 r_2^2 = m_1 m_2/m_1+m_2\ \ell^2$

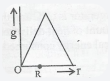


Question 123.

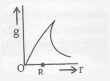
Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by:-

[4 Marks]

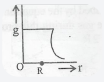
(A)



(B)



(C)



(D)



Explanation:

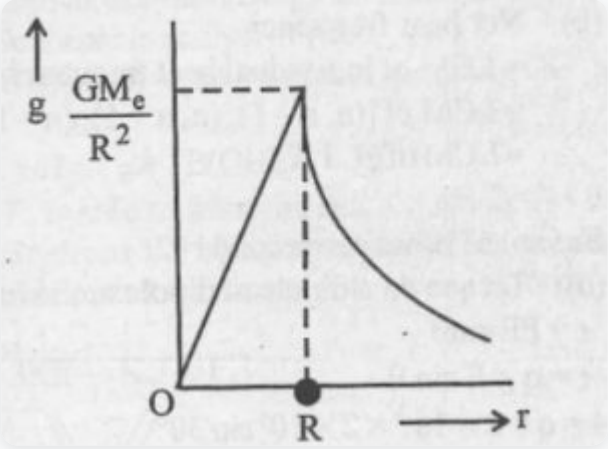
As we know

$g = (GM_e/R_e^3)\, r$ when $0 < r \leq R_e$

$g = GM_e/r^2$ when $r \geq R_e$

↑

g GM_e/R^2



Question 124.

A satellite of mass *m* is orbiting the earth (of radius *R*) at a height *h* from its surface. The total energy of the satellite in terms of g_0, the value of acceleration due to gravity at the earth's surface, is:

[4 Marks]

(A) $2mg_0R^2/R+H$

(B) $mg_0R^2/2(R+H)$

(C) $-2mg_0R^2/R+H$

(D) $-mg_0R^2/2(R+H)$

Explanation:

Total energy = $- GM_em/2(R+h)$

$\therefore g_0 = GM_e/R^2 \Rightarrow M_e = g_0R^2/G$

$\therefore$ Energy = $- mg_0R^2/2(R+h)$

Question 125.

A rectangular film of liquid is extended from (4 cm × 2 cm) to (5 cm × 4 cm). If the work done is 3×10^{-4} J, the value of the surface tension of the liquid is:

[4 Marks]

(A) 0.125 Nm^{-1}

(B) 0.250 Nm^{-1}

(C) 0.2 Nm^{-1}

(D) 8.0 Nm^{-1}

Explanation:

Work done $W=T(2\Delta A) = 3\times10^{-4}$ J

$\Rightarrow T= W/2\Delta A = 3\times10^{-4}/2\times12\times10^{-4} = 0.125\ Nm^{-1}$

Question 126.

Three liquids of densities ρ_1, ρ_2, and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$), having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1, θ_2, and θ_3 obey:

[4 Marks]

(A) $0 \le \theta_1 < \theta_2 < \theta_3 < \square/2$

(B) $\square/2 < \theta_1 < \theta_2 < \theta_3 \ge 0$

(C) $\square/2 < \theta_1 < \theta_2 < \theta_3 < \square$

(D) $\square < \theta_1 < \theta_2 < \theta_3 < \square/2$

Explanation:

The rise or fall of a liquid in a capillary tube is given by,

$h= 2T\cos\theta/\rho gr$

as r, h, T re same

$\Rightarrow \cos\theta/\rho$ = constant

$\Rightarrow \cos\theta_1/\rho_1 = \cos\theta_2/\rho_2 = \cos\theta_3/\rho_3$

as $\rho_1>\rho_2>\rho_3$

$\Rightarrow \cos\theta_1 > \cos\theta_2 > \cos\theta_3$

$\Rightarrow \theta_1 < \theta_2 < \theta_3$

As water rises $\Rightarrow \theta$ must be acute

So, $0 \leq \theta_1 < \theta_2 < \theta_3 < \pi/2$

Question 127.

Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100°C, while the other one is at 0°C. If the two bodies are brought into contact, then assuming no heat loss, the final common temperature is:

[4 Marks]

(A) 50°C

(B) 0°C

(C) less than 50°C but greater than 0°C

(D) more than 50°C

Explanation:

Let θ be the final common temperature. Further, let s_c and s_h be the average heat capacities of the cold and hot (initially) bodies respectively (where s_c < s_h given).

From, Principle of calorimetry,

heat lost = heat gained

S_h (100° C-θ) = S_cθ

$\therefore \theta = S_h/ (S_h+S_c) \times 100°C = 100°C/ (1+S_c/S_h)$

$\therefore$ S_c/ S_h <1

$\therefore$ θ> 100°C/2 or θ>50°C

Question 128.

A body cools from temperature 3T to 2T in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be:

[4 Marks]

(A) 3/2 T

(B) 7/4 T

(C) 4/3 T

(D) T

Explanation:

According to Newton's laws of cooling

T_1-T_2/t = K (T_1 + T_2/2-T)

3T-2T/10 = K (5T-2T/2) ⇒ T/10 = k (3T/2).....(i)

2 T-T′/10 = k (2T+T′/2 -T)

⇒2T-T′/10 = k (T′/2)....(ii)

By solving (i) and (ii)

T′ = 3/2 T

Question 129.

One mole of an ideal monatomic gas undergoes a process described by the equation PV^3=constant. The heat capacity of the gas during this process is:

[4 Marks]

(A) 5/2R

(B) R

(C) 2R

(D) 3/2R

Explanation:

PV^y = constant (Polytropic process)

Heat capacity in polytropic process is given by

[$C=C_v + R/1+\gamma$]

Given that PV^3 = constant ⇒γ =3....(i)

also gas is monoatomic f=3 ....(ii)

by formula

C = fR/2 + R/1-γ

C= 3/2 R- R/2 = R

Question 130.

The temperature inside a refrigerator is t2°C and the room temperature is t1°C. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be:

[4 Marks]

(A) t_1+273/t_1-t_2

(B) t_1/t_1-t_2

(C) t_1+t_2/t_1+273

(D) t_2+273/t_1-t_2

Explanation:

Heat delivered = Q_1

Coefficient of performance,

$\beta= t_2+273/ t_1-t_2 = Q_2/W= Q_1-W/W = Q_1/W -1$

$\Rightarrow Q_1/W=1 + t_2+273/ t_1-t_2= t_1+273/t_1-t_2$

Question 131.

A given sample of an ideal gas occupies a volume V at a pressure P and absolute temperature T. The mass of each molecule of the gas is m. Which of the following gives the density of the gas:

[4 Marks]

(A) Pm/(kT)

(B) P/(kT)

(C) mkT

(D) P/(kTV)

Explanation:

As we know,

$P/\rho = RT/M_w$ (Gas equation)

$\Rightarrow \rho = PM_w/ RT = P\times(mN_A)/kN_AT = Pm/kT$

Question 132.

A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations becomes 5 s. The value of m in kg is:

[4 Marks]

(A) 9/16

(B) 4/3

(C) 3/4

(D) 16/9

Explanation:

Tension is a spring

$T = 2\pi\sqrt{m/k}$

$3=2\pi\sqrt{m/k}$ .....(i)

$5= 2\pi\sqrt{m+1/k}$ ....(ii)

Squaring and dividing 'eqn' (i) by 'eqn' (ii)

$9/25 = m/m+1 \Rightarrow m =9/16$

Question 133.

The second overtone of an open organ pipe has the same frequency as the overtone of a closed pipe L metre long. The length of the open pipe will be:

[4 Marks]

(A) L

(B) 2L

(C) 4L

(D) L /2

Explanation:

For second overtone (3rd harmonic)in open organ pipe,

$3\lambda/2 = \ell_0 \Rightarrow \lambda = 2\ell_0/3$

For first overton (3rd harmonic) in closed organ pipe,

$3\lambda/2 = \ell_0 \Rightarrow 4\ell_c/3 = 4L/3$

So, $2\ell_0/3 = 4L/3 \Rightarrow \ell_0 = 2L$

Question 134.

Three sound waves of equal amplitudes have frequencies (n−1), n, (n+1). They superimpose to give beats. The number of beats produced per second will be:

[4 Marks]

(A) 2

(B) 1

(C) 3

(D) 4

Explanation:

Net beat frequency

=LCM of individual beat frequencies

=LCM of [(n, n-1), (n, n+1), (n-1, n+1)]

= LCM of (1, 1,2)

= 2 HZ

so, no.of beats per second = 2

Question 135.

An electric dipole is placed at an angle of 30° with an electric field intensity 2×10^5 N/C. It experiences a torque equal to 4 Nm. The charge on the dipole, if the dipole length is 2 cm, is:

[4 Marks]

(A) 8 mC

(B) 2 mC

(C) 7 μC

(D) 5 mC

Explanation:

Torque on a dipole of dipole moment (P)

$\tau = PE \sin\theta$

$\tau = q\ell E \sin\theta$

$4 = q \times 2 \times 16^{-3} \times 2 \times 10^{5} \sin 30°$

$\Rightarrow q = 2$ mC

Question 136.

Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weighs 10 g and 0.05 mole of X_3Y_2 weighs 9 g, the atomic weights of X and Y are

[4 Marks]

(A) 40, 30

(B) 60, 40

(C) 30, 20

(D) 20, 30

Explanation:

Let us assume that atomic weight of X is A_x and Y is A_y

No. of moles = Mol. wt. in gms / Molar mass

$\Rightarrow n_xY_2 = 0.1 = 0.5 = 10 / (A_x + 2A_y)$

$\Rightarrow A_x + 2A_y = 100$ …(1)

$n_{x3}Y_2 = 0.05 = 9 / (3A_x + 2A_y)$

$\Rightarrow 3A_x + 2A_y = 180$ …(2)

From solving eq. (1) and (2), we get— $A_x = 40$, $A_y = 30$

Question 137.

Which of the following pairs of d-orbitals will have electron density along the axis?

[4 Marks]

(A) d_z^2, d_xz

(B) d_x_z, d_yz

(C) d_xy, $d_{x^2-y^2}$

(D) d_z^2, $d_{x^2-y^2}$

Explanation:

d_z^2 and $d_{x^2-y^2}$ have electron density concentrated on the axis; others have electron density between the axis.

Question 138.

How many electrons can fit in the orbital for which n = 3 and l = 1?

[4 Marks]

(A) 6

(B) 14

(C) 2

(D) 10

Explanation:

n = 3, l = 1, hence the orbital is 3p. Total 6 electrons can fit in the orbital of 3p.

Question 139.

Among the following which one is a wrong statement?

[4 Marks]

(A) PH_3 and $BiCl_5$ do not exist

(B) SeF_4 and CH_4 have same shape

(C) pπ–dπ interactions are present in SO_2

(D) I_3^+ has bent geometry

Explanation:

Both have different shape. SeF_4 is sp^3d hybridised and see-saw shape, while CH_4 is sp^3 hybridised and tetrahedral in shape.

Question 140.

The hybridizations of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are

[4 Marks]

(A) sp, sp^2 and sp^3

(B) sp, sp^3 and sp^2

(C) sp^3, sp^2 and sp

(D) sp^2, sp and sp^3

Explanation:

Hybridisation (H) is given by

$H = ½ (V + M – C + A)$

V = valence electron in central atom

M = monovalent atom

C/A = Charge on cation/anion

NO_2^+ : $H = ½ (5 – 1) = 2$ (sp)

NO_3^- : $H = ½ (5 + 1) = 3$ (sp^2)

NH_4^+ : $H = ½ (5 + 1 – 1) = 4$ (sp^3)

Question 141.

Which of the following pairs of ions is isoelectronic and isostructural?

[4 Marks]

(A) ClO_3^-, CO_3^{2-}

(B) SO_3^{2-}, NO_3^-

(C) ClO_3^-, SO_3^{2-}

(D) CO_3^{2-}, NO_3^-

Explanation:

Isoelectronic compounds contain same no. of electrons and the structure of isostructural compounds are same. Here—

In SO_3^{2-}, ClO_3^-, No. of electrons = 42, Shape: Pyramidal

In CO_3^{2-}, NO_3^-, No. of electrons = 32, Shape: Trigonal planar

Question 142.

For a sample of perfect gas when its pressure is changed isothermally from p_i to p_f, the entropy change is given by

[4 Marks]

(A) $\Delta S = nRT \ln(p_f / p_i)$

(B) $\Delta S = RT \ln(p_i / p_f)$

(C) $\Delta S = nR \ln(p_i / p_f)$

(D) $\Delta S = nR \ln(p_f / p_i)$

Explanation:

The entropy change of an ideal gas is given by

$\Delta S = nC_p m \ln (T_f / T_i) + nR \ln (P_i / P_f)$

For isothermal $T_i = T_f$, $\ln 1 = 0$

$\Delta S = nR \ln (P_i / P_f)$

Question 143.

The percentage of pyridine (C_5H_5N) that forms pyridinium ion ($C_5H_5NH^+$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is

[4 Marks]

(A) 0.013%

(B) 1.6%

(C) 0.77%

(D) 0.0060%

Explanation:

Pyridine (C_5H_5N) is a weak base. For a weak base, $K_b = C\alpha^2$

$\alpha = \sqrt{(1.7 \times 10^{-9} / 0.1)}$

$\alpha = 1.30 \times 10^{-4}$

$\%\alpha = 1.30 \times 10^{-4} \times 100$

$\%\alpha = 0.013\%$

Question 144.

The solubility of AgCl(s) with solubility product 1.6×10^{-10} in 0.1 M NaCl solution would be

[4 Marks]

(A) 1.6×10^{-11} M

(B) zero

(C) 1.26×10^{-5} M

(D) 1.6×10^{-9} M

Explanation:

.

$$\begin{array}{lcll} NaCl(aq) & \rightarrow & Na^+(aq) & + & Cl^-(aq) \\ 0.1M & & 0 & & 0 \\ 0 & & 0.1M & & 0.1+S \end{array}$$

$$\begin{array}{lcll} AgCl(s) & \rightleftharpoons & Ag^+(aq) & + & Cl^-(aq) \\ a & & 0 & & 0 \\ a-S & & S & & S+0.1 \end{array}$$

$$K_{sp} = 1.6 \times 10^{-10} = [Ag^+][Cl^-] = S(0.1+S)$$

$\because$ K_{sp} is small, S is neglected with respect to 0.1 M

Hence, $1.6 \times 10^{-10} = S \times 0.1$

$S = 1.6 \times 10^{-9}$ M

Question 145.

Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behaviour?

[4 Marks]

(A) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

(B) $3S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

(C) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$

(D) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

Explanation:

Oxidation is a process in which an atom loses an electron and therefore, there is an increase in its oxidation number.

$CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

In this reaction, none of the atom has changed oxidation number. Hence H_2SO_4 is not showing oxidising behaviour.

Question 146.

In context with beryllium, which one of the following statements is incorrect?

[4 Marks]

(A) Its salts rarely hydrolyze.

(B) Its hydride is electron-deficient and polymeric.

(C) It is rendered passive by nitric acid.

(D) It forms Be_2C.

Explanation:

Be is small atom having high ionization potential and are covalent nature. So these are easily hydrolysed.

Question 147.

Boric acid is an acid because its molecule

[4 Marks]

(A) combines with proton from water molecule

(B) accepts OH^- from water releasing proton

(C) contains replaceable H^+ ion

(D) gives up a proton

Explanation:

$B(OH)_3$ is an weak lewis acid accepting OH^- ion from water $B(OH)_3 + H_2O \rightleftharpoons [B(OH)_4]^- + H^+$

Question 148.

AlF_3 is soluble in HF only in presence of KF. It is due to the formation of

[4 Marks]

(A) $K_3[AlF_6]$

(B) AlH_3

(C) $K_3[AlF_6H_3]$

(D) $K[AlF_3H]$

Explanation:

AlF_3 is able to form the salt $K_3[AlF_6]$. On the other hand anhydrous HF being weak acid does not dissociate on appreciable extent and hence AlF_3 does not form $[AlF_4]^-$ or $H[AlF_4]$

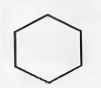
$AlF_3 + 3KF \rightarrow K_3[AlF_6]$

Question 149.

In which of the following molecules, all atoms are coplanar ?

[4 Marks]

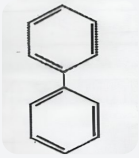
(A)



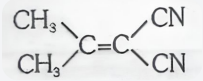
(B)



(C)

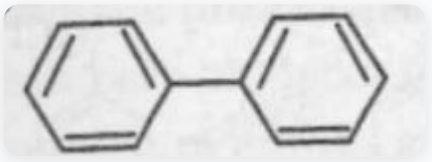


(D)



Explanation:

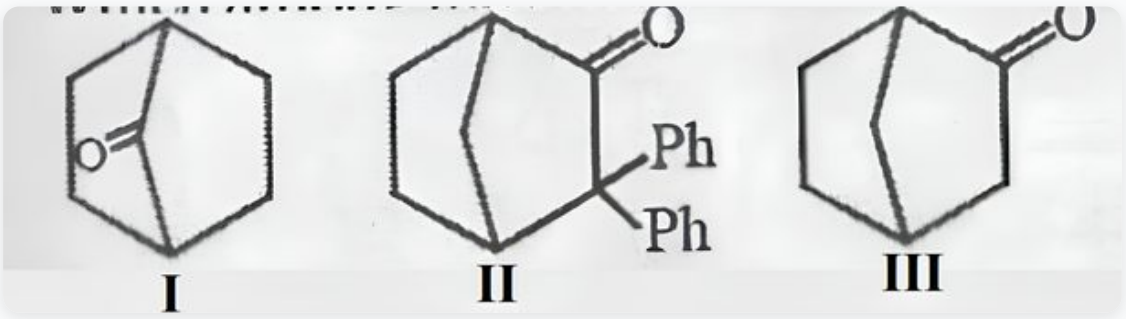
As the C-atoms undergoes sp^2 hybridisation, all the atoms are coplanar.



Question 150.

Which among the given molecules can exhibit tautomerism ?

[4 Marks]



(A) Both I and II

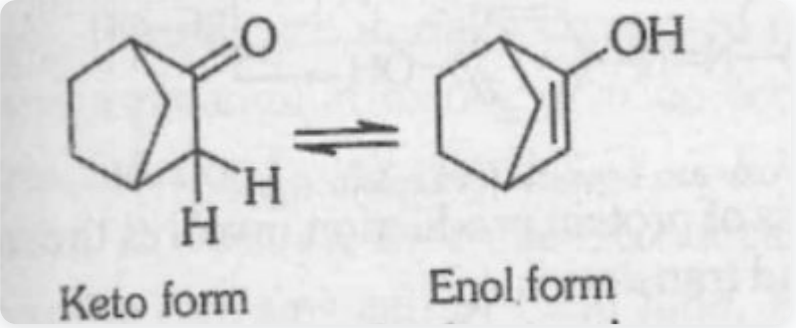
(B) Both II and III

(C) III only

(D) Both I and III

Explanation:

Only those molecules can show tautomerism which have hydrogen atom at carbon α position to the keto carbon

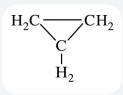


Question 151.

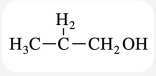
Which of the following compounds shall not produce propene by reaction with HBr followed by elimination or direct only elimination reaction?

[4 Marks]

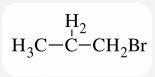
(A)



(B)



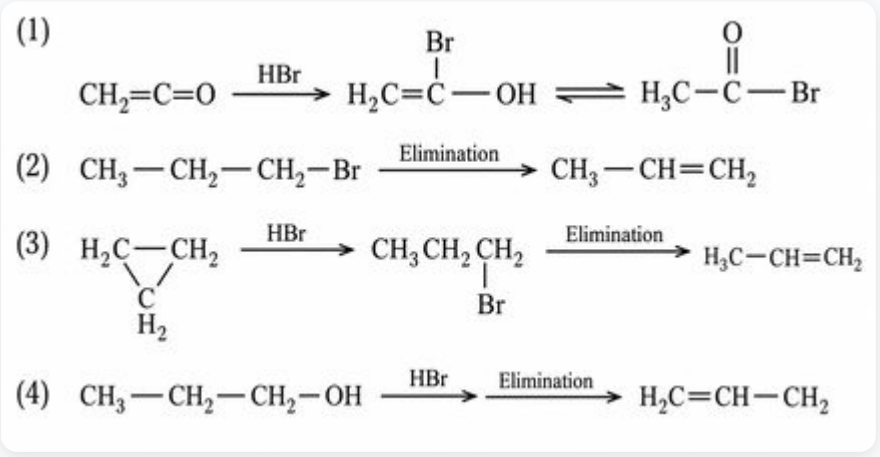
(C)



(D) $H_2C = C = O$

Explanation:

The steps in the reactions are given below:

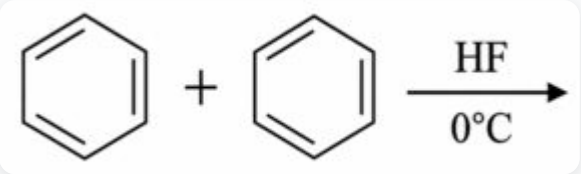


Question 152.

In the given reaction

the product P is :-

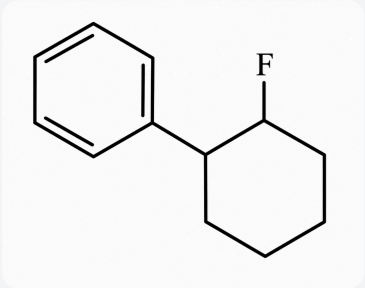
[4 Marks]



(A)



(B)



(C)

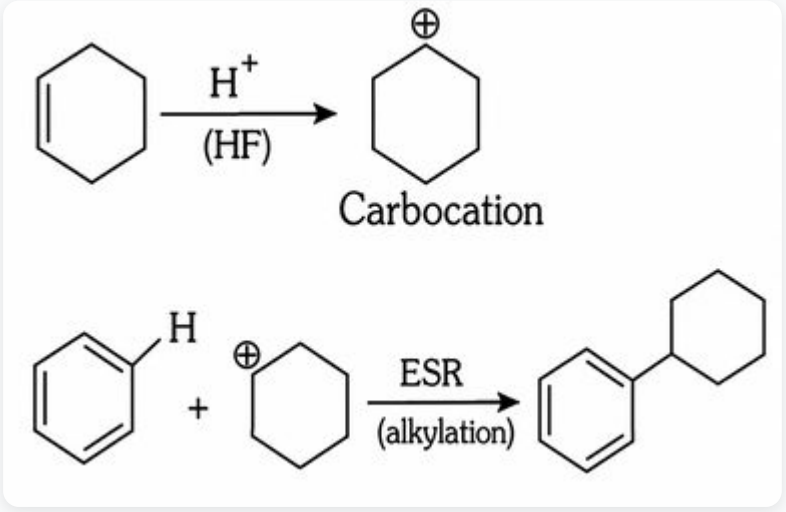


(D)



Explanation:

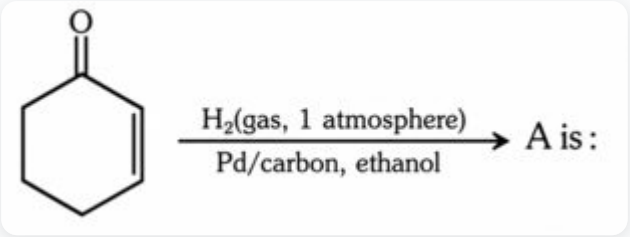
It is an example of Friedel craft reaction :



Question 153.

The correct structure of the product A formed in the reaction

[4 Marks]



(A)



(B)



(C)

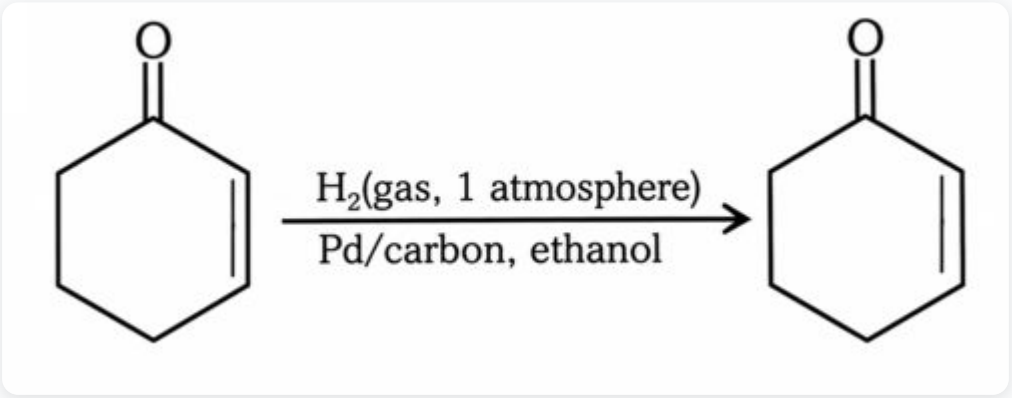


(D)



Explanation:

Its a hydrogenation reaction of alkene in presence of palladised charcoal.



Question 154.

The compound that will react most readily with gaseous bromine has the formula

[4 Marks]

(A) C_2H_2

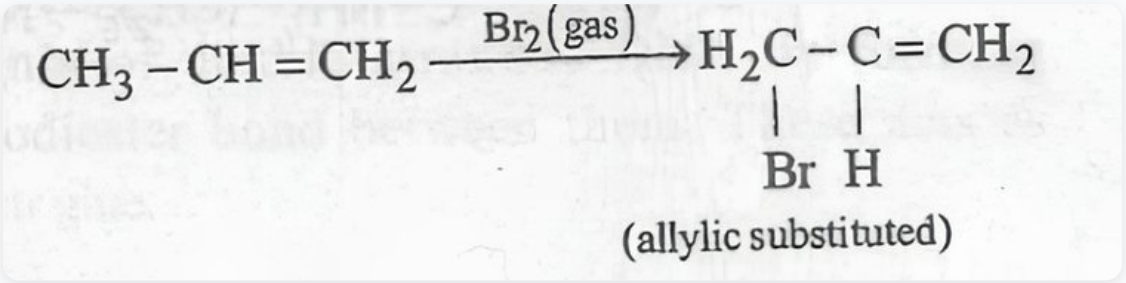
(B) C_3H_6

(C) C_4H_{10}

(D) C_2H_4

Explanation:

The reaction follows free radical mechanism.



Question 155.

In calcium fluoride, having the fluorite structure, the coordination numbers for calcium ion (Ca^{2+}) and fluoride ion (F^-) are

[4 Marks]

(A) 8 and 4

(B) 4 and 8

(C) 4 and 2

(D) 6 and 6

Explanation:

In CaF_2, the coordination numbers for Ca^{+2} = 8 and F^- = 4

Question 156.

The van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

[4 Marks]

(A) 2

(B) 3

(C) 1

(D) 0

Explanation:

$Ba(OH)_2$ is strong electrolyte, so it is completely dissociate in solution

$Ba(OH)_2 \rightarrow Ba^{+2}$ (aq) + $2OH^-$ (aq)

Van't Hoff factor = total number of ions present in solution, i = 1 + 2 = 3

Question 157.

Which one of the following is incorrect for ideal solution?

[4 Marks]

(A) $\Delta G_{mix} = 0$

(B) ΔP = P_obs p calculated by Raoult's law = 0

(C) $\Delta U_{mix} = 0$

(D) $\Delta H_{mix} = 0$

Explanation:

For an ideal solution, $\Delta H_{mix} = 0$

$\Delta U_{mix} = 0$

and $\Delta S_{mix} \neq 0$

According to $\Delta G_{mix} = \Delta H_{mix} - T\Delta S_{mix} = T\Delta S_{mix}$

$\Rightarrow \Delta G_{mix} \neq 0$

Question 158.

Which one of the following compounds shows the presence of intramolecular hydrogen bond?

[4 Marks]

(A) H_2O_2

(B) HCN

(C) Cellulose

(D) Concentrated acetic acid

Explanation:

Cellulose has intramolecular hydrogen bond. While other has intermolecular H-bonding.

Question 159.

The molar conductivity of a 0.5 mol/dm³ solution of $AgNO_3$ with electrolytic conductivity of 5.76×10^{-3} S cm^{-1} at 298 K is

[4 Marks]

(A) 28.8 S cm²/mol

(B) 0.086 S cm²/mol

(C) 11.52 S cm²/mol

(D) 2.88 S cm²/mol

Explanation:

Given:

$C_m = 0.5$ mol/dm³

$\kappa = 5.76 \times 10^{-3}$ S cm^{-1}

T = 298 K

$\lambda_m = \kappa \times 1000 / C_m = (5.76 \times 10^{-3} \times 1000) / 0.5$

= 11.52 S cm²/mol

Question 160.

During the electrolysis of molten sodium chloride, the time required to produce 0.10 mol of chlorine gas using a current of 3 amperes is

[4 Marks]

(A) 330 minutes

(B) 55 minutes

(C) 110 minutes

(D) 220 minutes

Explanation:

$2Cl^- \rightarrow Cl_2(g) + 2e^-$. According to Faraday's Law— W = zit and

z = Eq.wt/96500

Hence, W = E / 96500 × it

0.1 × 71 = 35.5 / 96500 × 3 × t(sec)

t(s) = 6433.33 sec

t(min) = 107.22 min ≈ 110 min

Question 161.

If the E_cell for a given reaction has a negative value, which of the following gives the correct relationships for the values of ΔG° and K_eq?

[4 Marks]

(A) ΔG° > 0; K_eq < 1

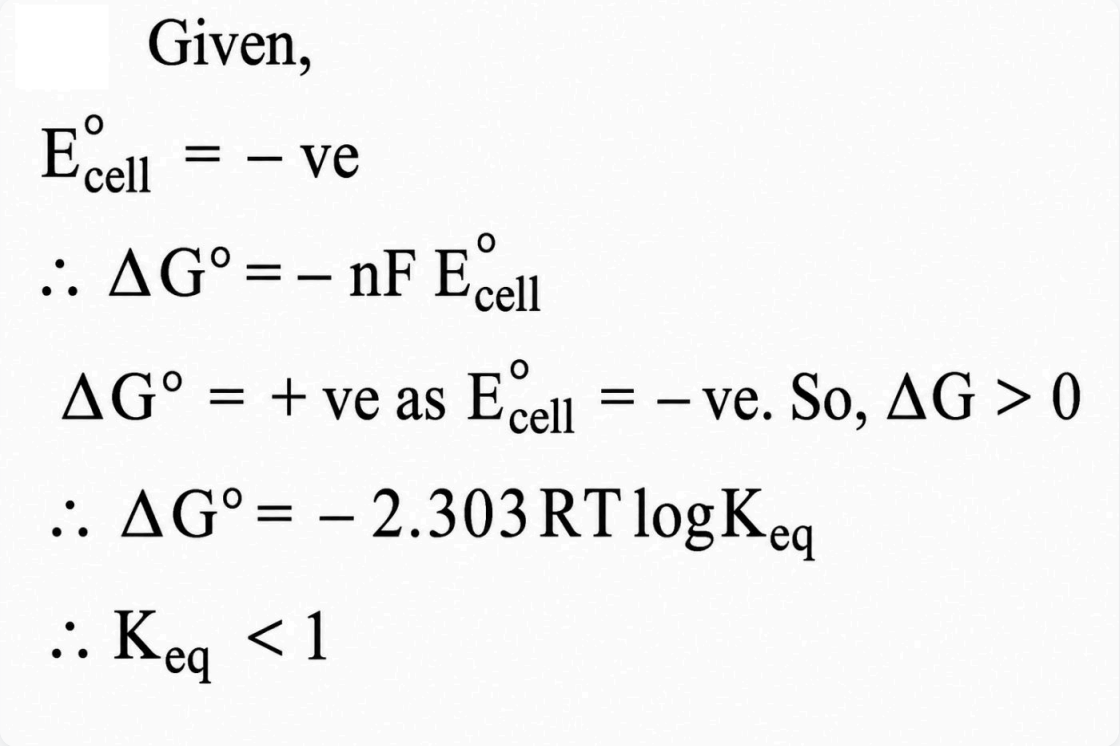
(B) ΔG° < 0; K_eq > 1

(C) ΔG° > 0; K_eq > 1

(D) ΔG° < 0; K_eq < 1

Explanation:

.



Question 162.

The number of electrons delivered at the cathode during electrolysis by a current of 1 ampere in 60 seconds is (charge on electron = 1.60×10^{-19} C)

[4 Marks]

(A) 6×10^{20}

(B) 6×10^{23}

(C) 3.75×10^{20}

(D) 7.48×10^{23}

Explanation:

Q = ne, n = no. of electron and e is electronic charge

$\Rightarrow i \cdot t = n \cdot e$ [$\because$ Q = i·t]

$n = (1 \times 60) / (1.6 \times 10^{-19}) = 3.75 \times 10^{20}$ electrons

Question 163.

Zinc can be coated on iron to produce galvanized iron but the reverse is not possible. It is because

[4 Marks]

(A) zinc has lower melting point than iron

(B) zinc is lighter than iron

(C) zinc has higher negative electrode potential than iron

(D) zinc has lower negative electrode potential than iron

Explanation:

Zinc has higher negative electrode potential than iron. Hence, iron cannot be coated on zinc. Zinc is more reactive than iron.

Question 164.

The decomposition of phosphine (PH_3) on tungsten at low pressure is a first-order reaction. It is because the

[4 Marks]

(A) rate is independent of the surface coverage

(B) rate is proportional to the surface coverage

(C) rate of decomposition is very slow

(D) rate is inversely proportional to the surface coverage

Explanation:

Because rate is proportional to the surface coverage of the tungsten metal.

Question 165.

The coagulation values in millimoles per litre of the electrolytes used for the coagulation of As_2S_3 are given below:

I. (NaCl) = 52,

II. ($BaCl_2$) = 0.69,

III. ($MgSO_4$) = 0.22

The correct order of their coagulating power is

[4 Marks]

(A) II > I > III

(B) I > II > III

(C) III > II > I

(D) III > I > II

Explanation:

Coagulation is a process of aggregating together the colloidal particles and coagulating power is inversely proportional to coagulation value.

Coagulation power ∝ 1 / coagulation value

So, the correct order is III > II > I

Question 166.

The suspension of slaked lime in water is known as

[4 Marks]

(A) aqueous solution of slaked lime

(B) milk of lime

(C) limewater

(D) quicklime

Explanation:

A suspension of fine slaked lime in water is called milk of lime and the solution is called limewater

Question 167.

The correct geometry and hybridization for XeF_4 are:

[4 Marks]

(A) Planar triangle, sp^3d^3

(B) square planar, sp^3d^2

(C) trigonal bipyramidal, sp^3d

(D) octahedral, sp^3d^2

Explanation:

The hybridization in XeF_4 is sp^3d^2 and geometry is octahedral.

Question 168.

Which of the following fluoro-compounds is most likely to behave as a Lewis base?

[4 Marks]

(A) CF_4

(B) SiF_4

(C) BF_3

(D) PF_3

Explanation:

PF_3 acts as a Lewis base due to the presence of a lone pair on the P atom, which it can share with a Lewis acid.

Question 169.

Which one of the following statements related to lanthanons is incorrect?

[4 Marks]

(A) The basicity decreases as the ionic radius decreases from Pr to Lu.

(B) Europium shows +2 oxidation state.

(C) Ce^{4+} solutions are widely used as oxidizing agent in volumetric analysis.

(D) All the lanthanons are much more reactive than aluminium.

Explanation:

The reactivity of Lanthanons is less than aluminium due to high IP which arises from Lanthanoid contraction (b) Ce^{4+} is a good oxidising agent and easily converted into Ce^{3+} (c) Eu(II) has a stable electronic configuration i.e. [Xe] $4f^7$ $5d^0$ $6s^0$ (d) As the size of the lanthanoid ions decreases, the covalent character of the hydroxides increases. Hence, basic strength decreases.

Question 170.

Jahn-Teller effect not observed in high spin complexes of :

[4 Marks]

(A) d^4

(B) d^8

(C) d^9

(D) d^7

Explanation:

John Teller effect is axial distortion in perfect

octahedral geometry.

In general degenerate states electronic states occupying the e, orbital set tend to show stronger J-T effects. This is primarily caused by the occupation of these high energy orbitals.

Question 171.

The correct increasing order of trans-effect of the following species is:

[4 Marks]

(A) $NH_3 > CN^- > Br^- > C_6H_5^-$

(B) $CN^- > Br^- > C_6H_5^- > NH_3$

(C) $Br^- > CN^- > NH_3 > C_6H_5^-$

(D) $CN^- > C_6H_5^- > Br^- > NH_3$

Explanation:

The trans effect, often called the kinetic trans effect, refers to the observation that certain ligands increase the rate of ligand substitution when positioned trans to the departing ligand. Strong trans effect = strong σ–donor + π–strong acceptor Trans effect order: $CN^- > C_6H_5 > Br^- > NH_3$

Question 172.

Which of the following can be used as the halide component for Friedel-Crafts reaction?

[4 Marks]

(A) Chlorobenzene

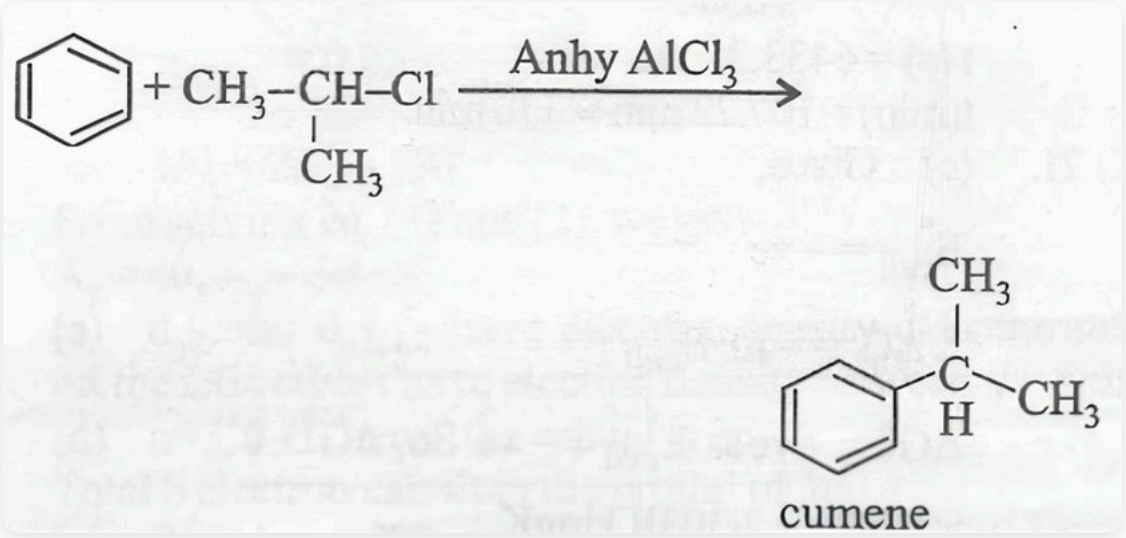
(B) Chloroethene

(C) Isopropyl chloride

(D) Bromobenzene

Explanation:

In chlorobenzene, bromobenzene, and chloroethene, the lone pair of halogen is delocalised with π bonds, leading to double bond character and hence less reactivity.



Question 173.

Consider the reaction

$CH_3CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$

This reaction will be the fastest in

[4 Marks]

(A) methanol

(B) ethanol

(C) water

(D) N,N-dimethylformamide (DMF)

Explanation:

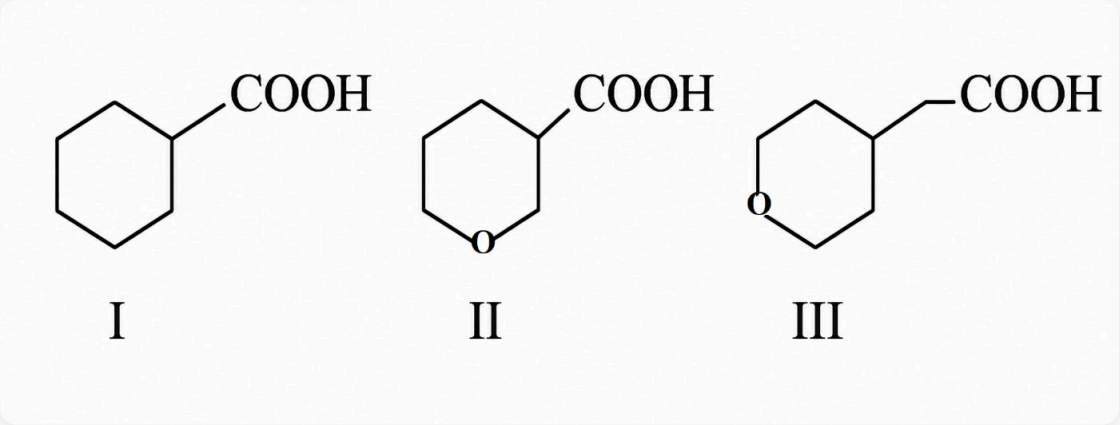
$CH_3–CH_2–CH_2Br + NaCN \rightarrow CH_3–CH_2–CH_2CN + NaBr$

The above reaction is a nucleophilic substitution following S_N2 mechanism. S_N2 reactions are conducted by polar aprotic solvents like DMF, DMSO, etc.

Question 174.

The correct order of strengths of the carboxylic acids

[4 Marks]



(A) III > II > I

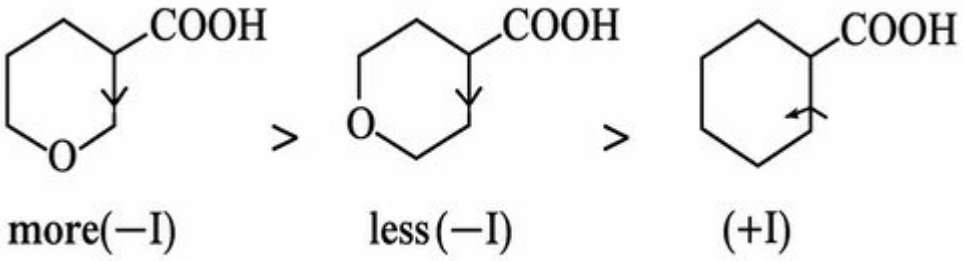
(B) II > I > III

(C) II > III > I

(D) I > II > III

Explanation:

Acidic strength increases as the negative inductive effect of the ring on carboxylate ion increases.

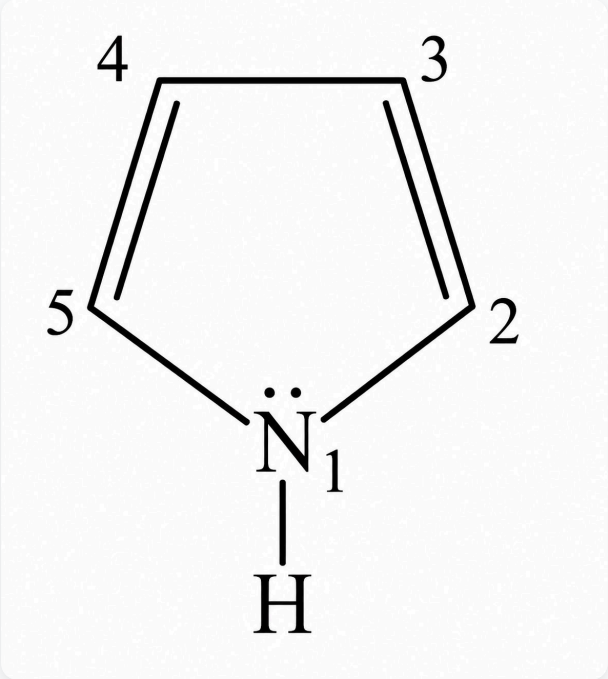


Question 175.

In pyrrole

The electron density is maximum on:

[4 Marks]



(A) 2 and 4

(B) 2 and 5

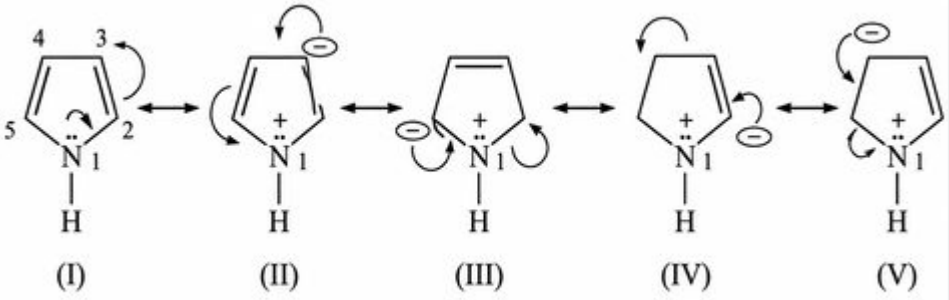
(C) 2 and 3

(D) 3 and 4

Explanation:

Resonance hybrids of pyrrole is :

It is clear from these resonating structures that III & IV are more stable that (II) & (V). Hence maximum electron density is at (2) and (5).

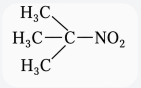


Question 176.

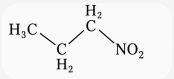
Which one of the following nitro-compounds does not react with nitrous acid?

[4 Marks]

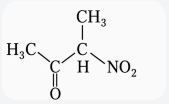
(A)



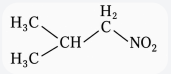
(B)



(C)

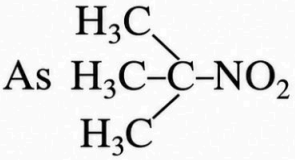


(D)



Explanation:

.

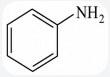
As  does not have α–H atoms. This does not react with HNO_2.

Question 177.

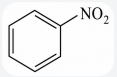
A given nitrogen-containing aromatic compound A reacts with Sn/HCl, followed by HNO_2 to give an unstable compound B. B, on treatment with phenol, forms a beautiful coloured compound C with the molecular formula $C_{12}H_{10}N_2O$. The structure of compound A is:

[4 Marks]

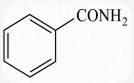
(A)



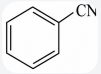
(B)



(C)

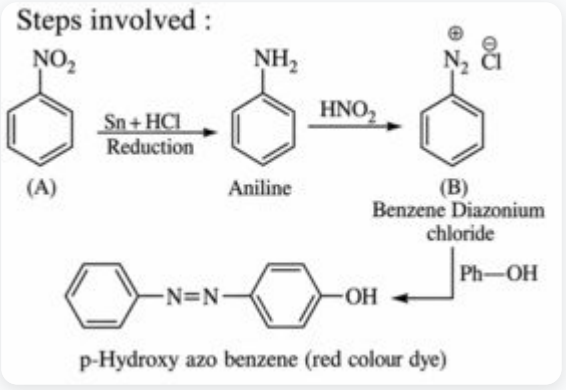


(D)



Explanation:

.



Question 178.

The central dogma of molecular genetics states that the genetic information flows from :

[4 Marks]

(A) DNA → Carbohydrates → Proteins

(B) Amino acids → Proteins → DNA

(C) DNA → RNA → Carbohydrates

(D) DNA → RNA → Proteins

Explanation:

The process of protein production involves the steps : transcription and translation

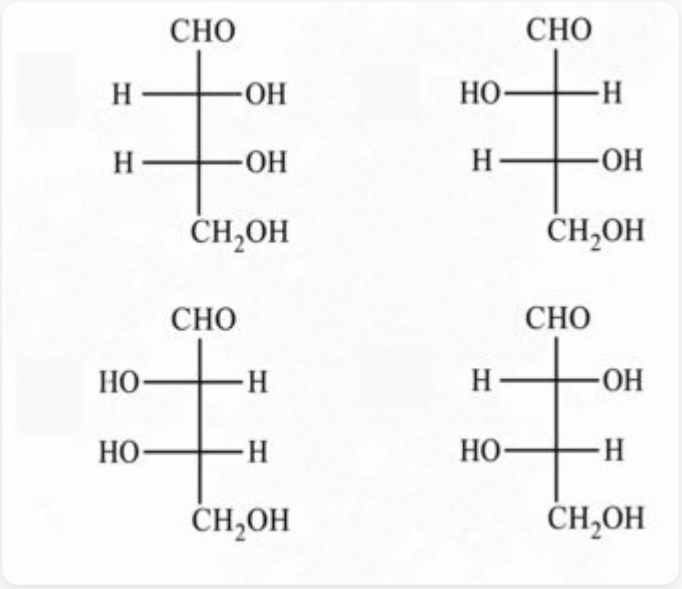


Question 179.

The correct corresponding order names of four aldoses with configuration given below

respectively, are:

[4 Marks]



(A) D-threose, D-erythrose, L-threose, L-erythrose

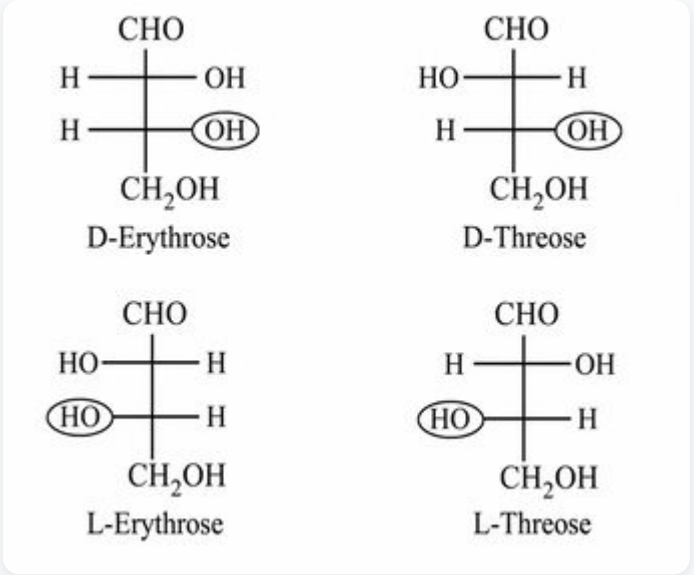
(B) L-erythrose, L-threose, L-erythrose, D-threose

(C) D-erythrose, D-threose, L-erythrose, L-threose

(D) L-erythrose, L-threose, D-erythrose, D-threose

Explanation:

The sugars are aldotetroses having two asymmetric carbon atoms at -C_2 and C_3. A monosaccharide is given D - configuration if the OH group at the last chiral carbon lies to the right hence side or else L-configuration.

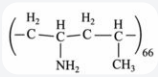


Question 180.

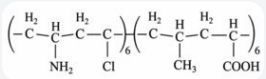
Which one of the following structures represents nylon 6,6 polymer ?

[4 Marks]

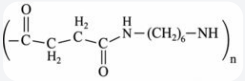
(A)



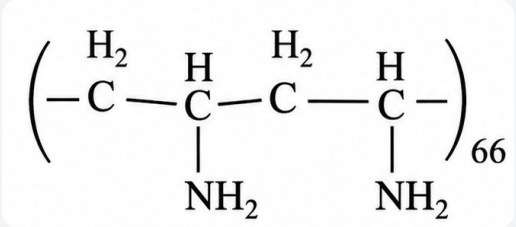
(B)



(C)

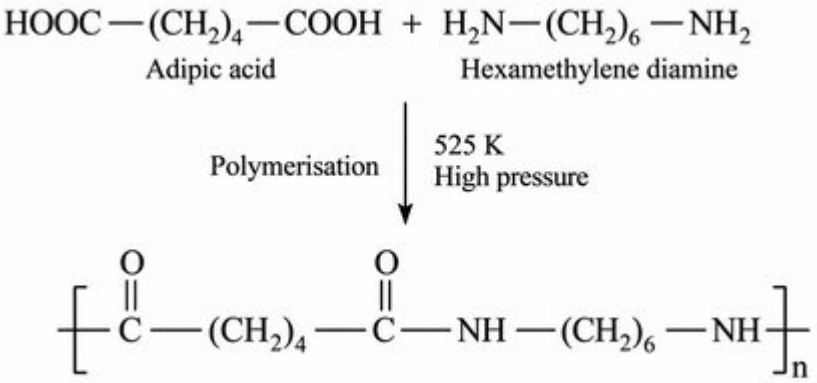


(D)



Explanation:

Nylon 6,6 is condensation polymer of adipic acid and hexamethylenediamine


HOOC—(CH2)4—COOH + H2N—(CH2)6—NH2
Adipic acid
Hexamethylene diamine
Polymerisation
525 K
High pressure
O
O
C—(CH2)4—C—NH—(CH2)6—NH
n