Botany - Section A

1.

Match each item in Column I with one item in Column II and choose your answer from the codes given below.

Column I - (Disease)	Column II - (causative organism)
I. Potato spindle tuber disease	1. Viroid
II. Creutzfeldt Jakob Disease	2. Prion
III. Mosaic disease of tobacco	3. Virus
IV. Rust of wheat	4. Fungus

Codes:

	I	II	III	IV
(1)	1	2	3	4
(2)	2	1	4	3
(3)	2	1	3	4
(4)	1	2	4	3

2.

Match each item in Column I with one item in Column II and choose your answer from the codes given below.

Column I - (Androecium)	Column II - (Example)
I. Epipetalous	1. Brinjal
II. Epiphyllous	2. Lily
III. Monoadelphous	3. China rose
IV. Polyadelphous	4. Citrus

Codes:

	I	II	III	IV
(1)	1	2	3	4
(2)	2	1	4	3
(3)	2	1	3	4
(4)	1	2	4	3

3.

In a TS of lenticel, arrange these in order (interior to exterior)
A. Secondary cortex
B. Epidermis
C. Cork cambium
D. Complimentary cells
1. A, C, D, B
2. A, B, C, D
3. A, D, C, B
4. D, A, B, C

4.

Find the incorrect statement

1. The presence of vessels is the characteristic feature of angiosperms

2. sieve tubes are present in gymnosperms

3. The radial conduction of water takes place by the ray parenchymatous cells.

4. Xylem fibres have highly thickened walls and obliterated central lumens

5.

Which of the following statement is not true about the family Liliaceae.

1. Perennial herbs with underground bulbs/corms/rhizomes

2. Flower: bisexual, zygomorphic

3. Gynoecium: tricarpellary, syncarpous, superior, trilocular with many ovules, axile placentation

4. Tulip, Gloriosa, Aloe, Asparagus and colchicum belongs to Liliaceae

6.

Which of the following are true for cyanobacteria?

(I) They are freshwater/marine or terrestrial algae.

(II) Often form blooms in unpolluted water bodies

(III) Maybe unicellular, colonial, or filamentous.

(IV) Some of them fix atmospheric nitrogen.

1. I, III, IV

2. I, II, III, IV

3. II, III, IV

4. I, II, IV

7.

Which of the following is true for the reproduction of bacteria?

1. Reproduce mainly by fission.

2. Under unfavourable conditions, they produce spores.

3. Also reproduce by sort of sexual reproduction.

4. All of these

8.

A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics.
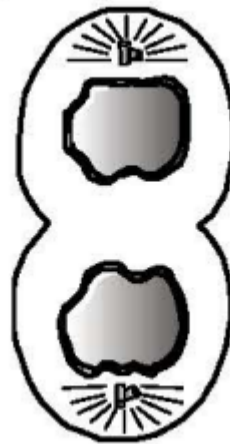

1.	Late anaphase	Chromosomes move away from equatorial plate, Golgi complex not present
2.	Cytokinesis	Cell plate formed, mitochondria distributed between two daughter cells
3.	Telophase	Endoplasmic reticulum and nucleolus not reformed yet
4.	Telophase	Nuclear envelop reforms, Golgi complex reforms

1. (1)

2. (2)

3. (3)

4. (4)

9.

Which kind of modification is seen in the given diagrams?
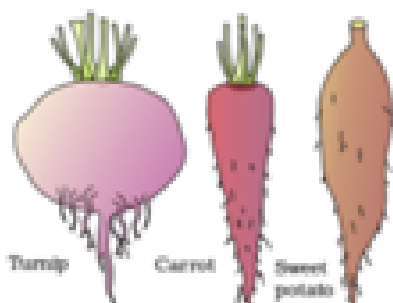
1. Vegetables for storage

2. Roots for absorption

3. Roots for storage

4. Stem for protection

10.

Phyllotaxy is

1. Pattern of arrangement of leaves on the stem or branch

2. Pattern of arrangement of petals on the stem or branch

3. Pattern of arrangement of sepals on the flower

4. Pattern of arrangement of perianth on the flower

11.

The floral diagram does not provide which of the following information?

1. Provides information about the number of parts of the flower

2. Arrangement of flower parts

3. Relation of flower parts with respect to each other

4. Medicinal use of plant

12.

How many of the following statements are true for heartwood?
I. It provides mechanical support to the stem
II. It does not conduct water
III. It is hard, durable, and resistant to the attacks of microbes
IV. It is the innermost layer of the wood
V. It comprises dead elements with highly lignified walls
VI. More the heartwood is present the better is the quality of the wood

1. Four
2. Five
3. Six
4. Three

13.

In which one of the following options, the two given taxonomic categories are correctly matched with their organism?

| Taxonomic Categories	Organism
1. Diptera and Felidae	- Musca
2. Solanaceae and Polymoniales	- Datura
3. Canidae and Primate	- Gibbon
4. Triticum and Sapindales	- Wheat

14.

Match the following

Column l	Column ll
(a) G_1 phase	(i) Longest phase of cell cycle
(b) M phase	(ii) Synthesis of histone proteins
(c) S-phase	(iii) Cell quiescence
(d) G_0	(iv) Nuclear division

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

15.

Formation of recombination nodules and chiasmata occur in which of the following stages?
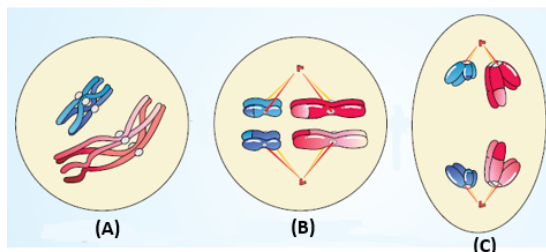
1 A & B

2 B & C

3 B only

4 A only

16.

All are the significance of mitosis, **except**

1 Production of daughter cells with identical genetic complement

2 Restoration of nucleocytoplasmic ratio

3 Plays important role in evolution by inducing variations

4 Responsible for growth of multicellular organisms

17.

From the characters given below, how many of them are associated with numerical taxonomy?

i. No usage of computers for data analysis

ii. Based on all observable characteristics

iii. After the data processing numbers and codes are assigned to all characters

iv. Hundreds of characters are considered at same time

v. Give equal weightage to all characters

Choose the correct option

1. 5

2. 4

3. 3

4. 2

18.

Certain marine brown and red algae produce large amounts of

1 Carrageen and algin respectively

2 Fixed nitrogen

3 Sulphated phycocolloids

4 Water holding substances

19.

Read the following statements (w.r.t. angiosperms)

(a) Embryo sac formation is preceded by meiosis

(b) Pollen grains germinate on the ovule and the resulting pollen tube grows through the tissues of stigma and style

(c) A large group of plants occurring in a wide range of habitats

(d) Synergids, antipodals and PEN degenerate after fertilization

How many of the above statement(s) is/are **wrong**?
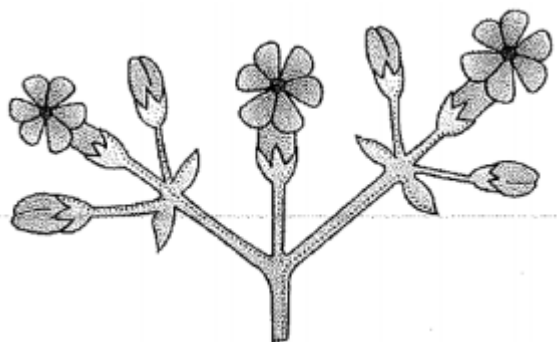
1. Two

2. Three

3. Four

4. One

20.

Which of the following is mis-matched pair?

1. Belladonna - Medicine - Solanaceae

2. Asparagus - Vegetable - Liliaceae

3. Trifolium - Ornamental plant - Fabaceae

4. Tobacco - Fumigatory - Potato family

21.

Choose correct option w.r.t. given below inflorescence

1. Main axis terminates in flower
2. Acropetal arrangement of flowers
3. Unlimited growth of main axis
4. More than one option is correct

22.

Which of the following fungus is used extensively in biochemical and genetic work?

1. Aspergillus
2. Colletortichum
3. Neurospora
4. Claviceps

23.

Which fungi are edible :-

1. Truffles
2. Morels
3. *Agaricus*
4 All of these

24.

Mark the correct statement (w.r.t. lateral meristem)

1. Secondary meristem producing primary permanent tissues

2. Intercalary meristem producing secondary tissues

3. Cylindrical meristem producing the secondary tissues

4. Promeristem producing secondary permanent tissues

25.

Mark the mismatched pair.

1. Amyloplast	(i) Store protein granule
2. Elaioplast	(ii) Store oils or fats
3. Chloroplasts	(iii) Contain chlorophyll pigments
4. Chromoplasts	(iv) Contain colored pigments other than chlorophyll

26.

The protozoans that cause malaria in humans are :

1. Radiolarians
2. Dinoflagellates
3. Chrysophytes
4. Sporozoans

27.

Coralloid roots of gymnosperms are/have
1. Irregular roots and possess a large number of roots hairs.
2. Symbiotic association with Rhizobium.
3. Symbiotic association with N_2 - fixing cyanobacteria.
4. VAM

28.

Find the odd one w.r.t. the fungi imperfecti

1. *Alternaria*

2. *Colletotrichum*

3. *Trichoderma*

4. *Penicillium*

29.

According to the five-kingdom classification system, which of the following kingdom has multicellular/loose tissue level body organization?

1. Protista

2. Plantae

3. Animalia

4. Fungi

30.

The edible part of mango is:-

(1) Receptacle

(2) Epicarp

(3) Mesocarp

(4) Endocarp

31.

All of the given characteristics are related to parenchyma tissue, except

1. Composed of living cells

2. Generally isodiametric cells

3. Cell wall is mainly made up of suberin

4. Either closely packed cells with no intercellular spaces or have small intercellular spaces

32.

Lichens are mutually beneficial associations between

1. Autotrophic and heterotrophic members

2. Two autotrophic partners

3. Two heterotrophic partners

4. Fungi and roots of higher plants

33.

Match the Column-l with Column-ll

Column-l	Column-ll
(a) Marginal placentation	(i) Single ovule is present in unilocular ovary
(b) Axile placentation	(ii) False septum may be present
(c) Parietal placentation	(iii) Placenta forms a ridge along the ventral suture of ovary
(d) Basal placentation	(iv) Tomato, Lemon

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

34.

Identify the incorrectly matched pair:

1.	Dicot root	Parenchymatous conjunctive tissue between xylem and phloem
2.	Monocot root	Polyarch xylem bundles and well-developed pith
3.	Isobilateral leaf	Palisade and spongy parenchyma in mesophyll
4.	Dorsiventral leaf	Bulliform cells are absent

35.

Which of the following statements is correct?

1. Organisms that depend on living plants are called saprophytes.

2. Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells.

3. The fusion of two cells is called Karyogamy.

4. Fusion of protoplasms between two motile or non-motile gametes is called plasmogamy.

Botany - Section B

36.

What is absent in Euglenoids?

1. Two flagella, a short and a long one.

2. Pellicle, a protein-rich layer.

3. Pigments identical to those present in higher plants.

4. Cell wall with stiff cellulose plates.

37.

Match the following column I with column II.

Column I	Column II
A. Synapsis aligns homologous chromosomes	1. Anaphase II
B. Synthesis of RNA and protein	2. Zygotene
C. Action of enzyme recombinase	3. G2 - phase
D. Centromeres do not separate, but chromatids move towards opposite poles	4. Anaphase I
	5. Pachytene

	A	B	C	D
(1)	2	1	3	4
(2)	2	3	5	4
(3)	1	2	5	4
(4)	2	3	4	5

38.

The lateral branches originate from the basal and underground portion of the main stem, grow horizontally beneath the soil, and then come out obliquely upward to give rise to leafy shoot. Which of the following examples are associated with such modifications?

1. Banana, Mint, Jasmine

2. Banana, Pineapple, Chrysanthemum

3. Pineapple, Mint, Citrus

4. Papaya, Citrus, Banana

39.

Which of the following statement is correct about Leaf?

1. It is attached to the stem by the leaf base

2. It always bears two lateral small leaf-like structures called stipules

3. All monocots have a small sheath-like leaf base that covers the stem wholly

4. All leguminous plants have swollen leaf base

40.

The Stomatal apparatus comprises of
1. stomatal aperture and guard cells
2. stomatal aperture, guard and subsidiary cells
3. stomatal aperture, guard, subsidiary and epidermal cells
4. stomatal aperture and subsidiary cells

41.

The hypodermis of dicot stem and monocot stem is made up of
1. collenchyma and sclerenchyma respectively
2. collenchyma in both
3. sclerenchyma in both
4. sclerenchyma and collenchyma respectively

42.

Bryophytes are also called amphibians of plant kingdom because

1 Sporophyte is dependent on gametophyte

2 Zygote does not undergo meiosis immediately

3 Produce biflagellate male gametes

4 Can live in soil but depend on water for fertilization

43.

Dipotene stage is initiated by

1 Synaptonemal complex development

2 Dissolution of synaptonemal complex

3 Disappearance of nuclear membrane and nucleolus completely

4 Starting of spindle formation

44.

Creeping, green, branched and frequently filamentous like stage in *Funaria*

1 Is called prothallus

2 Arises upon spore germination

3 Is known as gametophore

4 Bear gemma cups for sexual reproduction

45.

Select the two correct statements out of the four (a-d) given below about gymnosperms.

a. Roots in some non-vascular archegoniate have a fungal association in the form of mycorrhiza

b. Leaves are well adapted to withstand extremes of temperature, humidity and wind

c. Nucellus is protected by ovary wall and the composite structure is called an ovule

d. Multicellular female gametophyte is retained within megasporangium

The **correct** statements are

1. a & c

2. b & c

3. c & d

4. b & d

46.

In the seeds of maize, the seed coat

1. Is fused with the pericarp

2. Store aleurone grains

3. Is membranous and triploid

4. Has an outgrowth, called strophiole

47.

Correct statement in relation to vacuoles is

1. It is a triple membrane-bound space found in cytoplasm containing sap

2. It can occupy 90% of cell volume in plants

3. Its membrane allows transport of materials along the concentration gradient only

4. Concentration of ions is significantly lesser in vacuole than cytoplasm

48.

Choose the incorrect match:-

1. Diatoms - Silicated cell wall

2. Gonyaulax - Soap box-like cell wall

3. Albugo - Parasite on mustard

4. Euglenoids - Mixotrophic nutrition

49.

The classification given by Bentham and Hooker is:-

1. Artificial

2. Natural

3. Phylogenetic

4. Numerical

50.

The synthesis of spindle proteins occurs during

1. G_1-phase

2. S-phase

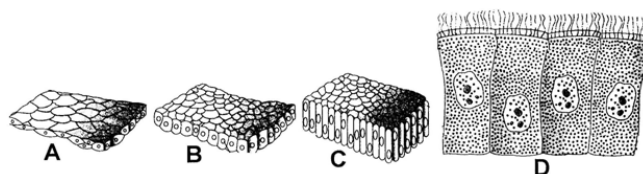3. G_2-phase

4. M-phase

Zoology - Section A

51.

NAD, NADH and NADP are

1. not a participant in any catalytic reaction

2. participants as cofactors in non-catalytic reaction

3. participants as cofactor in enzyme catalysed reactions

4. participants as cofactor in both non-catalytic and enzyme catalysed reactions.

52.

Identify the following simple epithelial tissues:

	A	B	C	D
1.	Cuboidal	Squamous	Columnar	Ciliated column
2.	Squamous	Cuboidal	Columnar	Ciliated columnar
3.	Pseudo-stratified squamous	Cuboidal	Columnar	Ciliated columnar
4.	Squamous	Cuboidal	Columnar	Pseudo-stratified columnar (ciliated)

53.

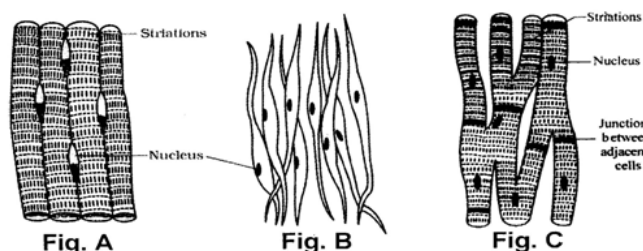Go through the following figures. Identify these muscles (A, B and C):

	Fig. A	Fig. B	Fig. C
(1)	Smooth muscles	Striated muscle	Cardiac muscle
(2)	Cardiac muscles	Smooth muscle	Striated muscle
(3)	Striated muscles	Smooth muscle	Cardiac muscle
(4)	Involuntary muscles	Voluntary muscle	Heart muscle

54.

Which among the following statements are correct ?

(I) Saliva is secreted by exocrine glands.

(II) Epithelial tissue rests on non-cellular basement membrane.

(III) Muscular tissue possesses cell junctions.

(IV) Mucus-secreting goblet cells are multicellular.

1. I and II only

2. I and IV only

3. I, II and III

4. Only III

55.

Tissue	Location
Bones	D
A	Tendons and ligaments
B	Dry surface of skin
C	Skin

A, B, C and D in the above table are:

	A	B	C	D
1.	Loose connective tissue	Columnar epithelium	Dense regular connective tissue	chondro-cytes
2.	Specialised connective tissue	Stratified epithelium	Columnar epithelium	Hard and pliable
3.	Dense regular connective tissue	Stratified epithelium	Dense irregular connective tissue	Tibia and femur
4.	Dense regular connective tissue	Columnar epithelium	Glandular epithelium	Hard and pliable

56.

Which one is false?
1. Fatty acids may be unsaturated (with one or more C = C bonds) or a saturated (without double bonds)

2. Fatty acid(s) may be esterified with glycerol forming monoglyceride, diglyceride and then triglyceride

3. Some tissues especially neural tissues have lipids with very simple structures

4. Fats and oils are triglycerides

57.

Disc shaped proteinaceous structure attached to centromere of a chromosome is called

1. Chromocentre

2. NOR

3. Chromomere

4. Kinetochore

58.

Which of the following is true about sugar of DNA

1. Ribose sugar is present

2. 2'deoxyribose sugar is present

3. 4C sugar is present

4. Both B and C

59.

Which of the following options gives the correct sequence of events during mitosis?

1. Condensation, nuclear membrane disassembly, arrangement at equator, centromere division, segregation, telophase

2. Condensation, crossing over, nuclear membrane disassembly, segregation, telophase

3. Condensation, centromere division, segregation, arrangement at equator, telophase

4. condensation, nuclear membrane disassembly, crossing over, segregation, telophase

60.

Match the columns and identify the correct option.

Column I	Column II
A. Thylakoids	1. Disc-shaped sacs in Golgi apparatus
B. Cristae	2. Condensed structure of DNA
C. Cisternae	3. Flat membranous sacs in stroma
D. Chromatin	4. Infolding in mitochondria

	A	B	C	D
(1)	4	3	1	2
(2)	3	4	1	2
(3)	3	1	4	2
(4)	3	4	2	1

61.
Polysome is formed by

1. several ribosomes attached to a single mRNA

2. many ribosomes attached to a strand of endoplasmic reticulum

3. a ribosome with several subunits

4. ribosomes attached to each other in a linear arrangement

62.

Consider following features:

(a) Organ system level of organisation

(b) Bilateral symmetry

(c) True coelomates with segmentation of body

Select the correct option of animal groups which possess all the above characteristics.

1. Annelida, Mollusca and Chordata

2. Annelida, Arthropoda and Chordata

3. Annelida, Arthropoda and Mollusca

4. Arthropoda, Mollusca and Chordata

63.

Which of the following is correct?

1. The ES complex formation is a transient phenomenon

2. The structure of the substrate gets transformed into the structure of product.

3. All the structures formed between substrate and product are called intermediates.

4. All of these

64.

Which of the following statements is incorrect with respect to cockroach?

1. Tropical regions have witnessed bright yellow, red and green colored cockroaches

2. Their size ranges from ¾ inches to 3 inches

3. Nocturnal omnivores

4. Serious pest and vector of several diseases

65.

Given below is the structure of a monosaccharide. The homopolymer of this monosaccharide is used in:
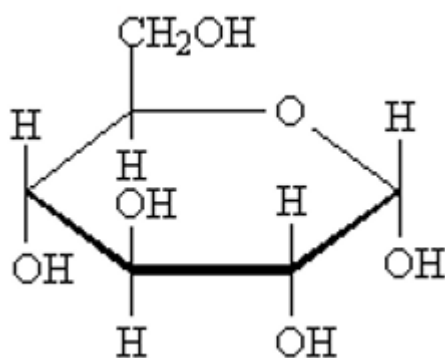
1. Storage of carbohydrates in plants

2. Storage of carbohydrates in animals

3. Making the medium for microbial culture

4. Formation of the structure of the plant cell wall

66.

The sequence of amino acids forms the _____ structure of the protein; the left end amino acid is ___ terminal amino acid and the right end amino acid is ____ terminal amino acid.

1. Primary, N, C

2. Primary, C, N

3. Tertiary, N, C

4. Tertiary, C, N

67.

Mark the incorrect statements

1 Flora contains the actual account of habitat and distribution of plants of a given area

2 Manuals are useful in providing information for identification of names of species found in an area

3 Monographs contain information on many taxa

4 Each statement in the key is called 'lead'

68.

Read the following statements:

a. As we go higher from species to kingdom, the number of common characteristics goes on decreasing

b. Lower the taxa, less are the characteristics that the members within the taxon share

c. Higher the category, greater is the difficulty of determining the relationship to other taxa at the same level

1 Only (a) is correct

2 (b) and (c) are correct

3 (a) and (b) are correct

4 (a) and (c) are correct

69.

Find the **odd** one out w.r.t. meiotic cell cycle

1 DNA replication occurs once only *i.e.,* before Gap-2

2 Karyokinesis occurs twice

3 Reduction of ploidy at metaphase-l

4 Crossing over in tetrad stage

70.

In which of the following phases, do centromeres split and chromatids separate, and then chromatids move to opposite poles?

1 Metaphase-l, Anaphase

2 Anaphase, Anaphase-l

3 Anaphase-l, Metaphase-ll

4 Anaphase, Anaphase-ll

71.

Which of the following groups of animals depicted in the diagrams given below are dioecious, coelomate, metamerically segmented and have closed circulatory systems?
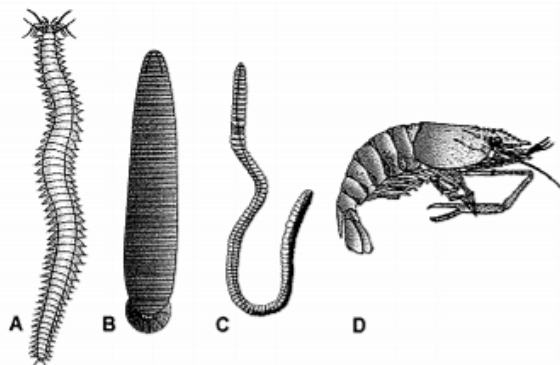
Options

1. A only

2. A & B

3. C only

4. A,B & C

72.

Choose the correct match w.r.t. animals and their common names

1.
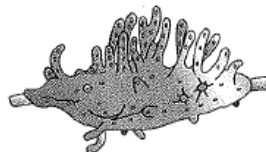
Bath sponge

2.

Venus flower basket

3.

Freshwater sponge

4.

Jellyfish

73.

Read the following paragraph having three blanks A, B and C.

Subphyla Urochordata and Cephalochordata are often referred to as protochordates and are __A__, marine. In __B__, notochord is present only in larval tail, while in __C__ it extends from head to tail region and is persistent throughout their life.

The correct option for the three blanks is

	A	B	C
(1)	Generally	Urochordata	Cephalochordata
(2)	Exclusively	Cephalochordata	Urochordata
(3)	Exclusively	Herdmania	Branchiostoma
(4)	Generally	Ascidia	Branchiostoma

74.

The endoplasmic reticulum, Golgi complex, lysosomes and vacuoles are considered together as an endomembrane system because

1. These are present in eukaryotic cells

2. They lack DNA

3. Their functions are coordinated

4. They have cisternae

75.

Read the following statements carefully:

A. Lipid component of the plasma membrane mainly consists of phosphoglycerides.

B. Polar molecules can pass through the lipid bilayer of plasma membrane, therefore they do not require carrier proteins to facilitate their transport.

C. The secondary wall is capable of growth and it is formed on the outer side of the cell.

D. Quasifluid nature of lipid enables the lateral movement of proteins within the overall lipid bilayer of the plasma membrane.

E. Middle lamella glues the different neighboring cells together.

How many statements are incorrect?

1. Three

2. Five

3. Four

4. Two

76.

Mouth parts of cockroach are :-

1. Piercing and sucking type

2. Sucking and siphoning type

3. Biting and chewing type

4. Sponging type

77.

Diagrams (A, B, C and D) of four different animals are given below. Which one of the following option identifies the animal, its phylum and one of its character correctly ?
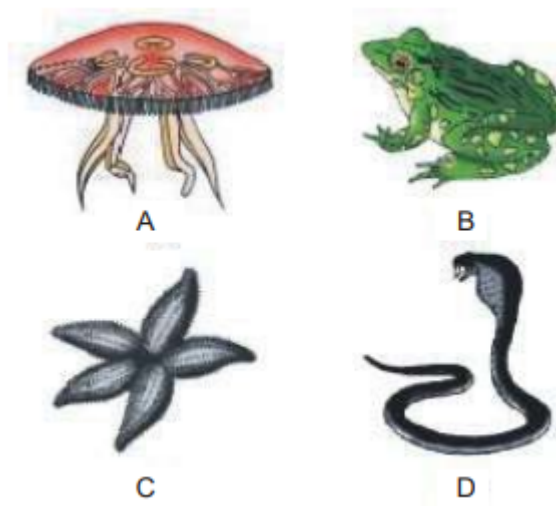
	Animal	Phylum	Character
B	Rana	Amphibia	3 – chambered heart
C	Asterias	Echinodermata	Water canal system
A	Aurelia	Coelenterata	Cnidoblast cells
D	Naja	Chordata	Non-poisonous snake

1. B

2. C

3. A

4. D

78.

Different types of hearts and the blood circulation patterns seen in the animal kingdom are given in the following table. Which of the following is Incorrect match w.r.t. the animal group, and types of heart?

	Animal group	Type of heart
1.	Fishes	Two chambered
2.	Amphibians	Three Chambered
3.	Birds	Incompletely four chambered
4.	Mammals	Four chambered

79.

Select the wrong statement:

1. The substrate binds to the active site of enzymes.

2. Enzymes isolated from thermophilic organisms get denatured at $50°C$

3. The active site of enzyme breaks the chemical bonds of the product.

4. Prosthetic groups are tightly bound to apoenzyme.

80.

Identify the statement which is incorrect.

1. Sulphur is an integral part of cysteine.

2. Glycine is an example of lipids.

3. Lecithin contains a phosphorus atom in its structure.

4. Tyrosine possesses an aromatic ring in its structure.

81.

Select the incorrect match w.r.t. group of animals and their taxon

1. Ichthyophis, Bufo, Hyla – Amphibia

2. Hippocampus, Exocoetus, Pterophyllum – Osteichthyes

3. Corvus, Chelone, Calotes – Reptilia

4. Pteropus, Equus, Delphinus – Mammalia

82.

Identify the option where all the columns are not correctly matched:

	Animal	Phylum	Features
1.	Pleurobrachia	Ctenophora	Comb plates, Only sexual reproduction
2.	Loligo	Mollusca	Radula, Dioecious
3.	Balanoglossus	Hemichordata	Respiration by gills, Proboscis gland
4.	Ascidia	Chordata	Marine, Notochord persistent throughout life

83.

Match List - I with List - II

List - I	List - II
(a) Metamerism	(i) Coelenterata
(b) Canal system	(ii) Ctenophora
(c) Comb Plates	(iii) Annelida
(d) Cnidoblasts	(iv) Porifera

Choose the correct answer from the options given below.

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

84.

Match the following

List-I	List-II
(a) Physalia	I. Pearl oyster
(b) Limulus	II. Portuguese Man of War
(c) Ancylostoma	III. Living fossil
(d) Pinctada	IV. Hookworm

Choose the correct answer from the options given below.

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

85.

Upon complete burning of the tissue, all the carbon compounds are oxidized to

1. Gaseous from (NH_3, CO_2)

2. Gaseous from (CO_2, water vapour)

3. Solid form (CO_2, water vapour)

4. Liquid form (CH_4, CO_2)

Zoology - Section B

86.

Select the option having all correctly matched pairs.

A. Alkaloids (i) Carotenoid; Anthocyanin

B. Pigments (ii) Vinblastin; curcumin

C. Drugs   (iii) Morphine; Codeine

1. A-i;B-ii;C-iii

2. A-ii;B-iii;C-i

3. A-iii;B-i;C-ii

4. A-i;B-iii;C-ii

87.

All the statements with respect to cockroach are correct except :

1. Three ganglia lie in thorax and six ganglia lie in the abdomen.

2. Hindgut is broader than midgut.

3. Exchange of gases takes place at tracheoles of diffusion.

4. Phallomeres are chitinous symmetrical structures surrounding the male gonopore.

88.

Which among the following is incorrect with respect to blood vascular system of cockroach ?

1. Blood from sinuses enter heart through ostia and is pumped anteriorly to sinuses again.

2. Its blood vessels open into haemocoel.

3. Visceral organs are bathed in haemolymph which is composed of coloured plasma and haemocytes.

4. Heart is differentiated into funnel shaped chambers with ostia on either side.

89.

The left end of the polysaccharides is _____ while the right end is _____ in nature.

1. reducing and non- reducing respectively

2. non- reducing and reducing respectively

3. both ends are non-reducing

4. both ends are reducing

90.

Which structures perform the function of mitochondria in bacteria ?

1. Nucleoid

2. Ribosomes

3. Cell wall

4. Mesosomes

91.

The cytoskeleton is made up of

1. calcium carbonate granules

2. callose deposits

3. cellulosic microfibrils

4. proteinaceous filaments

92.

Which of the following is incorrect?

1. The substrate binds to the active site of the enzyme

2. The binding of the substrate induces the enzyme to alter its shape.

3. The active site of the enzyme when it is in close proximity of the substrate breaks the chemical bonds of the substrate.

4. None of these

93.

Select the incorrect statement.

1 Isolated metabolic reaction in vitro are living reactions

2 Human beings is the only organism to have self-consciousness

3 Reproduction is an all-inclusive property of living beings

4 Unicellular organisms grow by cell-division

94.

Select the **correct** statement

1 Human cell divide once approximately every 24 hours

2 Centrioles duplicates in the cytoplasm during G_2 - phase

3 In the quiescent stage, cells remain metabolically inactive

4 During G_1 - stage cell is metabolically active but does not grow

95.

a. Spindle fibers attach to kinetochores of chromosomes during metaphase.

b. Cell growth results in disturbing the ratio between the nucleus and the cytoplasm.

c. Pachytene stage is relatively short-lived compared to the leptotene.

d. Interkinesis is a short-lived stage characterized by duplication of DNA.

1 a, b & c are correct

2 Only c is incorrect

3 b & d are correct

4 a & b are correct

96.

Bilaterally symmetrical animals can be acoelomate, pseudocoelomate, or coelomate. Study the diagrammatic representation of body cavity and the animal illustrated in diagrams A to D.
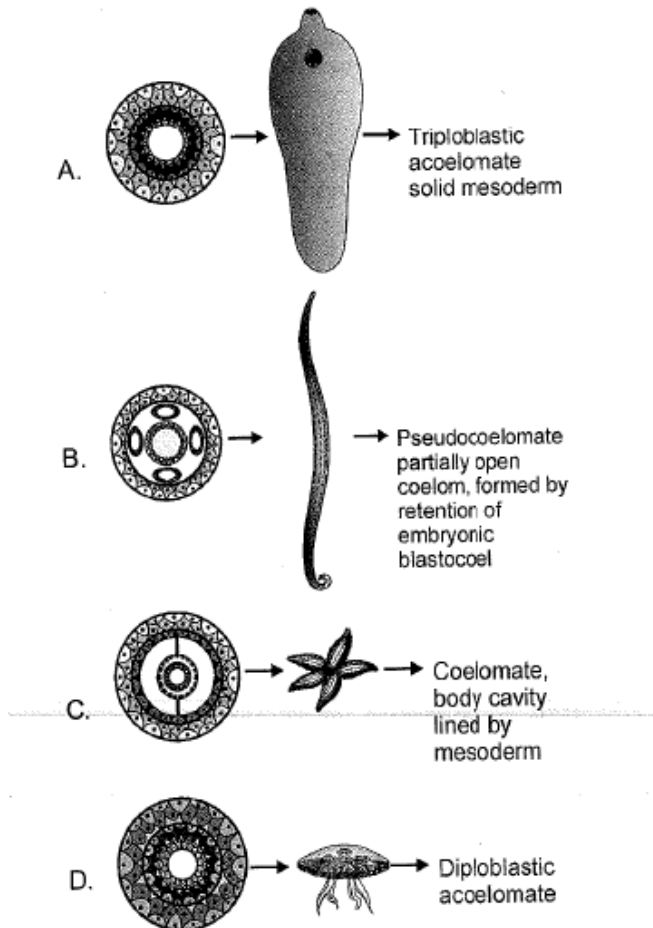
How many of the above illustrations are correct?

1. Four

2. Three

3. Two

4. One

97.

What will be the ratio of number of microtubules in peripheral and central parts of the axoneme in a eukaryotic flagellum respectively?

1. 9 : 2

2. 9 : 0

3. 9 : 1

4. 27 : 0

98.

Which of the following statements is not related to centriole?

1. Made up of nine evenly spaced peripheral fibrils of tubulin protein

2. Spindle fibres that give rise to spindle apparatus during cell division in plant cells

3. The central part of the proximal region is called the hub

4. It form the basal body of eukaryotic flagella

99.

Given below are four statements A - D each with one or two blanks. Select the option which correctly fills up the blanks in two statements.

A. Members of kingdom animalia are __(i)__ , all of them do not exhibit the same pattern of organisation of cells. Sponges exhibit __(ii)__ level of organisation.

B. For sessile animals, __(i)__ symmetry is advantageous, as it allows the food to be gathered from all sides.

C. Bilateral symmetry arose when animals on the ocean floor became mobile. A crawling animal is most likely to encounter food with the end that goes ahead. Head, enclosing the brain became associated with mouth end. This is called __(i)__ .

D. Notochord is a __(i)__ derived rod-like structure formed on the __(ii)__ side during embryonic development in some animals.

1. A. (i) Unicellular or multicellular

   (ii) Cellular

   B. (i) Radial

2. B. (i) Bilateral

   C. (i) Cephalisation

3. A. (i) Multicellular

   (ii) Celluar

   D. (i) Mesodermally

   (ii) Dorsal

4. B. (i) Bilateral

   D. (i) Ectodermally

   (ii) Dorsal

100.

Match the following columns and select the correct option :

Column - I	Column - II
(a) Smooth endoplasmic reticulum	(i) Protein synthesis
(b) Rough endoplasmic reticulum	(ii) Lipid synthesis
(c) Golgi complex	(iii) Glycosylation
(d) Centriole	(iv) Spindle formation

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

Chemistry - Section A

101.

Which of the following thermodynamic quantities is an outcome of the second law of thermodynamics?

1. Work

2. Enthalpy

3. Internal energy

4. Entropy

102.

The correct order of strength of London forces in the following molecule is -

HF, HCl, HBr , HI

1. HF>HCl>HBr>HI

2. HBr>HCl>HBr>HF

3. HI>HBr >HCl > HF

4. HF>HI>HBr>HF

103.

If travelling at same speeds, which of the following matter waves have the shortest wavelength?

1. Electron

2. Alpha particle (He^{2+})

3. Neutron

4. Proton

105.

In NO_3^- ion, the number of bond pairs and lone pairs of electrons on the nitrogen atom is

1. 2, 2

2. 3, 1

3. 1, 3

4. 4, 0

104.

Match the correct ionization enthalpies and electron gain enthalpies of the following elements.

	Elements		ΔH_1	ΔH_2	$\Delta_{eg}H$
(i)	Most reactive non-metal	A.	419	3051	-48
(ii)	Most reactive metal	B.	1681	3374	-328
(iii)	Least reactive element	C.	738	1451	-40
(iv)	Metal forming binary halide	D.	2372	5251	+48

Codes

	A	B	C	D
1.	ii	i	iv	iii
2.	i	ii	iii	iv
3.	i	iv	iii	ii
4.	iv	i	iii	ii

106.

Match the items given in Column I with examples given in Column II.

Column I	Column II
A. Hydrogen bond	1. C
B. Resonance	2. LiF
C. Ionic solid	3. H_2
D. Covalent solid	4. HF
	5. O_3

Codes

	A	B	C	D
(1)	2	3	4	1
(2)	1	2	3	5
(3)	5	4	3	2
(4)	4	5	2	1

107.

$$2\,Zn\left(s\right) + O_2\left(g\right) \rightarrow 2\,ZnO\left(s\right);$$

$$\Delta H = -693.8 \ kJ \ mol^{-1}$$

The correct statements among the following is -

(a) The enthalpy of two moles of ZnO is less than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ

(b) The enthalpy of two moles of ZnO is more than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ

(c) $693.8 \ kJ \ mol^{-1}$ energy is evolved in the reaction

(d) $693.8 \ kJ \ mol^{-1}$ energy is absorbed in the reaction

1. (a, b)

2. (b, c)

3. (c, d)

4. (a, c)

108.

The ion that has sp^3d^2 hybridization for the central atom is -

1. $[ICl_4]^-$

2. $[ICl_2]^-$

3. $[BrF_2]^-$

4. $[IF_6]^-$

109. The diamagnetic species and has the shortest bond length among the following is-

1. N_2^{2-}

2. O_2

3. C_2^{2-}

4. O_2^{2-}

110.

During the change of O_2 to O_2^- , the incoming electron goes to the orbital is-

1. σ_{2pz}^*

2. π_{2py}

3. σ_{2pz}

4. π_{2px}^*

111.

The molality of 20% (mass/mass) aqueous solution of KI is-

(molar mass of KI = 166 g mol^{-1})

1. 1.51
2. 1.35
3. 1.08
4. 1.48

112.

An ideal gas is allowed to expand form 1 L to 10 L against a constant external pressure of 1 bar. The work done in kJ is-

1. +10.0
2. − 9.0
3. − 2.0
4. –0.9

113.

The compound that has the largest H–M–H bond angle (M=N, O, S, C), is-

1. H_2O

2. CH_4

3. NH_3

4. H_2S

114.

For the reaction:

$Fe_2N_{(s)} + \frac{3}{2}H_{2(g)} \rightleftharpoons 2Fe_{(s)} + NH_{3(g)}$
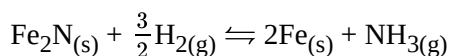
1. $K_c = K_p(RT)$

2. $K_c = K_p(RT)^{-3/2}$

3. $K_c = K_p(RT)^{-1/2}$

4. $K_c = K_p(RT)^{1/2}$

115.

The atomic number of Unnilunium is-

1. 111
2. 110
3. 101
4. 107

116.

For a chemical reaction A + B $\rightleftharpoons$ C + D (Δ_rH^0 = 80 kJ mol^{-1}) the entropy change Δ_rS^0 depends on the temperature T (in K) as Δ_rS^0 = 2T (JK^{-1} mol^{-1}).

The minimum temperature at which it will become spontaneous is-

1. 200 K

2. 250 K

3. 300 K

4. 350 K

117.

The pH of ammonium phosphate solution, if pK_a of phosphoric acid and pk_b of ammonium hydroxide are 5.23 and 4.75 respectively, is-

1. 8

2. 6

3. 7

4. 10

118.

Given

$C_{(graphite)} + O_2(g) \rightarrow CO_2(g)$

$\Delta_rH° = -393.5 \text{ kJ mol}^{-1}$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$

$\Delta_rH° = -285.8 \text{ kJ mol}^{-1}$

$CO_2(g) + 2H_2O(l) \rightarrow CH_4(g) + 2O_2(g)$
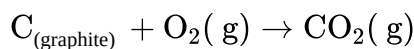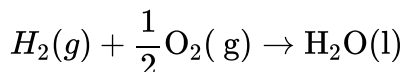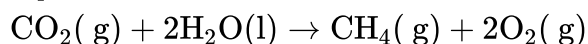
$\Delta_rH° = +890.3 \text{ kJ mol}^{-1}$

Based on the above thermochemical equations, the value of $\Delta_rH°$ at 298 K for the reaction

$C_{(graphite)} + 2H_2(g) \rightarrow CH_4(g)$ will be;
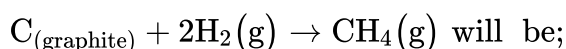
1. –74.8 kJ mol^{-1}

2. –144.0 kJ mol^{-1}

3. +74.8 kJ mol^{-1}

4. +144.0 kJ mol^{-1}

119.

Given:

$E^o_{Cl_2/Cl^-} =$
$1.36V, \quad E°_{Cr^{3+}/Cr} = -0.74V,$

$E°_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33V, \ E°_{MnO_4^-/Mn^{2+}} = 1.51V,$

The strongest reducing agent among the following is -

1. Cr^{3+}

2. Cl^-

3. Cr

4. Mn^{2+}

120.

The electrons identified by quantum numbers n and l

a. n = 4, l = 1

b. n = 4, l = 0

c. n = 3, , l = 2

d. n = 3, l = 1

can be placed in order of increasing energy as -

1. (d) < (b) < (c) < (a)

2. (b) < (d) < (a) < (c)

3. (a) < (c) < (b) < (d)

4. (c) < (d) < (b) < (a)

121.

The ionic radii (in Å) of $N^{3-}, O^{2-} \text{ and } F^-$ are respectively :

1. 1.36, 1.40 and 1.71

2. 1.36, 1.71 and 1.40

3. 1.71, 1.40 and 1.36

4. 1.71, 1.36 and 1.40

122.

At 25°C, the solubility product of $Mg(OH)_2$ is 1.0×10^{-11}. At which pH, will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a solution of 0.001 M Mg^{2+} ions?

1. 8

2. 9

3. 10

4. 11

123.

The equilibrium constant at 298 K for a reaction A + B ⇌ C + D is 100. If the initial concentration of all the four species were 1 M each, then equilibrium concentration of D (in mol L^{-1}) will be :

1. 0.182

2. 0.818

3. 1.818

4. 1.182

124.

The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} & 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be –

1. 5.0×10^{-5}

2. 5.0×10^{15}

3. 5.0×10^{-15}

4. 0.2×10^5

125.

The oxidation number of carbon in carbon suboxide is :

1. $+\frac{2}{3}$

2. $+\frac{4}{3}$

3. $+4$

4. $-\frac{4}{3}$

126.

The number of moles of magnesium phosphate, $Mg_3(PO_4)_2$ that contain 0.25 mole of oxygen atoms is -

1. 0.02

2. 3.125×10^{-2}

3. 1.25×10^{-2}

4. 2.5×10^{-2}

127.

The conjugate base of $H_2PO_4^-$ is:

1. PO_4^{3-}

2. P_2O_5

3. H_3PO_4

4. HPO_4^{2-}

128.

6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of urea solution is: (Avogadro constant, $N_A = 6.02 \times 10^{23}\ mol^{-1}$)

1. 0.001 M

2. 0.01 M

3. 0.02 M

4. 0.1 M

129.

The equilibrium constant for the reaction
$\mathrm{N}_2(g) + \mathrm{O}_2(g) \rightleftharpoons 2\mathrm{NO}(g)$
at temperature T is 4×10^{-4} . The value of K_c for the reaction :
$\mathrm{NO}(g) \rightleftharpoons \frac{1}{2}\,\mathrm{N}_2(g) + \frac{1}{2}\mathrm{O}_2(g)$ at the same temperature is :

1. 2.5×10^2

2. 50

3. 4×10^{-4}

4. 0.02

130.

An aqueous solution of 1M NaCl and 1M HCl is :

1. not a buffer but pH < 7

2. not a buffer but pH >7

3. a buffer with pH <7

4. a buffer with pH >7

131.

The correct statement among the following is-

1. When a covalent bond is formed, transfer of electrons takes place

2. Pure H_2O does not contain any ion

3. A bond is formed when attractive forces overcome repulsive forces

4. HF is less polar than HBr

132.

The volume of hydrogen gas , at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen is-

1. 89.6 L

2. 67.2 L

3. 44.8 L

4. 22.4 L

133.

For the reaction equilibrium , $\mathrm{N}_2\mathrm{O}_4(g) \rightleftharpoons 2\mathrm{NO}_2(g),$ the concentrations of $\mathrm{N}_2\mathrm{O}_4$ and NO_2 at equilibrium are 4.8×10^{-2} and 1.2×10^{-2} mol L^{-1} respectively. The value of K_c for the reaction is-

1. 3.3×10^2 mol L^{-1}

2. 3×10^{-1} mol L^{-1}

3. 3×10^{-3} mol L^{-1}

4. 3×10^3 mol L^{-1}

134. Resonance is not shown by-

1. C_6H_6

2. CO_2

3. CO_3^{2-}

4. SiO_2

135. The ratio of σ bond and π bond in naphthalene is-

1. 8 : 4
2. 2 : 1
3. 17 : 4
4. 19 : 5

Chemistry - Section B

136.

The enthalpy and entropy change for the reaction :

Br_2 (l) + Cl_2 (g)$\rightarrow$ 2BrCl (g)
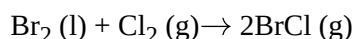
are 30 kJ mol^{-1} and 105 J K^{-1} mol^{-1} respectively.

The temperature at which the reaction will be in equilibrium is :

1. 285.7 K

2. 273.4 K

3. 450.9 K

4. 300.1 K

137.

The concentration of $[H^+]$ ion in a solution containing 0.1M HCN and 0.2 M NaCN is -

(K_a for HCN = 6.2×10^{-10})

1. 3.1$\times 10^{10}$

2. 6.2×10^5

3. 6.2×10^{-10}

4. 3.1×10^{-10}

138.

The number of radial nodes for 3p orbital is _____.

1. 3

2. 4

3. 2

4. 1

139.

Assertion (A) Boron has a smaller first ionisation enthalpy than beryllium.

Reason (R) The penetration of 2s electron to the nucleus is more than the 2p electron hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

1. Both assertion and reason are true and the reason is the correct explanation of assertion.

2. Both assertion and reason are true and the reason is not the correct explanation of assertion.

3. Assertion is true but the reason is false.

4. Assertion is false but the reason is true.

140.

Sulphuric acid reacts with sodium hydroxide as follows

$$H_2\,SO_4 + 2NaOH \rightarrow Na_2\,SO_4 + 2H_2O$$
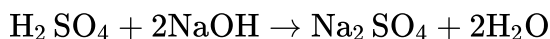
When 1L of 0.1 M sulphuric acid solution is allowed to react with 1 L of 0.1 M sodium hydroxide solution, the amount of sodium sulphate formed and its molarity in the solution obtained are respectively-

1. 0.1 M, 7.10g

2. 7.10g, 0.025 M

3. 0.025 M, 3.55g

4. 3.55g, 0.25 M

141.

A gas deviates most from the ideal behaviour under -

(a) Low pressure

(b) High pressure

(c) Low temperature

(d) High temperature

1. (a, b)

2. (b, c)

3. (c, d)

4. (a, d)

142.

Which of the following statement(s) is/are not true about the following decomposition reaction?

$$2\,KClO_3 \rightarrow 2KCl + 3O_2$$
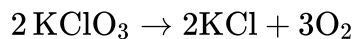
(a) Potassium is undergoing oxidation

(b) Chlorine is undergoing oxidation

(c) Oxygen is reduced

(d) None of the species are undergoing oxidation or reduction

The correct choice among the above is -

1. (a, b, d)

2. (b, c, d)

3. (b, d, a)

4. None of the above

143.

5 moles of an ideal gas at 100 K are allowed to undergo reversible compression till its temperature becomes 200 K. If C_V = 28J K^{-1} mol^{-1}, The value of ΔU is-

1. ΔU = 8kJ

2. ΔU = 14kJ

3. ΔU = 10kJ

4. ΔU = 2.8 kJ

144.

A balloon is filled with hydrogen at room temperature. It will burst if pressure exceeds 0.2 bar. If at 1 bar pressure the gas occupies 2.27 L volume, upto what volume can the balloon be expanded ?

1. 11.35 L

2. 08.35 L

3. 13.35 L

4. None of the above

145.

The shape/structure of $[XeF_5]^-$ and XeO_3F_2, respectively, are :

1. Pentagonal planar and trigonal bipyramidal

2. Trigonal bipyramidal and pentagonal planar

3. Octahedral and square pyramidal

4. Trigonal bipyramidal and trigonal bipyramidal

146.

The isostructural pairs among the following is-

$A.\,SO_4^{2-}\ and\ CrO_4^{2-}$
$B.\,SiCl_4\ and\ TiCl_4$
$C.\,NH_3\ and\ NO_3^-$
$D.\,BCl_3\ and\ BrCl_3$

1. C and D only

2. A and B only

3. A and C only

4. B and C only

147.

Consider the following reaction :

$$a\text{Cu} + b\text{HNO}_3 \rightarrow c\text{Cu(NO}_3)_2 + d\text{NO} + e\text{H}_2\text{O}$$
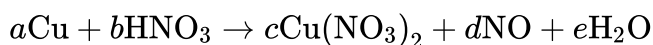
The values of a, b and e in the reaction are, respectively-

1. 3, 8 and 4

2. 5, 2 and 8

3. 5, 2 and 16

4. 2, 5 and 8

148.

Phosphorus pentachloride dissociates as follows, in a closed reaction vessel,

$$\text{PCl}_5(g) \rightleftharpoons \text{PCl}_3(g) + \text{Cl}_2(g)$$

If total pressure at equilibrium of the reaction mixture is P and degree of dissociation of PCl_5 is x, the partial pressure of PCl_3 will be :

1. $\left(\frac{x}{x+1}\right) P$

2. $\left(\frac{2x}{x-1}\right) P$

3. $\left(\frac{x}{x-1}\right) P$

4. $\left(\frac{x}{1-x}\right) P$

149.

Energy of H-atom in the ground state is -13.6 eV , hence energy in the second excited state is :

1. -6.8 eV

2. -3.4 eV

3. -1.51 eV

4. -4.53 eV

150. Statement 1: The standard enthalpy change for the formation of one mole of a compound from its elements in their most stable states (reference states) is called standard molar enthalpy of formation.

Statement 2: For, $CaO(s)+ CO_2$ (g) → $CaCO_3$(s) ; $\Delta_f H^{\ominus}$ = -178.3 kJmol^{-1} , the $\Delta_r H^{\ominus}$ is equal to the $\Delta_f H^{\ominus}$.

1. Both Statement I and II are true.

2. Statement I is true and statement II is false.
3. Both Statement I and II are false.
4. Statement I is false, Statement II is true.

Physics - Section A

151. The number of significant digits in 0.001001 is:
1. 6
2. 4
3. 7
4. 2

152. A Vernier callipers has 1 mm divisions on the main scale. It has 20 equal divisions on the Vernier scale which match with 18 main scale divisions. The least count for these Vernier callipers is:
1. 0.2 mm
2. 0.1 mm
3. 0.02 mm
4. 0.01 mm

153. If error in the measurement of mass is 0.8% and in volume it is 0.4%, then error in the measurement of density is:
1. 1.2 %
2. 0.4 %
3. 0.8 %
4. 1 %

154. The acceleration-time graph of a particle is shown in the figure. What is the velocity of the particle at t = 8s if the initial velocity of the particle is 3 m/s?
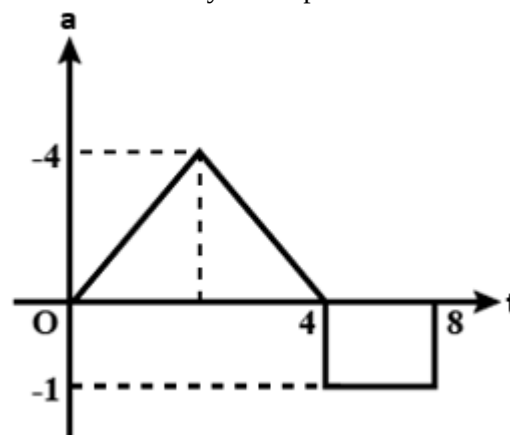
1. 4 m/s
2. 5 m/s
3. 6 m/s
4. 7 m/s

155. The acceleration of a particle moving along x-axis is a = -100x + 50. It is released from x = 2. Here 'a' and 'x' are in S.I. units. The speed of the particle at origin will be:
1. $10\sqrt{2}$ m/s
2. 1.5 m/s
3. 10 m/s
4. 12 m/s

156. In the figure shown, a river of width 4 km is flowing with the speed of 5 km/h. A swimmer whose swimming speed relative to the water is 4 km/h, starts swimming from a point A on the bank. On the other bank, B is a point which is directly opposite to A. At what angle with the downstream the man should swim so that he reaches point B directly?
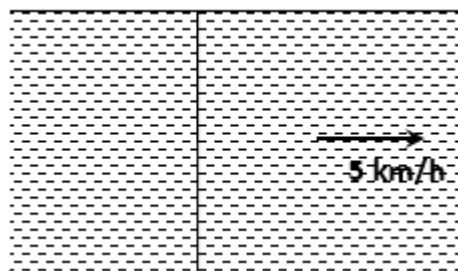
1. 90°
2. 120°
3. 150°
4. Not possible

157. Find the value of 'u' so that the ball reaches at point B. (Take g = 10 m/s^2)
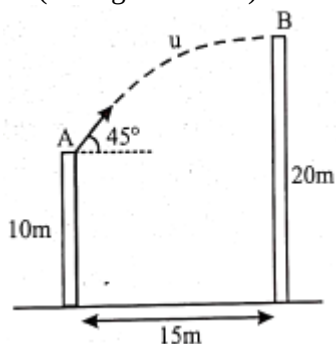
1. 20 m/s
2. 40 m/s
3. $15\sqrt{2}$ m/s
4. 50 m/s

158. Two objects A and B are thrown upward simultaneously with the same speed. The mass of A is greater than the mass of B. Suppose the air exerts a constant and equal force of resistance on the two bodies
1. The two bodies will reach the same height
2. A will go higher than B
3. B will go higher than A
4. Any of the above three may happen depending on the speed with which the objects are thrown

159. A particle moves with a speed v in a circle of radius R. The x-component of the average velocity of the particle in a half-revolution, as shown in the figure, is:
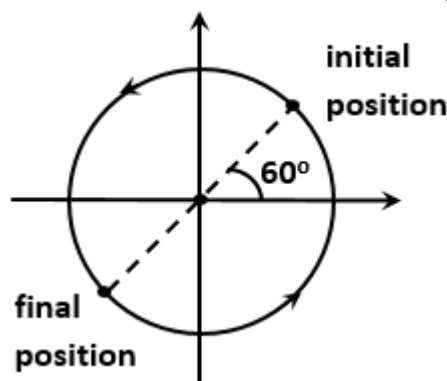
1. $-\frac{v}{\pi}$
2. $-\frac{v}{2\pi}$
3. $-\frac{v}{4\pi}$
4. $-\frac{2v}{\pi}$

160. In the arrangement shown in the figure, the pulley has a mass 3m. Neglecting friction on the contact surface, the force exerted by the supporting rope AB on the ceiling is:
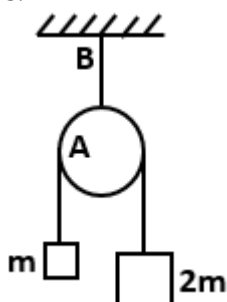
1. 6 mg
2. 3 mg
3. $\frac{17\ mg}{3}$
4. 8/3 mg

161. A block of mass 3 kg is at rest on a rough inclined plane as shown in the figure. The magnitude of net force exerted by the surface on the block will be
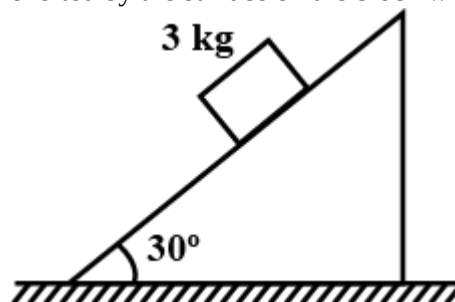
1. 26 N
2. 19.5 N
3. 10 N
4. 30 N

162. Second law of motion is used to find
1. forces
2. velocity
3. momentum
4. impulse

163. If the normal force is doubled, the coefficient of friction is:
1. not changed
2. halved
3. doubled
4. tripled

164. Swimming is possible on account of
1. First law of motion
2. Second law of motion
3. Third law of motion
4. Newton's law of gravitation

165. A car is moving with a uniform velocity on a rough horizontal road. Therefore according to Newton's first law of motion:
1. no force is being applied by its engine
2. a force is surely applied by its engine
3. an acceleration is being produced in the car
4. none of these

166. A lift is moving up with an acceleration of 3.675 m/s^2. The weight of a man
1. increases by 36.75%
2. decreases by 37.5%
3. increases by 137.5%
4. remains the same

167. Two blocks of equal masses (M) are connected by a string and are kept on rough horizontal surface as shown in figure. The coefficient of friction between the blocks and the surface is μ.
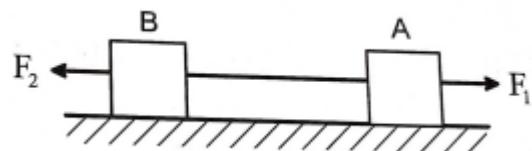
If 0 < F$_1$ - F$_2$ < 2 μmg, then choose the correct statement.
1. the direction of friction on block A is towards right
2. the direction of friction on block B may be towards left or right
3. tension in the string must be zero
4. friction force on block B must be zero

168. Potential energy of a two-body system is given by U(x) = 12x^2 - 16x. The value of force when x = 1 m is
1. -4
2. 4
3. 8
4. -8

169. Two springs of spring constants k_1 and k_2 are attached in series. The work done in stretching the spring by a small length d is
1. $\frac{1}{2}\sqrt{k_1 k_2}d^2$
2. $\frac{1}{2}\left(k_1+k_2\right)d^2$
3. $\frac{1}{2}\frac{k_1 k_2}{k_1+k_2}d^2$
4. $\frac{1}{3}\frac{k_1 k_2}{k_1+k_2}d^2$

170. Consider a system in which the workdone by external forces acting equals -10 Joules and the Potential Energy decreases by 30 Joules, which of the following statements is true?
1. There are defintely no "non-conservative" forces acting in this situation
2. Atlease one of the forces in this situation is "Conservative" in nature.
3. Workdone by the "internal" forces would be -30 joules
4. Workdone by the "internal" forces would be -40 joules

171. A particle of mass m is moving in a circular path of constant radius 'r' such that its centripetal acceleration a$_c$ is proportional to t^n (where 't' is time). Then the power 'p' is proportional to
1. t^n
2. t^{n-2}
3. t^{n-1}
4. $t^{(n/2-1)}$

172. The minimum work done by the agent, in pulling a small particle of mass m from A to B as shown in figure, is
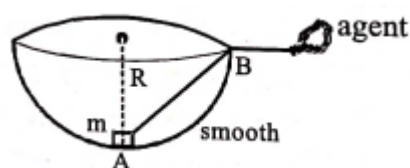

1. 4 mgR
2. mgR
3. 3 mgR
4. 2 mgR

173. A sphere of mass m, attached at its center to a spring on incline as shown in figure, is held in unstretched position of spring. Suddenly the sphere is set free, the maximum extension of spring is (friction is enough to prevent slipping)
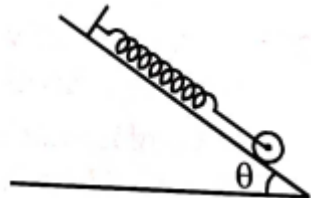
1. $\frac{2mg}{k}$
2. $\frac{2mg\cos\theta}{k}$
3. $\frac{2mg\sin\theta}{k}$
4. $\frac{mg\sin\theta}{k}$

174. A uniform disc of mass 2kg and radius 50 mm is released from rest on a rough incline with coefficient of static friction sufficient to sustain pure rolling. If the length of incline equals 60 cm, the time taken by the disc to arrive at bottom equals
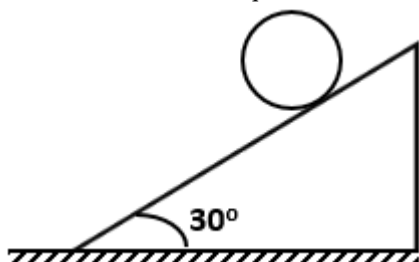
1. 1 s
2. 0.8 s
3. 0.6 s
4. 0.5 s

175. A boy is standing on a rotating table with heavy spheres in his extended hands. If he suddenly withdraws his hands to his chest, the angular velocity of the table:
1. becomes zero
2. increases
3. decreases
4. remains unchanged

176. For the uniform 'T' shaped structure, with mass 3M, moment of inertia about an axis normal to the plane and passing through 'O' would be
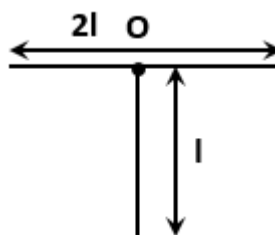
1. $\frac{2}{3}Ml^2$
2. Ml^2
3. $\frac{Ml^2}{3}$
4. $\frac{Ml^2}{2}$

177. For a system to be in rotational equilibrium the net torque acting on it must be zero. This is true only if the torque is taken about
1. centre of the system
2. any point on the system
3. any point on the system or outside it
4. the centre of mass of system

178. One quarter sector is cut from a uniform circular disc of radius R. This sector has mass M. It is made to rotate about a line perpendicular to its plane and passing through the centre of the original disc. Its moment of inertia about the axis of rotation is:
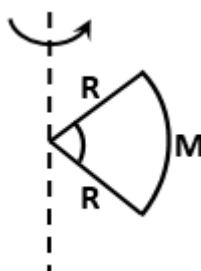

1. $\frac{1}{2}MR^2$
2. $\frac{1}{4}MR^2$
3. $\frac{1}{8}MR^2$
4. $\sqrt{2}MR^2$

179. How much is the magnitude of the frictional force acting at the point of contact for a cylinder which is rolling (without slipping) under the action of an external force 'F' as shown in the diagram below? (Assume 'F' to be constant and applied constantly at the same point on the cylinder as shown)
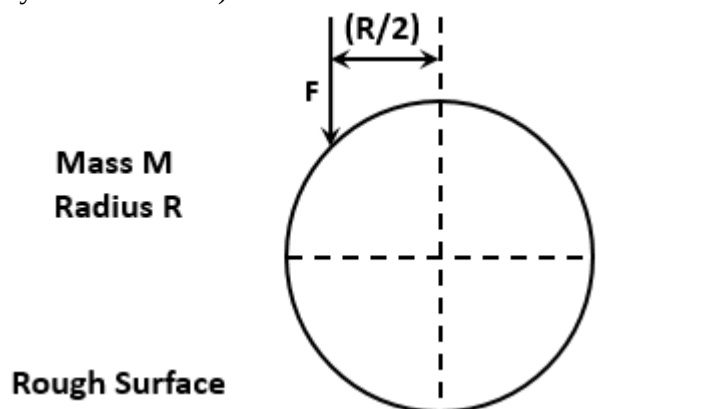

1. $f = \dfrac{F}{3}$
2. $f = \dfrac{2F}{3}$
3. $f = \dfrac{F}{2}$
4. $f = \dfrac{3F}{2}$

180. A sphere of mass m and radius r is released from rest at point A on a track in vertical plane. The track is rough enough to support rolling between A and B and from B onwards it is smooth. The maximum height attained by sphere from ground on its journey from B onwards is
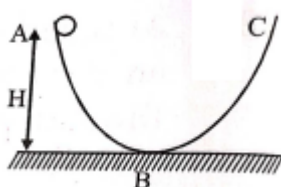
1. H
2. $\dfrac{5}{7}H$
3. $\dfrac{2}{5}H$
4. $\dfrac{2}{7}H$

181. A uniform solid cylinder of mass M and radius R is pulled horizontally by a force F acting at its center of mass from rest. Then indicate the correct direction of friction, assuming that it rolls without sliding on a horizontal surface
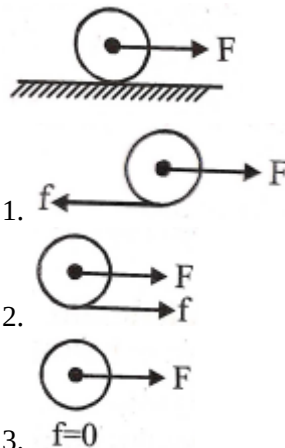
1.
2.
3. f=0
4. cannot be interpreted

182. Which of the following graphs correctly represents the variation of $\beta = -\left(\dfrac{dV}{dP}\right)/V$ with P for an ideal gas at constant temperature?


1. 2. 3. 4.
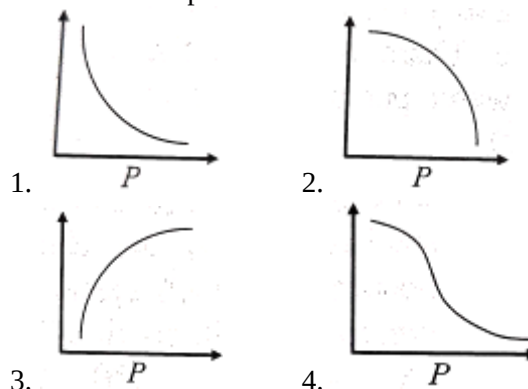
183. A geostationary satellite is taken to another orbit, radius of which is twice that of it earlier orbit. Its new time period would be
1. $48\sqrt{2}$ hours
2. 48 hours
3. $\dfrac{48}{\sqrt{2}}$
4. 24 hours

184. The energy required to shift a satellite from orbital radius r to orbital radius 2r is E. What energy will be required to shift the satellite from orbital radius 2r to orbital radius 3r?
1. E
2. E/2
3. E/3
4. E/4

185. Consider the two identical particles shown in the figure. They are released from rest and can move towards each other under the influence of their mutual gravitation forces. Speed of each particle when the separation reduces to half of initial value is:
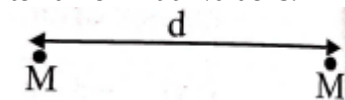
1. $\sqrt{\frac{GM}{d}}$

2. $\sqrt{\frac{2GM}{d}}$

3. $\sqrt{\frac{GM}{2d}}$

4. $\sqrt{\frac{4GM}{d}}$

Physics - Section B

186. If the acceleration due to gravity is 10 ms^{-2} and the units of length and time are taken as kilometer and hour respectively, the numerical value of the acceleration is
1. 360000
2. 72000
3. 36000
4. 129600

187. Two particles are simultaneously projected with the same speed in the same vertical plane, but perpendicular to each other, in a uniform gravitational field. Their times of flight are T_1, T_2 while the horizontal ranges are R_1, R_2, Then (choose one option)
1. $R_1 = R_2$
2. $R_1 + R_2 = 2gT_1T_2$
3. $\frac{R_1}{T_1} = \frac{R_2}{T_2}$
4. both (1) and (2) are true

188. The motion of a particle is given by S = 1 + 4t - 2t^2. The distance travelled by the particle during t = 0 to t = 2 seconds.
1. 0 unit
2. 2 unit
3. 4 unit
4. 3 unit

189. A balloon B is moving vertically upward and viewed by a telescope T. At a particular angular position $\theta = 53°$ measured parameters are r = 1 km, $\frac{dr}{dt} = 3 \, m/s$ and $\frac{d\theta}{dt} = 0.002 \, rad/s$. The magnitude of the linear velocity of the balloon at this instant is
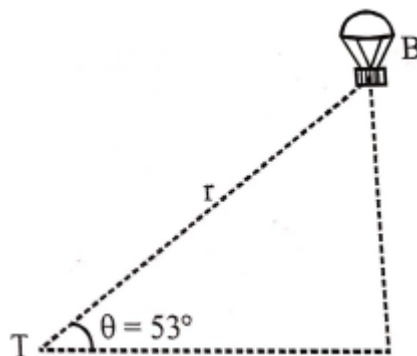
1. 1.2 m/s
2. 2.4 m/s
3. 3.6 m/s
4. 4.8 m/s

190. Find the speed of the block when it covers a horizontal distance 'l'. It is given that the block never loses contact with the smooth horizontal surface, and the force always acts an angle θ with the horizontal
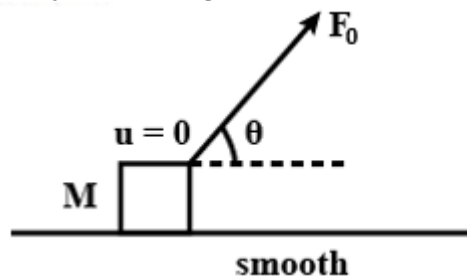

1. $\sqrt{\frac{lF_0 \cos\theta}{m}}$

2. $\frac{2lF_0 \cos\theta}{m}$

3. $\sqrt{\frac{2l}{m}F_0 \cos\theta}$

4. $\frac{lF_0 \cos\theta}{m}$

191. Water in a bucket is whirled in a vertical circle with a string attached to it. The water does not fall down even when the bucket is inverted at the top of its path. We conclude that in this position
1. $mg = \frac{mv^2}{r}$
2. mg is greater than $\frac{mv^2}{r}$
3. mg is not greater than $\frac{mv^2}{r}$
4. mg is not less than $\frac{mv^2}{r}$

192. What is the minimum value of the mass M so that the block is lifted off the table at the instant shown in the diagram? Assume that the blocks are initially at rest.
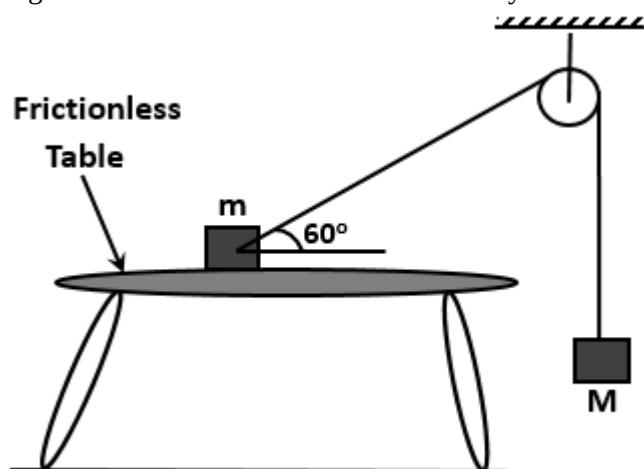
1. $\dfrac{m}{\sin 60^\circ}$
2. $\dfrac{m}{\tan 60^\circ}$
3. $m \sin 60^\circ$
4. $\dfrac{m}{\tan 30^\circ}$

193. In one dimensional motion, a 1 kg object placed on a smooth horizontal surface initially at rest experiences a force, F = 2t acting in the direction of motion. The work done by the force in first 4 seconds is
1. 16 J
2. 32 J
3. 64 J
4. 128 J

194. Two 20 g flatworms climb over a very thin obstruction, 10 cm high. One of the worms is 20 cm long, the other is wider and only 10 cm long. What is the ratio of the amounts of work done by the two worms, when half of it is over the top of the wall
1. $\dfrac{3}{4}$
2. $\dfrac{2}{3}$
3. $\dfrac{5}{4}$
4. $\dfrac{2}{5}$

195. A projectile starts vertically upwards with velocity v_0. If, at a height h above the surface of the earth, the velocity of the projectile is v, then $v_0^2 - v^2$ is equal to
1. $\dfrac{2gh}{\frac{R}{h}+1}$
2. $\dfrac{2gh}{\frac{R}{h}-1}$
3. $\dfrac{2gh}{1+\frac{h}{R}}$
4. $\dfrac{2gh}{1-\frac{h}{R}}$

196. When a fat person tries to touch his toes (As shown in the figure), keeping the legs straight, he generally falls because of:


1. Torque produced
2. Weight
3. Dizziness
4. None of these

197. A cylinder rolls on a horizontal plane surface. If the speed of the centre is 25 m/s, speed of the highest point is
1. 50 m/s
2. 25 m/s
3. 30 m/s
4. 60 m/s

198.

The figure shows two blocks of masses m and M connected by a string passing over a pulley. The horizontal table over which the mass m slides is smooth. The pulley has a radius r and moment of inertia I about its axis and it can freely rotate about this axis. The acceleration of the mass M assuming that the string does not slip on the pulley is:
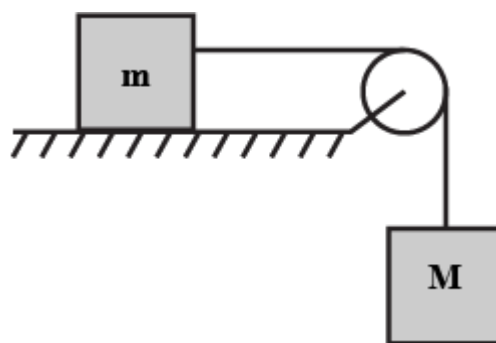
1. $\dfrac{mg}{M+m+I/r^2}$

2. $\dfrac{Mg}{M+m+I/r^2}$

3. $\dfrac{Mg}{M+m+2I/r^2}$

4. $\dfrac{mg}{M+m+2I/r^2}$

199.

A rod has a mass of 1 kg distributed uniformly over its length, the length of the rod is 1 m is pivoted at its centre and two masses of 5 kg and 2 kg are hung from the ends as shown in the figure. The initial angular acceleration of the rod assuming that it was horizontal in the beginning is:
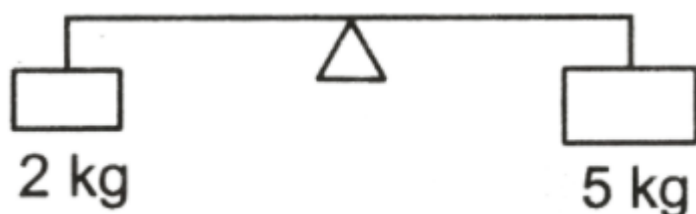
1. 3.0 rad/s^2

2. 4.0 rad/s^2

3. 8.0 rad/s^2

4. 5.0 rad/s^2

200. When rubber sheets are used in a shock absorber, the energy of vibration:

1. is converted into sound energy.
2. is converted into heat energy.
3. is converted into mechanical energy.
4. is transferred to the ground.

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