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.

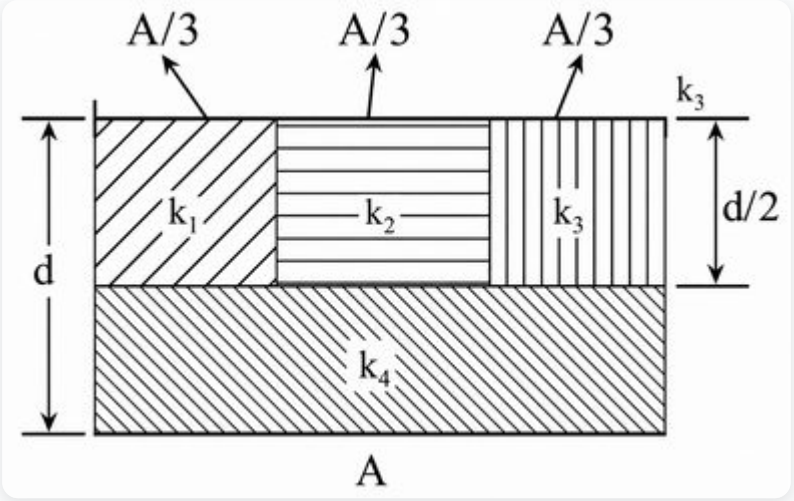
v. Use of calculator is NOT allowed.

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

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

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

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

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

Question 6.

The ovule of an angiosperm is technically equivalent to

[4 Marks]

(A) megasporophyll

(B) megasporangium

(C) megaspore

(D) megaspore mother cell

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

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

Question 9.

The equivalent of a structural gene is

[4 Marks]

(A) Operon

(B) Recon

(C) Cistron

(D) Muton

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

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

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

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

Question 14.

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

[4 Marks]

(A) Preservation

(B) Purification

(C) Expression

(D) Separation

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

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

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

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

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

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

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

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

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

Question 24.

Methanogens belong to

[4 Marks]

(A) Dinoflagellates

(B) Slime moulds

(C) Eubacteria

(D) 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

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

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

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

Question 29.

The term ‘polyadelphous’ is related to

[4 Marks]

(A) Androecium

(B) Gynoecium

(C) Corolla

(D) Calyx

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

Question 31.

Radial symmetry is found in the flowers of

[4 Marks]

(A) Brassica

(B) Trifolium

(C) Cassia

(D) Pisum

Question 32.

Free-central placentation is found in

[4 Marks]

(A) Dianthus

(B) Argemone

(C) Brassica

(D) Citrus

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

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

Question 35.

A non-proteinaceous enzyme is

[4 Marks]

(A) Lysozyme

(B) Ribozymes

(C) Ligase

(D) Deoxyribonuclease

Question 36.

Select the mismatch :-

[4 Marks]

(A) Large central vacoules - Animal cells

(B) Gas vacuoles-Green bacteria

(C) Methanogens-Prokaryotes

(D) Protists-Eukaryotes

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.

Question 38.

A cell organelle containing hydrolytic enzymes is

[4 Marks]

(A) Lysosome

(B) Microsome

(C) Mesosome

(D) Ribosome

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

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

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

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

Question 43.

Phytochrome is a

[4 Marks]

(A) Glycoprotein

(B) Lipoprotein

(C) Flavoprotein

(D) Chromoprotein

Question 44.

Which is essential for the growth of root tip?

[4 Marks]

(A) Zn

(B) Fe

(C) Ca

(D) Mn

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

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.

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

Question 48.

Which of the following is hormone releasing IUD?

[4 Marks]

(A) Lippes loop

(B) Cu7

(C) LNG-20

(D) Multiload 375

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

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

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

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

Question 53.

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

[4 Marks]

(A) Placenta

(B) Ovary

(C) Pituitary

(D) Fallopian tube

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

Question 55.

Genetic drift operates in

[4 Marks]

(A) non-reproductive population

(B) slow reproductive population

(C) small isolated population

(D) large isolated 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

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

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

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

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

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

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.

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

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

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

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

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

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

Question 69.

The highest DDT concentration in aquatic food chain shall occur in

[4 Marks]

(A) crab

(B) eel

(C) phytoplankton

(D) seagull

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

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

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.

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

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

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

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.

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

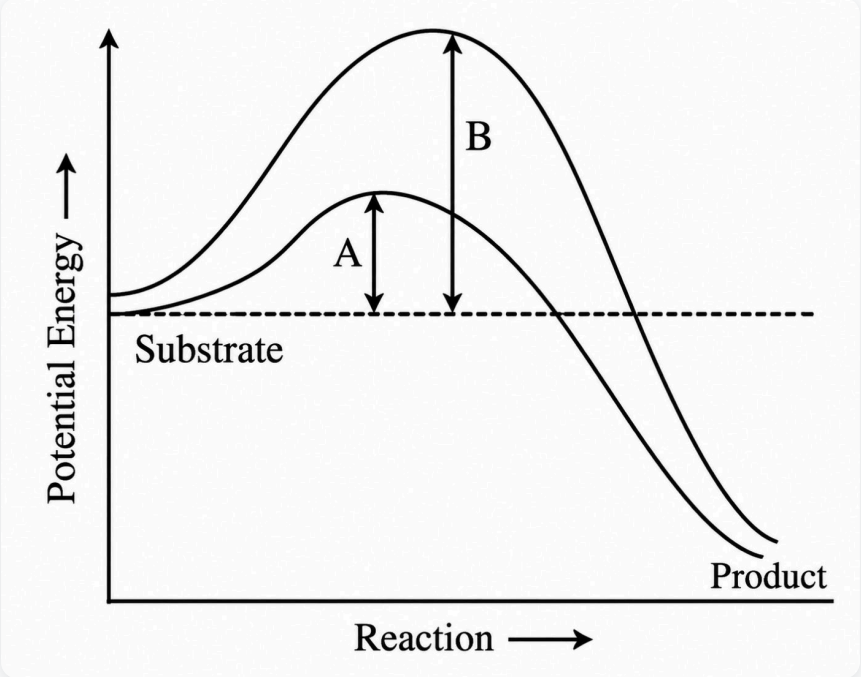
(C) Hydrogen bonds

(D) Electrostatic interaction

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

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

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

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

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

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.

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

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

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

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

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^{+}

Question 89.

Serum differs from blood in

[4 Marks]

(A) lacking albumins

(B) lacking globulins

(C) lacking clotting factors

(D) lacking antibodies

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

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

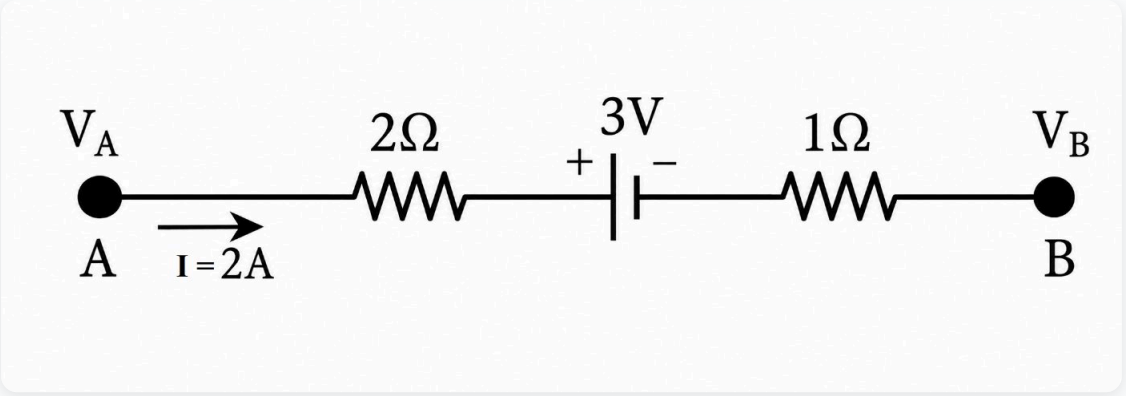
(C) it only stores and releases hormones

(D) it is provided with a duct

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

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

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

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) $\sqrt{3}W$

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

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

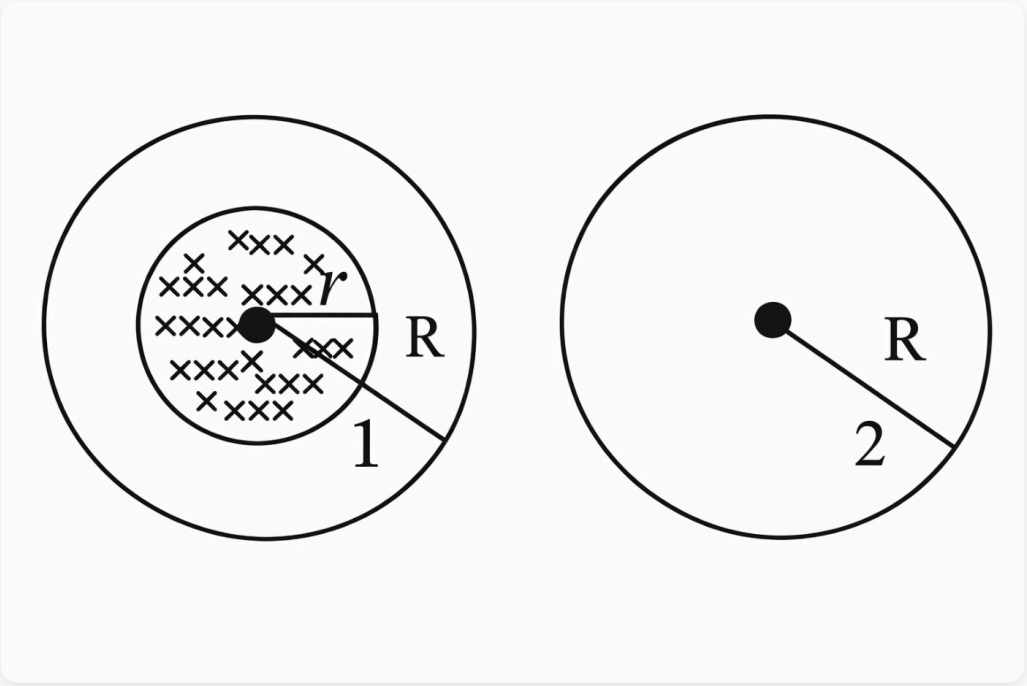
(C) R = 25 Ω, L = 1.5 H, C = 45 μF

(D) R = 25 Ω, L = 2.5 H, C = 45 μF

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) $(d\bar{B}/dt)$ □r² in loop 1 and $(d\bar{B}/dt)$ □r² in loop 2

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

(C) - $(d\bar{B}/dt)$ □r² in loop 1 and zero in loop 2

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

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

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

Question 101.

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

[4 Marks]

(A) f

(B) 4f/3

(C) 2f

(D) 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

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

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

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

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) $\lambda_0=2h/mc$

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

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 □

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

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

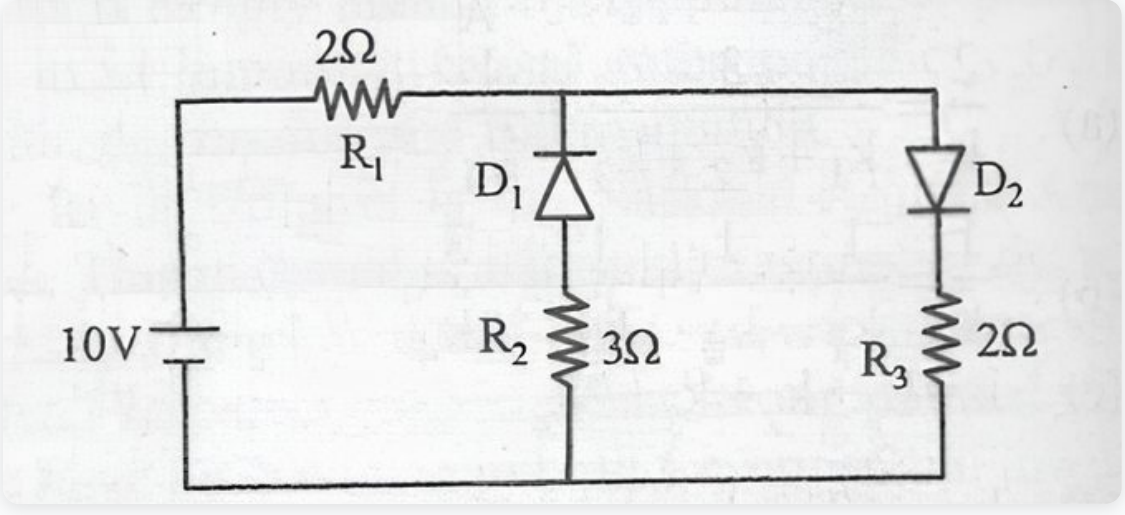
(C) 10mV

(D) 20mV

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

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

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

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)

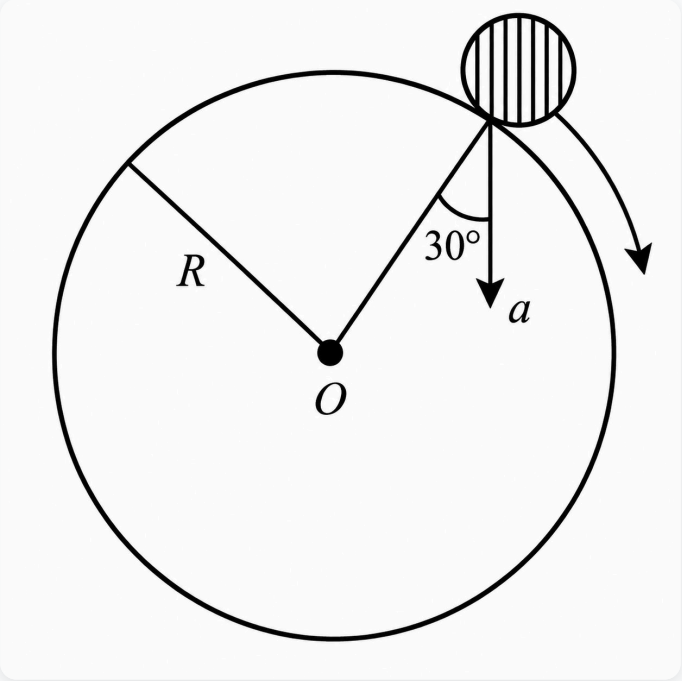
(C) (f − a) / [2(1 + b)]

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

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

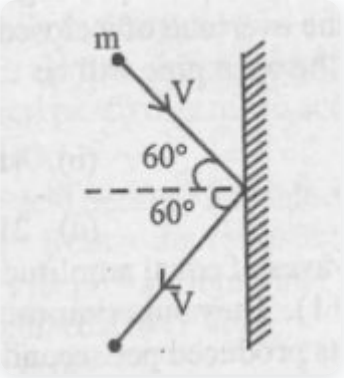
(C) 4.5 m/s

(D) 5.0 m/s

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

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}

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

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

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

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

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) $((m_1 + m_2) / (m_1m_2))\ \ell^2$

(C) $\sqrt{(m_1m_2)}\ \ell^2$

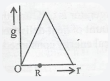
(D) $(m_1m_2 / (m_1 + m_2))\ \ell^2$

Question 123.

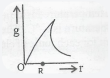
Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by:-

[4 Marks]

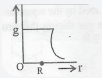
(A)



(B)



(C)



(D)



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

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}

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

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

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

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

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

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)

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

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

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

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

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

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}, $d_{x^2-y^2}$

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

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

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

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^-

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

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%

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

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

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.

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

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) $K[AlF_3H]$

Question 149.

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

[4 Marks]

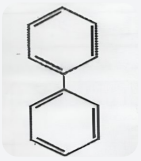
(A)



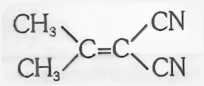
(B)



(C)



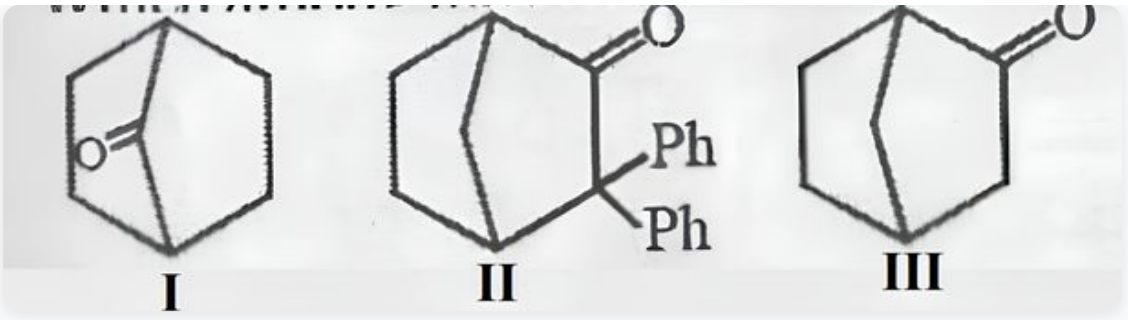
(D)



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

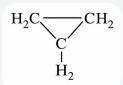
(D) Both I and III

Question 151.

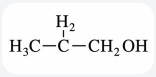
Which of the following compounds shall not produce propene by reaction with HBr followed by elimination or direct only elimination reaction?

[4 Marks]

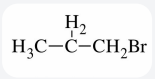
(A)



(B)



(C)



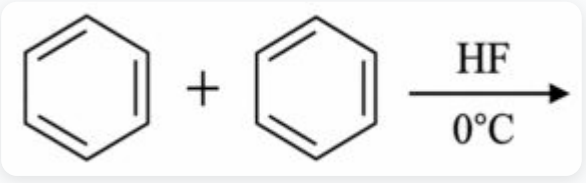
(D) $H_2C = C = O$

Question 152.

In the given reaction

the product P is :-

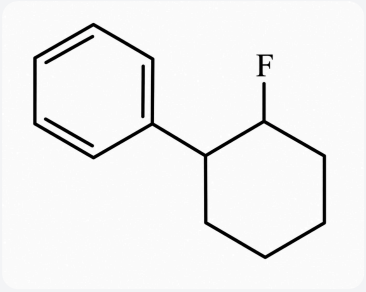
[4 Marks]



(A)



(B)



(C)



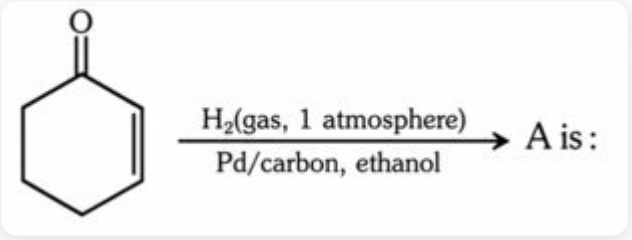
(D)



Question 153.

The correct structure of the product A formed in the reaction

[4 Marks]



(A)



(B)



(C)



(D)



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

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

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

Question 157.

Which one of the following is incorrect for ideal solution?

[4 Marks]

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

(B) $\Delta P = P_{obs}$ p calculated by Raoult's law = 0

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

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

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

Question 159.

The molar conductivity of a 0.5 mol/dm^3 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 cm^2/mol

(B) 0.086 S cm^2/mol

(C) 11.52 S cm^2/mol

(D) 2.88 S cm^2/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

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

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}

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

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

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

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

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

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

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.

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

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

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

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

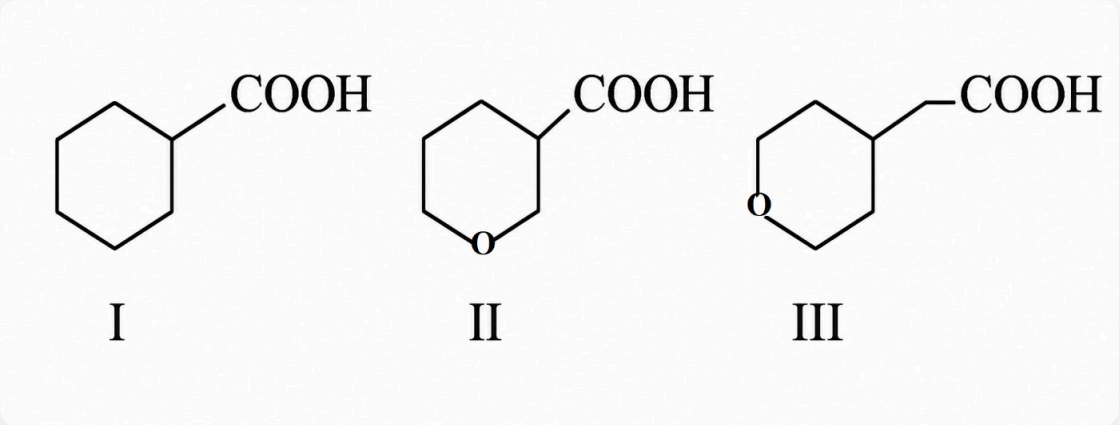
(C) water

(D) N,N-dimethylformamide (DMF)

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

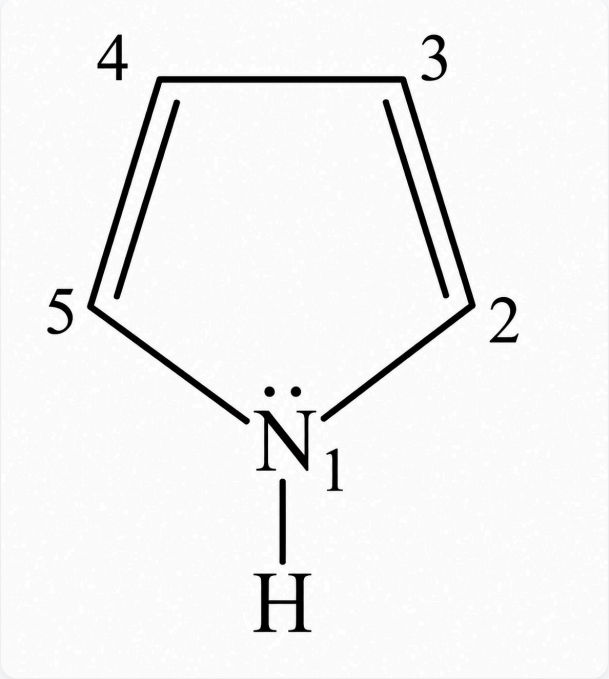
(D) I > II > III

Question 175.

In pyrrole

The electron density is maximum on:

[4 Marks]



(A) 2 and 4

(B) 2 and 5

(C) 2 and 3

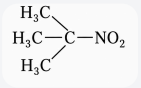
(D) 3 and 4

Question 176.

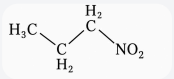
Which one of the following nitro-compounds does not react with nitrous acid?

[4 Marks]

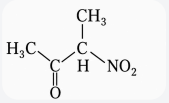
(A)



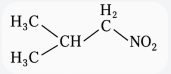
(B)



(C)



(D)

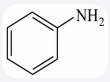


Question 177.

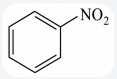
A given nitrogen-containing aromatic compound A reacts with Sn/HCl, followed by HNO_2 to give an unstable compound B. B, on treatment with phenol, forms a beautiful coloured compound C with the molecular formula $C_{12}H_{10}N_2O$. The structure of compound A is:

[4 Marks]

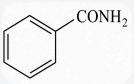
(A)



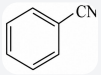
(B)



(C)



(D)



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

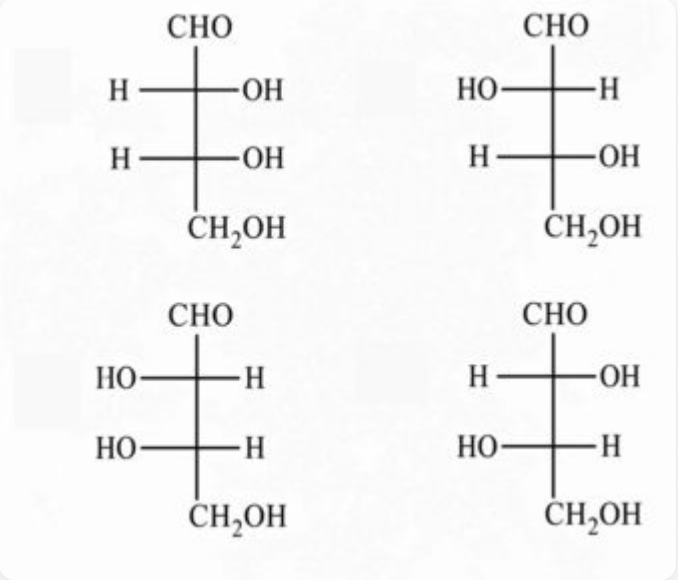
(D) DNA → RNA → Proteins

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

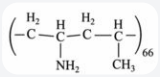
(D) L-erythrose, L-threose, D-erythrose, D-threose

Question 180.

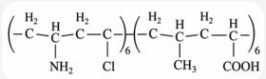
Which one of the following structures represents nylon 6,6 polymer ?

[4 Marks]

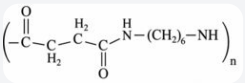
(A)



(B)



(C)



(D)

