Botany - Section A

1.

The term ‘archegonium’ for the female sex organ is not used for:
1. Liverworts
2. Pteridophytes
3. Angiosperms
4. Gymnosperms

2.

The botanical name for ‘makoi’ plant is:
1. *Solanum nigrum*
2. *Zea mays*
3. *Eleucine coracana*
4. *Sorghum bicolor*

3.

The type of meristem that may have evolved in grasses in response to damage by grazing herbivores will be:
1. Shoot apical meristem
2. Root apical meristem
3. Intercalary meristem
4. Floral meristem

4.

Identify the correctly matched pair:

	Pteriodophyte	Class
1.	Psilopsida	*Adiantum*
2.	Lycopsida	*Selaginella*
3.	Sphenopsida	*Dryopteris*
4.	Pteropsida	*Equisetum*

5.

The primary stain used in Gram staining is:
1. Lugol’s iodine
2. Acetone: Alcohol
3. Crystal violet
4. Safranin

6.

Regarding RuBisCO:
I. It is the most abundant protein in the whole of the biosphere.
II. Mg^{2+} is its activator
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

7.

Mango and wheat belong to the same:
I. Division
II. Class
III. Order
1. Only I
2. Both I and II
3. Only III
4. I, II, and III

8.

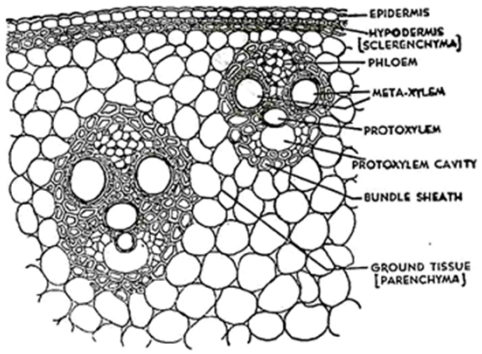
Specialized plastids like amyloplasts are differentiated forms of:
1. Chloroplasts
2. Chromoplasts
3. Leucoplasts
4. Gerontoplasts

9.

A heterogeneous collection of fructose polymers, produced by many types of plants, is:
1. Lectin
2. Ricin
3. Inulin
4. Concanavalin

10.

The given diagram shows the transverse section of a portion of a:



1. Monocot stem
2. Monocot root
3. Dicot stem
4. Dicot root

11.

The life cycle of a plant exhibits a dominant, independent, photosynthetic phase [haploid gametophyte] that alternates with a short-lived multicellular sporophyte totally or partially dependent on the gametophyte for its anchorage and nutrition. Such a life cycle is seen in:

1. All bryophytes
2. All pteridophytes
3. Most bryophytes, some pteridophytes and few angiosperms
4. All gymnosperms and angiosperms

12.

The sub-aerial modification of stem in Pistia and Eichhornia is called as:

1. Runner
2. Stolon
3. Sucker
4. Offset

13.

Which of the following is similar in size to viruses?

1. PPLO
2. Prions
3. Viroid
4. Actinomycetes

14.

Match the terms in Column I with their correct description in Column II and select the correct match from the codes given:

	COLUMN I		**COLUMN II**
A	Protonema	P	The first stage in development of the gametophyte in mosses.
B.	Prothallus	Q	The photosynthetic gametophyte in ferns.
C.	Seta	R	In bryophytes, the stalk that supports the capsule, if present.
D.	Stipe	S	The stem-like part of the thallus of brown algae such as kelp

Codes

	A	B	C	D
1.	P	Q	R	S
2.	Q	P	R	S
3.	P	Q	S	R
4.	Q	P	S	R

15.

The ‘photobiont’ [photosynthetic component] in a Lichen can be:

I. A green alga
II. A cyanobacterium

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

16.

Match each item in Column I with one in Column II and select the correct match from the given codes :

	COLUMN I		COLUMN II
A	Prop roots	P	Banyan
B	Stilt roots	Q	Maize
C	Pneumatophores	R	*Rhizophora*

Codes:

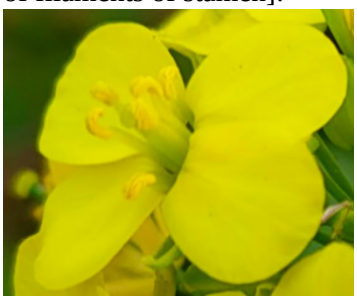
	A	B	C
1.	P	Q	R
2.	Q	P	R
3.	P	R	Q
4.	Q	R	P

17.

Regarding viroids:
I. They are small single-stranded, circular RNAs that are infectious pathogens.
II. The first recognized viroid was the Potato spindle tuber viroid, abbreviated PSTVd.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

18.

The following flower can be of [Hint: look at the lengths of filaments of stamen]:



1. Citrus
2. Mustard
3. Pea
4. Lemon

19.

Consider the given two statements:
I. At maturity, none of the components of xylem tissue is living.
II. At maturity, none of the components of phloem tissue is dead.
The correct statement/s is/are:
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

20.

The subkingdom ‘Dikarya’ of the Kingdom Fungi include:
1. Ascomycetes and Basidiomycetes
2. Only Deuteromycetes
3. Ascomycetes and Phycomycetes
4. Phycomycetes and Basidiomycetes

21.

If we go by the tenets of cell theory, viruses should be considered as non-living because they:
1. have a non-cellular organization
2. are obligate cellular endoparasites
3. are inert outside their specific host cell
4. can pass through bacteria-proof filters

22.

Identify the correct statement regarding members of Phaeophyceae:
1. The main photosynthetic pigment is fucoxanthin and chlorophyll a is absent.
2. The stored food is in the form of mannitol and laminarin is toxic to them.
3. Their cell walls have algin and polysulphate esters.
4. The flagellar number is 2, unequal in size and attached laterally.

23.

After cytokinesis in a plant cell, which of the following is formed first?

1. The primary cell wall
2. The middle lamella
3. The secondary cell wall
4. There is no particular chronology

24.

Consider the given two statements:

I. The term lenticel is usually associated with the breakage of periderm tissue; however, lenticels also refer to the lightly colored spots found on apples.

II. Both structures have similar functions in gas exchange.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

25.

Consider the given statements:

I. In dicot roots, the pericycle strengthens the roots and provides protection for the vascular bundles.

II. In dicot root, the vascular cambium is completely secondary in origin, and it originates from a portion of pericycle tissue.

III. The pericycle regulates the formation of lateral roots by rapidly dividing near the xylem elements of the root.

The correct statements are:

1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

26.

The inflorescence shown in the given picture can be of:

1. Mustard
2. Onion
3. Soybean
4. Radish

27.

What is the number of correct statements from those given below?

I. Primary xylem is endarch in roots

II. Phloem parenchyma is present in most of the monocots.

III. Phloem fibers are generally absent in the primary phloem.

IV. Companion cells are collenchymatous cells.

V. Angiosperms lack vessels in their xylem.

1. 0
2. 1
3. 2
4. 3

28.

Find the correct match [with respect to Whittaker's Five Kingdom classification]:

1.	Monera	All members have a cell wall
2.	Protista	All members are photosynthetic
3.	Fungi	All members are multi-cellular
4.	Animalia	All members are heterotrophs

29.

Identify the incorrect statement:
1. Ovary is half inferior in rose, plum and peach
2. Twisted aestivation is seen in china rose, lady's finger and cotton
3. The seeds are endospermous in bean, gram and pea
4. Epitepalous stamens are seen in lily, tulip and *Gloriosa*

30.

Consider the given two statements:
I. Dicot roots do not undergo secondary growth.
II. In the dicot root, the vascular cambium is completely secondary in origin.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

31.

The terms that can be applied to all gymnosperms include:
1. Naked seeds, Homosporous, Dominant independent sporophyte
2. Seeds enclosed in ovary wall, Heterosporous, Dominant independent sporophyte
3. Naked seeds, Heterosporous, Dominant independent sporophyte
4. Naked seeds, Heterosporous, Dominant independent gametophyte

32.

Match the angiosperm Family in Column I with the type of its gynoecium in Column II and select the correct match from the codes given:

	COLUMN I		**COLUMN II**
A	Fabaceae	P	Bicarpellary obliquely placed, syncarpous, ovary superior, bilocular, placenta swollen with many ovules
B	Solanaceae	Q	Tricarpellary, syncarpous, ovary superior, trilocular with many ovules
C	Liliaceae	R	Ovary superior, mono carpellary, unilocular with many ovules, style single

Codes:

	A	**B**	**C**
1.	P	Q	R
2.	Q	P	R
3.	R	P	Q
4.	R	Q	P

33.

The given picture shows the ear of wheat containing a mass of olive-brown SMUT spores. The disease is caused by a fungal pathogen belonging to:

1. Ascomycetes
2. Phycomycetes
3. Basidiomycetes
4. Deuteromycetes

Botany - Section B

34.

What would be true regarding reproduction by 'zoospores' in algae and fungi?
1. While they are produced in sexual reproduction in algae, in fungi they are produced in asexual reproduction.
2. While they are produced in sexual reproduction in fungi, in algae they are produced in asexual reproduction.
3. They are flagellated and motile in algae and non-motile in fungi.
4. They are motile and produced in asexual reproduction in both algae and fungi.

35.

Identify the incorrect comparison between monocots and dicots in general:

	Character	Monocots	Dicots
1.	Leaves	Parallel venation	Reticulate venation
2.	Roots	Primary root of short duration, replaced by adventitial roots forming fibrous or fleshy root systems	Develops from the radicle. Primary root often persists forming strong tap roots and secondary roots
3.	Plant stem: Vascular bundles	Ring of primary bundles with cambium, differentiated into cortex and stele	Numerous scattered bundles in ground parenchyma, cambium mostly absent, no differentiation between cortical and stelar regions
4.	Flowers	Parts in threes (trimerous) or multiples of three	Fours (tetramerous) or fives (pentamerous)

36.

Consider the given two statements:
I. Parthenocarpy is the equivalent of parthenogenesis in animals.
II. Parthenocarpy is the natural or artificially induced production of fruit without fertilisation of ovules
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

37.

What is true regarding aleurone layer in a monocot seed?
I. It is composed of proteinaceous material, usually in the form of granules.
II. It is the outermost cell layer of the endosperm.
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

38.

Chemotaxonomy is defined by the Merriam-Webster dictionary as 'the method of biological classification based on similarities and dissimilarities in the structure of certain compounds among the organisms being classified'. There is an argument that proteins are more reliable of genetic relationships. Which of the following most strongly supports the argument?
1. Almost all enzymes are proteins
2. Proteins in living organisms are more closely controlled by genes.
3. The primary structure of proteins is very easy to determine.
4. A ribozyme catalyses the formation of peptide bond leading to the formation of proteins.

39.

Consider the two statements:
I. Spindle formation does not occur in plant cells during mitosis
II. Plant cells lack centrosomes
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

40.

Consider the given two statements:
I. In angiosperms, the endosperm constitutes an organism separate from the growing embryo.
II. Endosperm is produced by separate fertilization.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

41.

Archaebacteria differ from other bacteria in having a different cell wall structure [NCERT page 19]. Which of the following is/are true?
I. No archaebacteria have peptidoglycan in their cell wall but some can have pseudopeptidoglycan.
II. No bacteria have S-layer in their cell envelopes but some may have slimy glycocalyx.
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

42.

Identify the incorrect comparison between cellulose and starch:

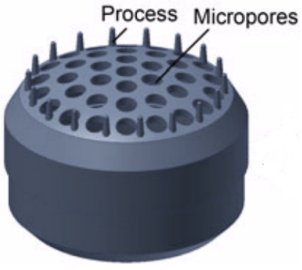
		Cellulose	Starch
1.	Monomer subunit	Beta Glucose	Alpha Glucose
2.	Helical secondary structure	Yes	No
3.	Linkage	β(1→4)-glycosidic bonds	α(1→4)-glycosidic bonds
4.	Type	Homopolymer	Homopolymer

43.

What is common to *Anabaena*, *Nostoc*, *Nitrosomonas* and *Nitrobacter*?
I. All are photosynthetic autotrophs.
II. All can directly fix atmospheric nitrogen.
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

44.

The structure shown in the given figure represents:



1. the newest version of a Bluetooth speaker by Amazon
2. the soap case like cell wall of a diatom
3. cellulosic plates in the walls of dinoflagellates
4. pellicle in the wall of euglenoids

45.

In the floral diagram shown below, the type of placentation seen is:

1. Axile
2. Basal
3. Marginal
4. Free central

46.

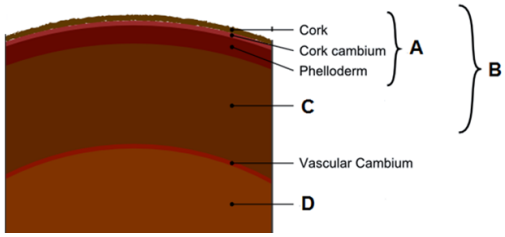
Consider the given two statements:
I. The older botany term ‘vascular cryptogams’ can be applied to the pteridophytes.
II. Pteridophytes do not produce seeds but have vascular or conducting system.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

47.

Similar to how Sieve Tube elements are associated with companion cells, sieve cells are associated with:
1. Albuminous cell
2. Lenticel
3. Bulliform cell
4. Guard cell

48.

In the given cross-section diagram of a tree A, B C and D respectively represent:



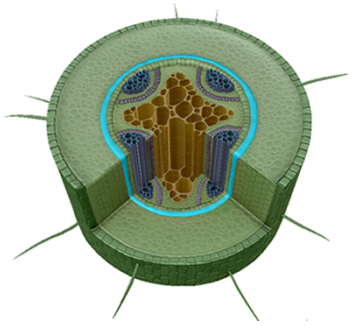
	A	B	C	D
1.	Periderm	Bark	Secondary phloem	Secondary xylem
2.	Periderm	Bark	Secondary xylem	Secondary phloem
3.	Bark	Periderm	Secondary phloem	Secondary xylem
4.	Bark	Periderm	Secondary xylem	Secondary phloem

49.

Edward Tatum and George Wells Beadle proposed "one gene, one enzyme" hypothesis and they won the Nobel Prize in Physiology or Medicine in 1958. The fungus used by them in their experiments was:
1. *Saccharomyces cerevisiae*
2. *Neurospora crassa*
3. *Penicillium chrysogenum*
4. *Trichoderma harzianum*

50.

In the given diagram of a dicot root, the highlighted blue portion:



I. is the endodermis and is included in the stele
II. is the pericycle and is included in the stele
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

Zoology - Section A

51.

Identify the correct statements regarding the members of Phylum Aschelminthes [c.f. page 52; para 1]:
I. Their body is circular in cross-section
II. Alimentary canal is complete
III. Often males are longer than females
1. Only II
2. Only I and II
3. Only II and III
4. Only III

52.

In a typical mollusc:
I. Head, muscular foot, and visceral hump are body segments.
II. Mantle over the visceral hump is formed by a layer of skin.
III. Radula is a file-like rasping organ
1. Only III is correct
2. Only II and III are correct
3. Only I and III are correct
4. Only I and II are correct

53.

Parazoa is a taxon at the base of the phylogenetic tree of the animal kingdom and includes the most primitive forms, characterized by not having proper tissues. [c.f. 4.1.1; page 46]. The phylum/phyla included in this taxon will be:
I. Porifera
II. Cnidaria
III. Ctenophora
1. Only I
2. Only II and III
3. Only I and II
4. I, II and III

54.

In cockroach:
I. The entire midgut is lined by cuticle.
II. Malpighian tubule is lined by glandular and ciliated cells.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

55.

Consider the given two statements:
I. Meiosis is responsible for maintaining the chromosome number across generations in sexually reproducing organisms.
II. Meiosis results in reduction of chromosome number by half in the daughter cells.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

56.

The endomembrane system is composed of the different membranes that are suspended in the cytoplasm within a eukaryotic cell. These membranes divide the cell into functional and structural compartments, or organelles. The system includes all the following except:
1. ER
2. Golgi apparatus
3. Chloroplasts
4. Vacuoles

57.

The larvae in echinoderms are:
I. Radially symmetrical
II. Free swimming
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

58.

In a cell undergoing meiosis:
1. The chromosome number and the DNA content is reduced only during Meiosis I
2. The chromosome number and the DNA content is reduced only during Meiosis II
3. While the chromosome number is reduced only in Meiosis I, DNA content is reduced in both Meiosis I and Meiosis II
4. While the chromosome number is reduced only in Meiosis I, DNA content is reduced only in Meiosis II

59.

In the DNA double helix:
I. At each step of ascent, the strand turns 34º.
II. The rise per base pair would be 0.36 nm.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

60.

The intercellular material of cartilage can best be described as:
1. Loose and semi-solid
2. Solid and pliable
3. Hard and non-pliable
4. Fluid

61.

Identify the incorrectly matched pair:

1.	Primary constriction	Satellite chromosome
2.	Cilia/flagella	9 + 2 arrangement of microtubules
3.	Centriole	9 + 0 arrangement of microtubules
4.	Lysosomes	Acid hydrolases

62.

Which of the following cofactors required by enzymes is often vitamins or made from vitamins?
1. Apoenzymes
2. Prosthetic groups
3. Zymogens
4. Co-enzymes

63.

Which of the following secondary metabolites is an alkaloid and is clinically used as a very potent analgesic?
1. Morphine
2. Abrin
3. Lectin
4. Taxol

64.

Compound epithelium lines all the following except:
1. dry surface of the skin
2. moist surface of buccal cavity
3. inner lining of ducts of salivary ducts
4. walls of blood vessels

65.

Transitional epithelium is a type of tissue that changes shape in response to stretching (stretchable epithelium). The transitional epithelium usually appear cuboidal when relaxed and squamous when stretched. Based on this information and your knowledge of human physiology, where do you think this type of epithelium is expected to be located in the human body?

1. Trachea
2. Bile duct
3. Urinary bladder
4. Aorta wall

66.

Octopus has: [c.f. 4.1.2 page 47]

1. Tetrameric radial symmetry
2. Hexameric radial symmetry
3. Octomeric radial symmetry
4. Bilateral symmetry

67.

Identify the incorrect statement:

1. Areolar tissue is a type of loose connective tissue with mast cells and macrophages present in it.
2. Tendons and ligaments have collagen fibres oriented in an irregular pattern.
3. Cartilage, bone and blood are specialized connective tissue.
4. Connective tissue is derived from the embryonic mesoderm.

68.

The ‘neck’ in Cockroach is:

1. an extension of the head capsule
2. the proximal tergite
3. the proximal sternite
4. an extension of prothorax

69.

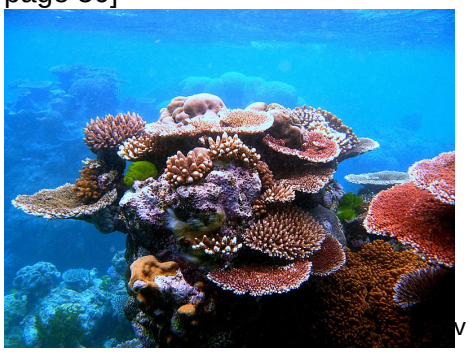
The substrate has to go through a higher energy state or transition state during its conversion to a product in:

I. Exothermic spontaneous reactions
II. Endothermic reactions
III. Enzyme catalyzed reactions

1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

70.

What do you see in the given picture? [c.f. 4.2.2 page 50]



1. Tube sponges
2. Cnidarian polyps connected by calcium carbonate
3. Echinoderm anthozoans
4. Comb jellies

71.

The diagram shows the presence of a pathogen amongst RBCs in the peripheral blood smear of a patient. Even though the shape is very easy to identify, the structure highlighted in the circle should enable you to identify the pathogen easily. It is:

1. *Trypanosoma*
2. *Plasmodium*
3. *Schistosoma*
4. *Clonorchis*

72.

Match each item in Column I with one item in Column II and select the correct match from the codes given:

	COLUMN I		**COLUMN II**
A	Largest marine animal phylum	P	Arthropoda
B	Largest animal phylum	Q	Mollusca
C	Largest vertebrate class	R	Pisces
D	Largest vertebrate endotherm class	S	Aves

Codes

	A	B	C	D
1.	P	Q	R	S
2.	Q	P	S	R
3.	P	Q	S	R
4.	Q	P	R	S

73.

Fibroblasts in connective tissue:

I. Secrete fibres of structural proteins
II. Secrete modified polysaccharides for matrix

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

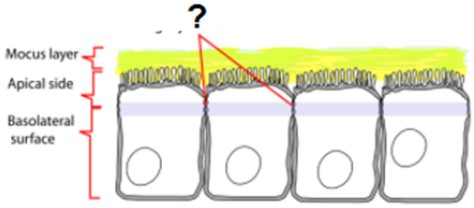
74.

Dictyotene is:

1. Abnormal meiosis in fungi
2. Prolonged resting phase in oogenesis
3. Failure of homologues to separate during meiosis
4. State of hypermotility in sperms

75.

The '?' in the given figure shows:



1. Tight junctions
2. Adhering junctions
3. Gap junctions
4. Desmosomes

76.

Which of the following chordate is a vertebrate?

1. *Doliolum*
2. *Branchiostoma*
3. *Ascidia*
4. *Petromyzon*

77.

The following reaction will be catalyzed by an enzyme classified as a/an:

$A–B + H_2O \rightarrow A–OH + B–H$

1. Oxidoreductase
2. Hydrolase
3. Lyase
4. Transferase

78.

Consider the given two statements:

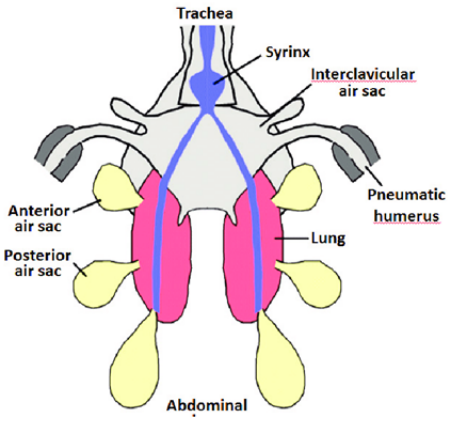
I. Higher the taxonomic category, greater is the difficulty of determining the relationship to other taxa at the same level.

II. All living organisms are linked to one another by sharing of the common genetic material, but to varying degrees.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

79.

The lungs shown in the given diagram belong to the respiratory system of:



1. Amphibians
2. Reptiles
3. Birds
4. Mammals

80.

The box given below has a list of animals. What is the number of animals in the list that have a true coelom but not a segmented body?

Meandrina, *Chaetopleura*, *Cucumaria*, *Ancylostoma*, *Bombyx*, *Aplysia*, Amphioxus, *Antedon*

1. 2
2. 3
3. 4
4. 5

81.

The karyotype of a healthy human being will not show:

1. Metacentric chromosomes
2. Submetacentric chromosomes
3. Acrocentric chromosomes
4. Telocentric chromosomes

82.

Consider the given two statements:

I. Living state and metabolism are synonymous.

II. Cellular organization with metabolism is the defining feature of life.

1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

83.

What is correct regarding the nervous system of cockroach?

1. The mosaic vision seen in cockroach has high sensitivity but low resolution.
2. Two ganglia lie in the thorax and eight in the abdomen.
3. Sub-oesophageal ganglion supplies nerves to antennae and compound eyes.
4. Maxillary and labial palps do not have any sensory function.

84.

Consider the given two statements:
I. Lipids come under acid insoluble fraction.
II. Lipids are macromolecules.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

85.

What is correct regarding centriole?
I. Centrioles are typically made up of nine sets of short microtubule triplets, arranged in a cylinder.
II. The main function of centrioles is to produce cilia during interphase and the aster and the spindle during cell division.
III. Centrioles start duplicating when DNA replicates.
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

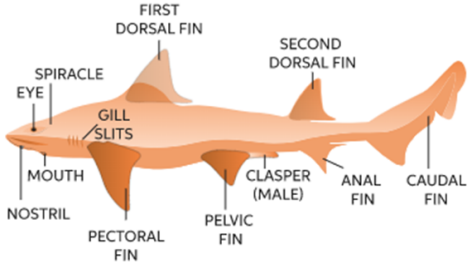
Zoology - Section B

86.

Digestion in sponges is intracellular. [c.f. 4.2.1 page 49] What is their major food?
1. Phytoplankton
2. Crustaceans
3. Bacteria
4. They actually depend on photosynthetic symbionts

87.

The diagram below shows the body plan of a:



1. Cephalochordate
2. Cyclostome
3. Cartilaginous fish
4. Bony fish

88.

Identify the incorrectly matched pair:

	Structure in cockroach	Number
1.	Hepatic caeca	6-8
2.	Malpighian tubules	100-150
3.	Ommatidia in one compound eye	About 2000
4.	Spiracles	12 pairs

89.

All tetrapods have:
1. internal fertilization
2. direct development
3. lungs
4. endothermy

90.

Centromeres split leading to the separation of sister chromatids and the pulling of the separated sister chromatids to the opposite poles is seen in:
I. Mitotic anaphase
II. Anaphase I
III. Anaphase II
1. Only I
2. Only I and II
3. Only III
4. Only I and III

91.

Microbodies in eukaryotic cells include all the following except:
1. Peroxisomes
2. Glycosomes
3. Lysosomes
4. Glyoxysomes

92.

Enzymes of the lysosomes are synthesised in the:
1. RER
2. SER
3. Golgi apparatus
4. Peroxisomes

93.

Consider the given two statements:
I. In competitive enzyme inhibition, the substrate and inhibitor cannot bind to the enzyme at the same time.
II. The inhibitor always has a much higher affinity for the active site than the normal substrate.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

94.

Match the structures in Cockroach given in Column I with their location in Column II and select the correct match from the codes given:

	COLUMN I		COLUMN II
A	Testes	P	6^{th} abdominal segment
B	Ovaries	Q	4^{th} – 6^{th} abdominal segments
C	Mushroom gland	R	6^{th} – 7^{th} abdominal segments
D	Spermatheca	S	2^{nd} – 6^{th} abdominal segments

Codes:

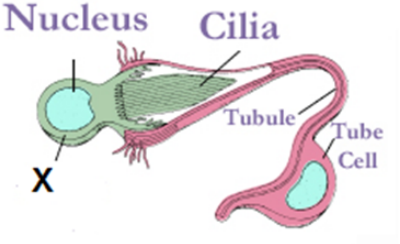
	A	B	C	D
1.	S	Q	R	P
2.	Q	S	R	P
3.	P	R	Q	S
4.	R	S	P	Q

95.

Consider the following two statements:
I. Enzyme catalyzed reactions are affected by the change in the temperature and pH.
II. Change in pH and temperature affects the tertiary structure of proteins.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

96.

The structure marked ‘X’ in the given diagram is [c.f. page 51 para 2; page 291 para 1]:



1. used in generating water current in sponges
2. a cell used for capturing prey in Cnidarians
3. a sticky cell used for anchorage in comb jellies
4. an excretory and osmoregulatory cell in flatworms

97.

A typical reptilian heart is shown by the figure:

1.	
2.	
3.	
4.	

98.

In metamerism, there is serial repetition of unit subdivisions of: [c.f. 4.1.5 page 48]
I. Ectoderm products
II. Mesoderm products
III. Endoderm products
1. Only II
2. Only I and II
3. Only II and III
4. I, II and III

99.

Consider the given two statements:
I. The atrial muscle mass in the human heart contract as a unit.
II. The atrial muscle mass is a multinucleate syncytium.
1. Both I and II are correct and II explains I
2. Both I and II are correct but II does not explain I
3. I is correct but II is incorrect
4. I is incorrect but II is correct

100.

Parapodia, found in annelids like *Nereis*, are [c.f.fig 4.1.1. (a) page 52]
1. paired, un-jointed lateral outgrowths that bear the chaetae
2. paired, jointed lateral outgrowths that bear the chaetae
3. paired, un-jointed lateral outgrowths that do not bear chaetae
4. un-paired, jointed lateral outgrowths that do not bear chaetae

Chemistry - Section A

101.

10 gram $CaCO_3$ is taken in a one litre container. Active mass of $CaCO_3$ will be (molecular weight of $CaCO_3$ = 100):

1. 0.1

2. 1

3. 0.01

4. 10

102.

Which among the following has the greatest number of atoms at NTP?

1. 5 ml CH_4

2. 20 ml N_2

3. 1 ml H_2O

4. 10 ml CO_2

103.

For a reaction, $A(g) \rightarrow 2B(g) + C(g)$; $\Delta H = 4kJ$ & $\Delta S = 10\ JK^{-1}$. At what temperature, is this reaction spontaneous?

1. >400 K
2. <400 K
3. 400 K
4. 27^oC

104.

For the given reaction: $H_2NCOONH_4\ (s) \rightleftharpoons 2NH_3\ (g) + CO_2\ (g)$,
total pressure at equilibrium is found to be 18 atmospheres. The value of K_p for the above equilibrium will be

1. $72\ atm^3$
2. $144\ atm^3$
3. $432\ atm^3$
4. $864\ atm^3$

105.

Assertion : For an exothermic reaction, the value of K_c decreases on increasing the temperature
Reason : Rate constant for a backward reaction increases more than the increase in the rate constant for a forward reaction

1. Both assertion and reason are true, and reason is the correct explanation of the assertion
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

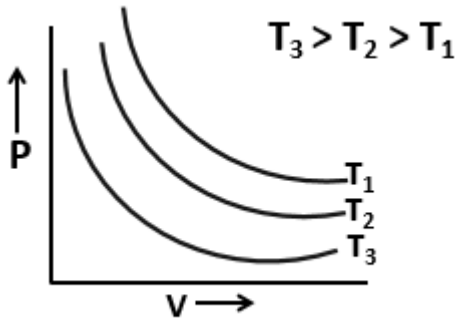
106.

The hydrolysis constant (K_H) of an aqueous solution of $CuSO_4$ will be ($K\omega$ =ionic product of water ; K_b = ionisation constant for base)

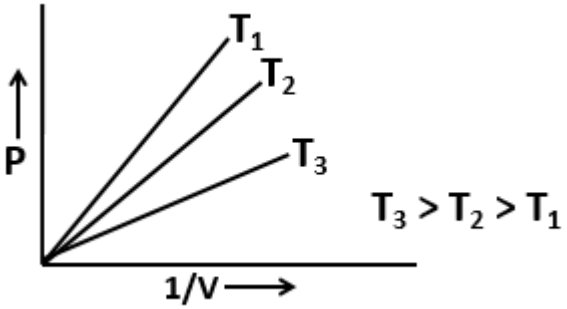
1. $\frac{K_\omega}{K_b}$
2. $\frac{K\omega^2}{K_b}$
3. $\frac{K\omega}{K_{b^2}}$
4. $\frac{K_b}{K\omega^2}$

107.

Which is the correct order of temperatures in the following graphs for Boyle's law ?

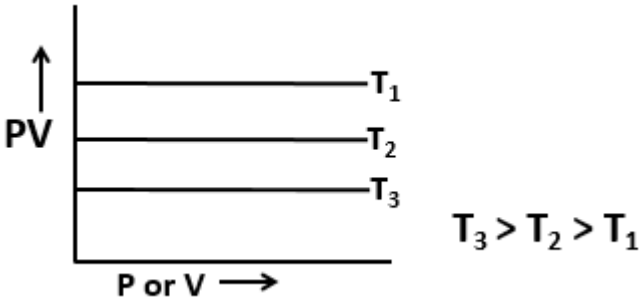


1.



2.

3.



4. All are incorrect order of temperature

108.

Solubilities of AgCl in 0.01M NaCl, 0.01M $CaCl_2$, 0.05M $AgNO_3$, pure water and in 0.01M NH_4OH are S_1 , S_2 , S_3 , S_4 and S_5 respectively. The correct order of these solubilities is

1. $S_1 > S_2 > S_3 > S_4 > S_5$
2. $S_3 > S_2 > S_1 > S_5 > S_4$
3. $S_5 > S_4 > S_1 > S_2 > S_3$
4. $S_5 > S_4 > S_3 > S_2 > S_1$

109.

At 4^oC , ionic product of water ($K\omega$) is 10^{-16} . At this temperature, a solution has pH = 7.5 . The nature of this solution at 4^oC will be

1. Acidic
2. Alkaline
3. Neutral
4. Cannot be predicted

110.

For any gas, the value of compressibility factor (Z) cannot be

1. $\frac{2}{8}$
2. $\frac{3}{8}$
3. $\frac{4}{8}$
4. $\frac{10}{8}$

111.

Which of the ions among the following is the largest in size?

1. Li^+ (aqueous)
2. Cs^+ (aqueous)
3. Li^+ (g)
4. Cs^+ (g)

112.

The degree of hydrolysis is highest for (K_a of CH_3COOH = K_b of NH_4OH = 1.8×10^{-5})

1. CH_3COONH_4
2. CH_3COONa
3. NH_4Cl
4. All of the above have the same degree of hydrolysis

113.

The bond order of C_2 molecule is two. Therefore, it can be concluded that it has a double bond. Consequently, it can also be concluded that C_2 molecule contains

1. Two sigma bonds
2. Two pi bonds
3. One sigma and one pi bond
4. Half sigma and one and half pi bond

114.

In which of the following case, does the entropy decrease?

1. Boiling of egg
2. Combustion of benzene at 27^oC
3. Combustion of benzene at 127^oC
4. Dissolution of sugar in water

115.

The heat of neutralisation of CH_3COOH and NaOH and NH_4OH and HCl are -50 and -51 kJ/mole respectively. The heat of neutralisation of CH_3COOH and NH_4OH will be

1. -101 kJ
2. -43.7 kJ
3. -50.5kJ
4. -57.3 kJ

116.

Which among the following molecule/ion has linear shape but hybridisation of the central atom is not exhibited to be sp?

1. CO_2
2. $BeCl_2$
3. I_3^-
4. All of these

117.

Which of the following is/are correct about isothermal expansion of work?

1. $\omega_{irreversible} = \omega_{reversible}$
2. $\omega_{irreversible} > \omega_{reversible}$
3. $\omega_{irreversible} < \omega_{reversible}$
4. All of thes above

118.

5.6 litre O_2 gas is mixed in 5.6 litre H_2 gas at NTP. The change in entropy will be

1. 1.44 J/K
2. 2.88 J/K
3. 5.76 J/K
4. 11.52 J/K

119.

Which of the following species has the highest bond energy?

1. N_2
2. CO
3. CO^+
4. N_2^+

120.

In the adduct of NH_3 and BF_3, the hybridised state of N and B, respectively, will be

1. sp^3 and sp^3
2. sp^3 and sp^2
3. sp^2 and sp^2
4. sp^2 and sp^3

121.

In solid PCl_5, the hybridised state of phosphorous will be

1. sp^3d
2. sp^3
3. sp^3 and sp^3d
4. sp^3 and sp^3d^2

122.

In which of the following transitions of hydrogen atom, radiation of minimum frequency is emitted ?

1. $n_2 = \infty$ to $n_1 = 1$
2. $n_2 = 2$ to $n_1 = 1$
3. $n_2 = 3$ to $n_1 = 2$
4. $n_2 = \infty$ to $n_1 = 3$

123.

The correct order of 3rd ionisation potential of Na , Mg, Al and Si will be

1. Si > Al > Mg > Na
2. Mg > Si > Al > Na
3. Mg > Na > Si > Al
4. Na > Mg > Si > Al

124.

The most basic oxide is

1. Bi_2O_3
2. Bi_2O_5
3. As_2O_3
4. Sb_2O_5

125.

In which of the following configurations, number of exchanges per electron is the highest?

1. p^6
2. d^5
3. d^{10}
4. f^7

126.

The pH of 10^{-6} M CH_3COOH will be (k_a of CH_3COOH = 1.8×10^{-5} & log 4.24 =0.63)

1. 5.37
2. 7
3. Slightly more than 6
4. 6.95

127.

According to van der Waal, some force of attraction is present in between the gas molecules. It concluded that

1. Pressure of real gas is less than pressure of ideal gas
2. Pressure of real gas is more than pressure of ideal gas
3. Pressure of real gas is equal to the pressure of ideal gas
4. Volume of real gas is more than the volume of ideal gas

128.

π bond of which of the following bond is strongest?

1. Double bond
2. Triple bond
3. Same strength in double as well as triple bond
4. Unpredictable & cannot be said

129.

Consider the reaction

a $K_2Cr_2O_7$ + b HCl $\rightarrow$ c KCl + d $CrCl_3$ + e H_2O + f Cl_2

The value of a,d & f, respectively, are

1. 2, 4, 8
2. 1, 2, 3
3. 2, 2, 3
4. 1, 2, 4

130.

Consider the balanced reaction
$3Zn + 8HNO_3 \rightarrow 3Zn(NO_3)_2 + 2NO + 4H_2O$

In this reaction equivalent weight of HNO_3 will be

1. 63
2. 84
3. 126
4. 31.5

131.

The mole fraction of a solute in an aqueous solution is 0.1. The molality of the solution, approximately, will be

1. 3.085
2. 6.17
3. 12.34
4. 24.68

132.

In chromium (Z=24), how many electrons are present in the subshell(s) with (n+l) value equal to 4?

1. 6
2. 7
3. 8
4. 1

133.

In K_3CrO_8 , the number of cyclic and non cyclic peroxide linkages respectively are

1. 4, 0
2. 3, 1
3. 2, 2
4. 1, 3

134.

The magnetic moment of Ni^{x+} is 2.84 BM. The value of x and electronic configuration of Ni^{x+} ,respectively, will be

1. 2 and $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^8$
2. 4 and $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
3. 2 and $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
4. 4 and $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^6$

135.

Assertion: Ortho nitrophenol is more volatile than para nitrophenol

Reason : In ortho nitrophenol , intramolecular as well as intermolecular hydrogen bonding is present while in para nitrophenol only intermolecular hydrogen bonding is present

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

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

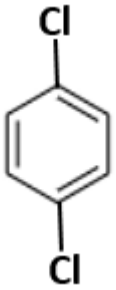
3. Assertion is true but reason is false

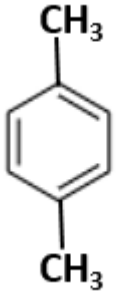
4. Both assertion and reason are false

Chemistry - Section B

136.

Which of the following has/have non zero dipole moment?

1. 

2. 

3. 

4. All have zero dipole moment

137.

The correct order of basic nature of conjugate bases is :

1. $H_2PO_2^- < H_2PO_3^- < H_2PO_4^-$

2. $H_2PO_2^- > H_2PO_3^- > H_2PO_4^-$

3. $H_2PO_2^- > H_2PO_3^- < H_2PO_4^-$

4. $H_2PO_2^- < H_2PO_3^- > H_2PO_4^-$

138.

In trimer of $SO_3(S_3O_9)$, six pi bonds are present. The type of all pi bonds present in S_3O_9 will be

1. 4 $p\pi - p\pi$ and 2 $d\pi - p\pi$
2. 3 $p\pi - p\pi$ and 3 $d\pi - p\pi$
3. 6 $d\pi - p\pi$
4. 2 $p\pi - p\pi$ and 4 $d\pi - p\pi$

139.

In which of the following neutralisation reactions, rise in temperature of the solution will be the highest?

1. 100 ml 0.1 M HCl + 150 ml 0.1 M NaOH
2. 50 ml 0.1 M HCl + 50 ml 0.1 M NaOH
3. 300 ml 0.1 M HCl + 400 ml 0.1 M NaOH
4. 75 ml 0.1 M HCl + 50 ml 0.1 M NaOH

140.

4.9 gram of $KClO_3$ is heated for some time. The weight loss was observed to be 0.192 gram. The percentage of $KClO_3$ decomposed is

1. 10%
2. 20%
3. 30%
4. 40%

141.

At equilibrium, which of the following is always zero?

1. ΔG_{system}
2. ΔS_{Total}
3. ΔS_{system}
4. Both (1) and (2)

142.

Ratio of the number of atoms in 4g CH_4 and 3g NH_3 is-

1. $\frac{68}{48}$
2. $\frac{85}{48}$
3. $\frac{48}{68}$
4. $\frac{48}{65}$

143.

In which of the following case, the heat of neutralisation is more than 13.7 k cal?

1. HCl and NaOH
2. HF and NaOH
3. CH_3COOH and NH_4OH
4. HI and NH_4OH

144.

Assertion : On heating PCl_5, it readily converts into PCl_3 and Cl_2

Reason : The axial P-Cl bond is larger than the equitorial P-Cl bond

1. Both assertion and reason are true, and reason is the correct explanation of the assertion
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

145.

The oxidation number of sulphur in H_2SO_4 and $H_2S_2O_8$ is +6 and +6 repectively. If H_2SO_4 is converted into $H_2S_2O_8$, then in this conversion which process occurs ?

1. Oxidation
2. Reduction
3. Neither oxidation nor reduction
4. Oxidation as well as reduction

146.

The IUPAC name of one super heavy element is ununquadium. The position of this element in periodic table is-

1. 12th group and 7th period
2. 16th group and 7th period
3. 14th group anf 7th period
4. 14th group and 6th period

147.

In a one litre container, pressure of dry N_2 gas is 600 mm of Hg and pressure of water vapours is 100 mm of Hg. So, total pressure is 700 mm of Hg. Now, volume of container increases from one litre to two litre and temperature becomes constant. Then, the final total pressure will be

1. 300 mm of Hg
2. 350 mm of Hg
3. 400 mm of Hg
4. 450 mm of Hg

148.

Case Study:

A buffer solution is defined as a solution whose pH remains practically constant even when small amounts of an acid or a base are added to it.
Types of buffer solutions :
(i) Acidic buffer: It is a solution of a mixture of a weak acid and a salt of this weak acid with a strong base (e.g. $CH_3COOH + CH_3COONa$)
(ii) Basic buffer: It is the solution of a mixture of a weak base and a salt of this weak base with a strong acid (e.g. $NH_4OH + NH_4Cl$)
Henderson's equation is used to determine pH of buffer mixtures of differ types:
for acidic buffer Henderson's equation is

$pH = pK_a + \log \frac{[Salt]}{[Acid]}$ (k_a = ionisation constant of weak acid)

for basic buffer Henderson's equation is :

$POH = Pk_b + \log \frac{[Salt]}{[Base]}$ (k_b = ionisation constant of weak base)

Which of the following mixtures acts as buffer?

1. 50 ml 0.1 M CH_3COOH + 50 ml 0.1 M NaOH
2. 100 ml 0.1 M CH_3COOH + 50 ml 0.1 M NaOH
3. 50 ml 0.1 M CH_3COOH + 100 ml 0.1 M NaOH
4. None of the above

149.

Case Study:

Based on the previous case study:

How many moles of HCl are required with 0.01 mole NaCN to prepare a buffer solution of pH =9?
(k_a of HCN = 1×10^{-10})

1. 0.009
2. 0.09
3. 0.9
4. Buffer solution cannot be formed

150.

Case Study:

Based on the previous case study:

When CH_3COONa is added in CH_3COOH solution, then pH of the solution

1. Decreases
2. Increases
3. Remains unchanged
4. First decreases and then increases

Physics - Section A

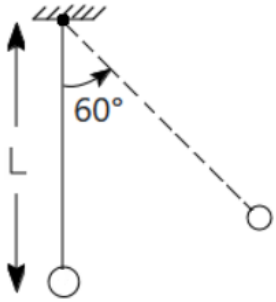
151.

A particle moves around a circle with uniform speed in every revolution, after the first revolution and during the 2nd revolution: its speed doubles; and during the 3rd revolution the speed becomes 3× the initial revolutions and so on. The time for the 1st revolution is 12s. The average time per revolution, for the first four revolutions, is

1. 4.8 s
2. 9.6 s
3. 6.25 s
4. 6 s

152.

The minimum speed that a simple pendulum's bob should be given so that it rises to a level where its string makes 60° with the vertical is,



1. $\sqrt{2gL}$
2. $\sqrt{2gL}$ cos60°
3. $\sqrt{2g(L - L\,cos60^\circ)}$
4. $\sqrt{2gL}$ sin60°

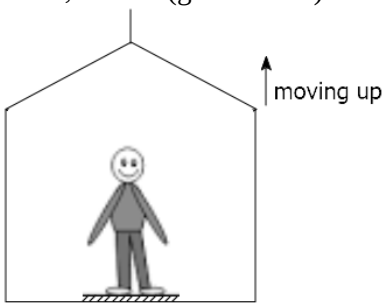
153.

The center of mass of a thin, uniform triangular lamina lies at its

1. Orthocenter
2. Circumcenter
3. Centroid
4. Incenter

154.

An elevator moving up is decelerating at 1 m/s^2. Then, the apparent 'weight' of a 50 kg man, on a weighing machine, will be (g = 10 m/s^2)



1. 55 kg

2. 45 kg

3. 40 kg

4. none of the above

155.

The diffusion equation is given by:

$$\frac{\partial n}{\partial t} = D\frac{\partial^2 n}{\partial x^2}$$

where n(x, t) is the concentration of particles per unit volume at position x, at time t. The dimension of the diffusion constant D, is,

1. LT^{-1}

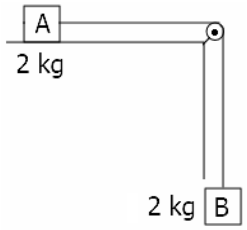
2. $L^{-1}T$

3. L^5T^{-1}

4. L^2T^{-1}

156.

The system consisting of the blocks A, B is released from rest. Assume that the strings, pulley are ideal and there is no friction. The block A moves horizontally, while B moves vertically down. The work done by tension on block A, when B descends through 1m is (g = 10 m/s^2)



1. 20 J

2. 40 J

3. 10 J

4. 5 J

157.

Find the unit of the ratio $\frac{E}{gB}$ where E = electric field, B = magnetic field, g = acceleration due to gravity.
Hint: F = qE, F = qvB

1. s^{-1}

2. s

3. m/s

4. s/m^2

158.

The moment of inertia of a uniform square lamina, of mass m, about one of its diagonals (diagonal-length: d) is

1. $\frac{md^2}{6}$

2. $\frac{md^2}{3}$

3. $\frac{md^2}{12}$

4. $\frac{md^2}{24}$

159.

A particle of mass 'm' is released from the origin, and it moves under the action of a force: $F(x) = F_0 - kx$

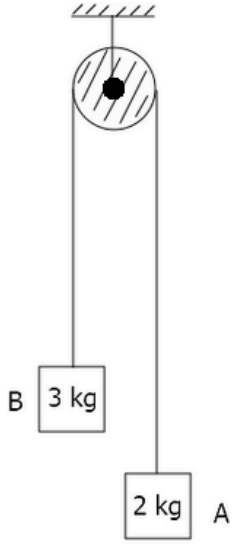
The maximum speed of the particle is, v =

1. $\sqrt{\frac{F_0^2}{mk}}$
2. $\sqrt{\frac{2F_0^2}{mk}}$
3. $\sqrt{\frac{F_0^2}{2mk}}$
4. $2\sqrt{\frac{F_0^2}{mk}}$

160.

The block A, B are connected as shown by an ideal string passing over a smooth pulley and released from rest. Take g = 10 m/s^2.

The acceleration of the block B, relative to A, will be



1. 5 m/s^2
2. 4 m/s^2
3. 2 m/s^2
4. 1 m/s^2

161.

A man driving a scooter at 15 m/s brakes at the rate of 2 m/s^2. His speed, after 10 s after the application of brakes will be

1. 5 m/s
2. -5 m/s
3. 0 m/s
4. 10 m/s

162.

A particle of mass 'm' is released from the origin, and it moves under the action of a force: $F(x) = F_0 - kx$

The position where it comes to a stop (i.e. speed = 0) is, x =

1. $\frac{F_0}{k}$
2. $\frac{2F_0}{k}$
3. $\frac{F_0}{2k}$
4. $\frac{-F_0}{2k}$

163.

The average force needed to accelerate a car weighing 500 kg from rest to 36 km/h through a distance of 25 m, up a 30° incline is (g = 10 m/s^2):

1. 1000 N
2. 2500 N
3. 1500 N
4. 3500 N

164.

The moment of inertia of a uniform solid sphere of mass m and radius R about a diameter equals the moment of inertia of a solid uniform cylinder of radius r and height 2r, about its axis. Their masses are the same. Then

1. $3r^2 = 4R^2$

2. $3r^2 = 2R^2$

3. $5r^2 = 2R^2$

4. $5r^2 = 4R^2$

165.

The net work done by all forces (internal and external) equals the change in

1. potential energy

2. kinetic energy

3. total energy

4. kinetic energy and conservative potential energy

166.

If the rate of rotation of the earth were to increase, the apparent acceleration due to gravity on the equator would

1. increase

2. decrease

3. remain unchanged

4. change in direction away from the center

167.

Assertion: Angular Momentum of an isolated system of particles is conserved.

Reason: The net torque on an isolated system of particles is zero and the rate of change of angular momentum equals the torque.

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

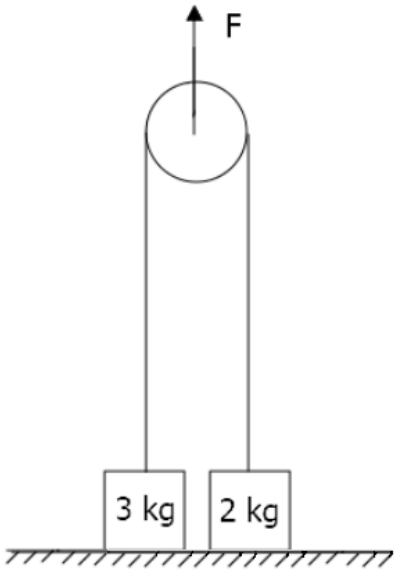
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion.

3. Assertion is true but reason is false.

4. Assertion is false but reason is true.

168.

The two blocks are at rest on a smooth horizontal plane and are connected by strings passing over a smooth light pulley as shown. The strings are vertical while the force F, applied to the pulley is vertical. For what minimum value of F will the 2 kg block be lifted off? ($g = 10\ m/s^2$)



1. 20 N

2. 30 N

3. 25 N

4. 40 N

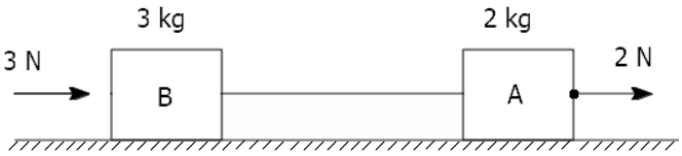
169.

A particle of mass m collides with another particle of mass m', which is at rest and the combined mass moves with 10% reduction in velocity. The ratio of the masses is

1. $\frac{m'}{m} = \frac{1}{10}$
2. $\frac{m'}{m} = \frac{1}{9}$
3. $\frac{m'}{m} = \frac{1}{8}$
4. $\frac{m'}{m} = \frac{1}{2}$

170.

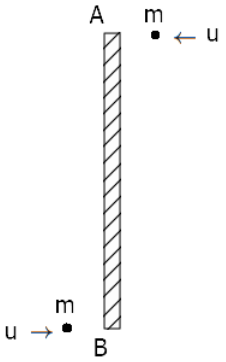
The two blocks A, B are placed on a smooth horizontal plane, with the string initially just taut. Forces are applied as shown. The tension in the string is



1. 5 N
2. 2 N
3. 1 N
4. 0 N

171.

A uniform rod of mass m and length L is struck at both ends by two particles of masses m, each moving with identical speeds u, but in opposite directions, perpendicular to its length. The particles stick to the rod after colliding with it. The system rotates with an angular speed



1. $\frac{u}{L}$
2. $\frac{2u}{L}$
3. $\frac{12u}{7L}$
4. $\frac{6u}{L}$

172.

The center of mass of a thin conical surface of height h lies at a distance λh from its apex, the base of the cone being hollow. The value of λ equals

1. $\frac{1}{2}$
2. $\frac{2}{3}$
3. $\frac{3}{4}$
4. $\frac{2}{5}$

173.

Two identical mass planets (mass : m) move around a star (mass : M) in a circular orbit of radius r, in a symmetrical manner. The orbital speed of the planets is

1. $\sqrt{\frac{2GM}{r}}$

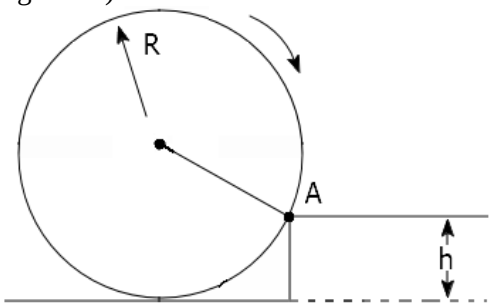
2. $\sqrt{\frac{5GM}{4r}}$

3. $\sqrt{\frac{G(M+m)}{r}}$

4. $\sqrt{\frac{G(M+m/4)}{r}}$

174.

A uniform solid wheel of mass m, radius R encounters a rectangular step of height h. The torque of the weight mg, of the wheel, about the forward edge of the step (A) is (in magnitude)



1. mgR

2. mg(R - h)

3. mgh

4. mg$\sqrt{h(2R-h)}$

175.

If a particle is projected vertically upward with a speed u, and rises to a maximum altitude h above the earth's surface then (g = acceleration due to gravity at surface)

1. $h > \frac{u^2}{2g}$

2. $h = \frac{u^2}{2g}$

3. $h < \frac{u^2}{2g}$

4. Any of the above maybe true, depending on the earth's radius

176.

'A' throws a ball towards B, who then catches it across the field. 'B' throws the ball back towards A, who then catches it. The angle of the throw is 30° for A, while it is 60° for B's throw. The ratio of their speeds of throw, V_A : V_B is

1. 3

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

3. $\sqrt{3}$

4. 1

177.

A particle moves along a straight line so that its velocity(v) is directed towards a fixed point on its path and is proportional to its distance (x) from that point. Its acceleration is proportional to

1. x

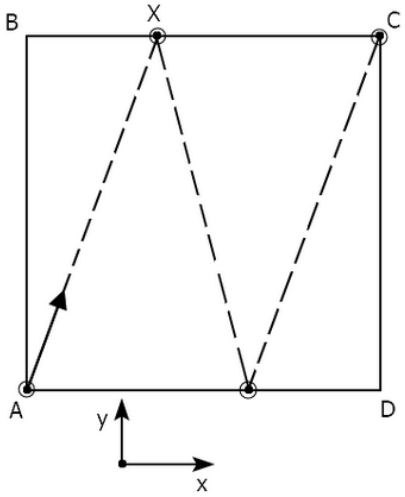
2. $\frac{1}{x}$

3. $\sqrt{x}$

4. $\frac{1}{\sqrt{x}}$

178.

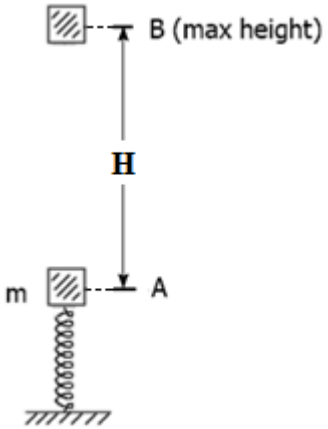
Consider a square carrom board ABCD of size 3ft × 3ft. A piece moves 'from' a pocket A (close from a pocket), strikes the side BC and then the side AD and reaches the pocket C. If the piece is reflected perfectly from each side, then the ratio of the x, y components of velocity is given by $\frac{V_x}{V_y} =$



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

179.

A small block of mass 'm' is placed against a compressed spring, of spring constant k. The initial compression in the spring is 'd'. The block is released and the spring relaxes, while the block is projected up to a height H relative to its initial position. Then, H =



1. $\frac{kd^2}{2mg}$
2. $\frac{kd^2}{2mg} + d$
3. $\frac{kd^2}{2mg} - d$
4. $\frac{kd^2}{mg} + d$

180.

Which of the following equations is dimensionally correct?

$(I)\ v = \sqrt{\frac{P}{\rho}}$ $(II)\ v = \sqrt{\frac{mgl}{I}}$ $(III)\ v = \frac{Pr^2}{2\eta l}$

where v = speed, P = pressure, r, l are lengths; ρ = density, m = mass, g = acceleration due to gravity, I = moment of inertia, and η = coefficient of viscosity

1. $I\ and\ II$
2. $I\ and\ III$
3. $II\ and\ III$
4. $I,\ II\ and\ III$

181.

Two projectiles are launched, one at twice the speed of the other; the slower one at 30° and the faster one at 60°. Their horizontal ranges are in the ratio (slower : faster)

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

2. $\frac{1}{4}$

3. $\frac{1}{6}$

4. $\frac{1}{12}$

182.

An astronaut, in a space shuttle, orbiting close to the earth's surface (take g = 10 m/s^2) - suddenly fires his engines so as to give him a forward acceleration of $\frac{3g}{4}$ along the direction of his motion. At that instant, his apparent weight is

1. 25% more

2. 25% less

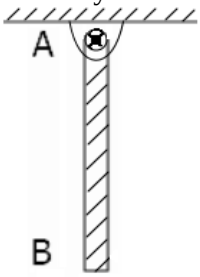
3. 75% more

4. 75% less

then his real weight.

183.

A rod of mass M and length L is suspended vertically at its highest point. The rod is held so that it is horizontal and free to rotate about A and then released. There is no friction anywhere.



The kinetic energy of the rod, when it reaches the lowest position, is

1. MgL

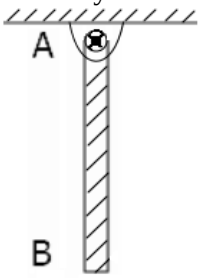
2. $\frac{MgL}{2}$

3. $\frac{2}{3}MgL$

4. $\frac{MgL}{12}$

184.

A rod of mass M and length L is suspended vertically at its highest point. The rod is held so that it is horizontal and free to rotate about A and then released. There is no friction anywhere.



The angular speed of the road, when it reaches its lowest position, is ω. Then ω^2=

1. $\frac{g}{L}$

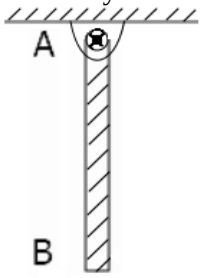
2. $\frac{2g}{L}$

3. $\frac{3g}{L}$

4. $\frac{12g}{L}$

185.

A rod of mass M and length L is suspended vertically at its highest point. The rod is held so that it is horizontal and free to rotate about A and then released. There is no friction anywhere.



The force exerted by the hinge at A, when the rod is at its lowest position, is

1. 2 Mg

2. 3 Mg

3. 4 Mg

4. 2.5 Mg

Physics - Section B

186.

Assertion: If the sun were to 'suddenly' be removed, then the earth would continue to move around in its orbit.

Reason: Angular momentum of a system of particles is conserved when there is no external torque.

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

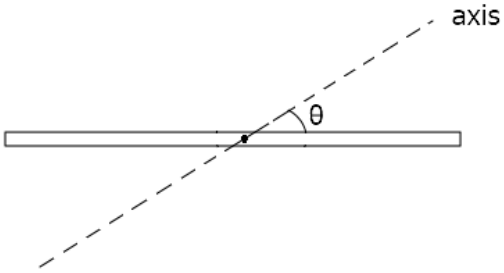
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion.

3. Assertion is true but reason is false.

4. Assertion is false but reason is true.

187.

The moment of inertia of a uniform rod of mass m and length L, about an axis passing through its center and making an angle θ with the rod is



1. $\frac{mL^2}{12}cos^2\theta$

2. $\frac{mL^2}{12}sin^2\theta$

3. $\frac{mL^2}{12}cos\theta$

4. $\frac{mL^2}{12}sin\theta$

188.

The acceleration due to gravity on the surface of the earth, g = 10 m/s^2. The value in km/(minute)^2 is

1. 36

2. 0.6

3. $\frac{10}{6}$

4. 3.6

189.

A projectile launched at an angle θ is observed to move at an angle of 45° with the vertical (upward) at some point on its trajectory.
If the launch angle θ was increased, then the horizontal range

1. decreases

2. increases

3. first increases then decreases

4. first decreases then increases

190.

The acceleration due to gravity, g, near a spherically symmetric planet's surface decreases with height, h according to the relation:

$g(h) = g_s - k \cdot h$, where $h \ll$ the radius of the planet.

The escape speed from the planet's surface is

1. $\frac{g_s}{2\sqrt{k}}$
2. $\frac{g_s}{\sqrt{k}}$
3. $\frac{2g_s}{\sqrt{k}}$
4. $g_s\sqrt{\frac{2}{k}}$

191.

Assertion: The net work done by gravity is equal to the loss in the vertical component of the kinetic energy, for a projectile.

Reason: The work energy theorem applies to all systems, including projectiles.

1. Both assertion and reason are true, and reason is the correct explanation of the assertion.
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion.
3. Assertion is true but reason is false.
4. Assertion is false but reason is true.

192.

A boy throws a ball straight up the side of a building and receives it after 4s. On the other hand, if he throws it so that it strikes a ledge on its way up, it returns to him after 3s. The ledge is at a distance d below the highest point, where d = (take acceleration due to gravity, g = 10m/s^2)

1. 5 m
2. 2.5 m
3. 1.25 m
4. 10 m

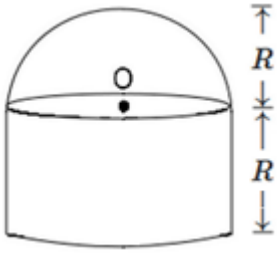
193.

A man drifting on a raft on a river observes a boat moving in the same direction at a relative speed which is 3 times the speed of the river's flow of 3 km/h. The boat overtakes him at a certain moment and reaches a point downstream after a time T_B while he reaches the same point after T_A = 3 hr. Then, T_B =

1. 1 hr
2. $\frac{1}{2}$ hr
3. $\frac{2}{3}$ hr
4. $\frac{3}{4}$ hr

194.

The center of mass of a combination of a hemispherical shell and a cylindrical shell, both having the same height and radii and same mass, lies at a distance h, from the center of the hemisphere. Then, h equals



1. $\frac{R}{2}$
2. $\frac{R}{\pi}$
3. $\frac{2R}{\pi}$
4. zero

195.

A projectile is launched from a cliff of height h, with an initial speed u, at angle θ. The speed with which its hits the ground

1. depends on the vertical component, $usin\theta$

2. depends on the horizontal component, $ucos\theta$

3. depends on u, but not on θ

4. depends on the quantity $utan\theta$

196.

A ball of mass m falls from a height h onto the ground and rebounds to a height $\frac{h}{4}$. The impulse on the ball from the ground has the magnitude

1. $\frac{3}{4}m\sqrt{2gh}$

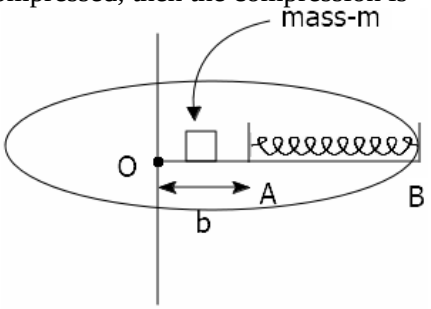
2. $\frac{5}{4}m\sqrt{2gh}$

3. $\frac{3}{2}m\sqrt{2gh}$

4. $\frac{1}{2}m\sqrt{2gh}$

197.

The mass 'm' can slide along a smooth radial groove in a horizontal turntable; at the other end is attached a spring - so that the mass 'm' presses against the spring as it moves 'outward'. The free-end (A) of the spring is at a distance 'b' from the center and the spring constant is 'k'.
If the turntable is rotated with an angular speed ω, and the mass 'm' is in 'equilibrium' with the spring compressed, then the compression is



1. $\frac{m\omega^2 b}{k}$

2. $\frac{m\omega^2 b}{k-m\omega^2}$

3. $\frac{m\omega^2 b}{m\omega^2-k}$

4. $\frac{m\omega^2 b}{m\omega^2+k}$

198.

Trains travel between station A and station B: on the way up (from A to B) - they travel at a speed of 80 km/h, while on the return trip the trains travel at twice that speed. The services are maintained round the clock. Trains leave station A every 30 min for station B, and reach B in 2 hr. All trains operate continuously, without any rest at A or B.

1. The frequency of trains leaving B must be twice as much as A

2. The frequency of trains leaving B must be half as much as A

3. The frequency of trains leaving B is equal to that at A

4. The situation is impossible to maintain, unless larger number of trains are provided at A

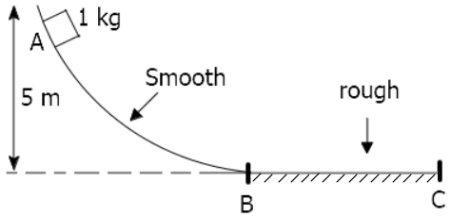
199.

Two identical projectiles A, B launched 'towards' each other collide head-on, elastically at their highest points and return to their respective points of projection. Their angles of projection were θ_A=30° and θ_B=45°. Their speeds are in the ratio ($V_A : V_B$ =)

1. 2 : 3
2. 3 : 2
3. $\sqrt{2} : \sqrt{3}$
4. $\sqrt{3} : \sqrt{2}$

200.

A block of 1 kg is released from a top of a smooth curve AB, and then it encounters a rough surface BC, coming to rest at C. The work done by friction is (g = 10 m/s^2)



1. 25 J
2. 50 J
3. -25 J
4. -50 J