Botany - Section A

1.

Match each essential element given in Column I with its known function in plants given in column II and select the correct match from the codes given:

COLUMN I		COLUMN II
A. Calcium	P.	Water splitting reaction in photosynthesis
B. Boron	Q.	Synthesis of the middle lamella
C. Chlorine	R.	Nitrogen metabolism
D. Molybdenum	S.	Pollen germination

Codes:

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

2.

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

COLUMN I		COLUMN II
A Auxins	P	Indole compounds
B. Cytokinins	Q	Skoog and Miller
C. Gibberellins	R	Terpenes
D. Ethylene	S	Cousins

Codes:

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

3.

The number of molecules of oxygen gas used during the glycolysis of one glucose molecule is:
1. 0
2. 1
3. 6
4. 36

4.

In a cytochrome molecule, which of the following actually accepts and releases electrons?
1. oxygen
2. zinc
3. carbon
4. iron

5.

The primary role in abscission in majority of the plants is played by:
1. ABA and ethylene
2. Auxin and ethylene
3. Auxin and ABA
4. Cytokinin and auxin

6.

Any mineral ion concentration is considered toxic to a plant if that concentration reduces the dry weight of the tissues of this plant by about:
1. 1 %
2. 5 %
3. 7 %
4. 10 %

7.

The number of steps in the Kreb's cycle where oxidative decarboxylation takes place is:
1. 1
2. 2
3. 3
4. 6

8.

In the electron transport system in the mitochondria, oxygen acts as a:
I. final acceptor of electrons
II. final acceptor of protons
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

9.

After vernalization:
1. flowering is always immediately induced in the plants
2. may require additional seasonal cues or weeks of growth before they will actually flower
3. seeds cannot germinate in spite of favorable environmental conditions
4. flowering is suppressed in the plants

10.

Based on the figures given below, calculate the efficiency of the process of aerobic cellular respiration in a eukaryotic cell:
I. The total yield is 32 ATP molecules
II. Complete oxidation of a mole of glucose releases 686 kcal or energy under standard conditions.
III. Phosphorylation of ADP to form ATP stores at least 7.3 kcal per mole of ATP
1. 3.5 %
2. 32 %
3. 34 %
4. 51 %

11.

Consider the given two statements:
I. The oxygenation reaction of RuBisCO is a wasteful process.
II. 3-phosphoglycerate is not created.
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

12.

Given below is a list of ten elements required by the plants. The numbers of macronutrients, micronutrients, and beneficial elements in the given list respectively are:
Iron, Selenium, Sulphur, Manganese, Silicon, Zinc, Nickel, Magnesium, Potassium, Sodium

1. 4, 3, and 3
2. 3, 3, and 4
3. 3, 4 and 3
4. 3, 5 and 2

13.

The changes in turgor pressure in guard cells result primarily from the reversible absorption and loss of:
1. H^+
2. K^+
3. Cl^-
4. $HCO3^-$

14.

Porins:
1. form channels in the cell walls of gram-positive bacteria
2. are large enough to allow diffusion of specific molecules
3. are also found in the inner membrane of mitochondria
4. allow passage of only hydrophobic molecules

15.

For the same amount of carbon dioxide fixed, a C_4 plant loses:
1. ¼ as much water as a C_3 plant
2. ½ as much water as a C_3 plant
3. equal amount of water than a C_3 plant
4. twice the amount of water than a C_3 plant

16.

The cells of which of the following regions in the root are primarily involved in the formation of nodules where the nitrogen-fixing bacteria live?
1. Epidermis
2. Cortex
3. Endodermis
4. Vascular cylinder

17.

In all living organisms, synthesis of coenzyme A requires ATP, pantothenate [vitamin B5] and:
1. cysteine
2. cholesterol
3. lecithin
4. tryptophan

18.

When oxygen is not available to a cell, NADH formed during glycolysis:
1. does not undergo any change as there is no need for the cell to regenerate NAD+
2. passes electrons to the electron transport system
3. passes hydrogen atoms to pyruvic acid
4. passes electrons and hydrogen atoms to acetyl coA

19.

In drought-prone areas, sprays of which of the following can be used as anti-transpirant?
1. ABA
2. GA3
3. IAA
4. Benzyl amino purine

20.

Consider the given two statements:
I. The deficiency symptoms nitrogen, potassium, and magnesium are visible first in the young leaves.
II. They are readily mobilized from young leaves to the older senescent leaves in plants.
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. Both I and II are incorrect

21.

Consider the given two statements:
I. No single prokaryotic cell can carry out both photosynthesis and nitrogen fixation.
II. Oxygen released during photosynthesis irreversible damages nitrogenase.
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 and II is incorrect
4. Both I and II are incorrect

22.

All the following regarding diffusion, as a means of transport, are true except:
1. Molecules move in a random fashion
2. It is not dependent on a living system
3. Diffusion of solids rather than diffusion in solids is more likely
4. It is the only means of gaseous movement within the plant body

23.

If you consider the overall flow of electrons in the light reactions, it can best be described as from:
1. Glucose to oxygen
2. PS I to PS II
3. Antenna complex to the reaction centre
4. Water to NADPH

24.

Identify the incorrect match:

		C_3 plants	C_4 plants
1.	Primary carbon dioxide acceptor	RuBP	PEP
2.	Primary carbon dioxide fixation product	PGA	OAA
3.	Presence of PEPcase	NO	Yes
4.	Cell type in which initial carboxylation reaction occurs	Mesophyll	Bundle sheath

25.

Like mitochondria, the chloroplasts:
I. have their own DNA
II. have an analogous inner membrane
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

26.

Electrons carried by NADH enter the electron transport system when they are transferred to:
1. FMN
2. Ubiquinone
3. Fe-S
4. FAD

27.

What is the direct source of energy for the production of ATP by ATP synthase?
1. the electron transport chain
2. the proton gradient
3. substrate-level phosphorylation
4. the oxidation reactions occurring during respiration

28.

Plant experimentally grown in a growth medium die when the medium lacks boron but does well when boron is added at a low concentration of 5 ppm in the medium. Boron should thus be classified as:
1. An essential macronutrient
2. A non-essential macronutrient
3. An essential micronutrient
4. A non-essential micronutrient

29.

Consider the following statements regarding seed dormancy:
I. Seed dormancy is the state in which a seed is unable to germinate, even under favorable growing conditions.
II. True dormancy or innate dormancy is caused by conditions within the seed that prevent germination under normally ideal conditions.
1. Only I is correct
2. Only Ii is correct
3. Both I and II are correct
4. Both I and II are incorrect

30.

Three minerals are needed for the proper functioning of Photosystem II. Identify the correct option:
1. Zinc in chlorophyll; Iron in cytochrome and Manganese in plastocyanin
2. Magnesium in chlorophyll; Iron in cytochrome and Manganese in plastocyanin
3. Magnesium in chlorophyll; Iron in cytochrome and Copper in plastocyanin
4. Potassium in chlorophyll; Iron in cytochrome and Cobalt in plastocyanin

31.

What would be true for pressure potential, a component of water potential, in plants?
I. Pressure potential increases as water enter a cell.
II. The pressure potential in a plant cell is usually positive.
III. Negative pressure potentials occur when water is pulled through an open system such as a plant xylem vessel.
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

32.

In a photosystem:
1. The reaction centre is where light is captured, while the antenna complex is where this light energy is transformed into chemical energy.
2. The antenna complex is where light is captured, while the reaction centre is where this light energy is transformed
into chemical energy.
3. The antenna complex is where light energy is captured and transformed into chemical energy.
4. The reaction centre is where light energy is captured and transformed into chemical energy.

33.

In most seeds, the ratio of which of the following pair of PGRs determines whether the embryo remains dormant or germinates?
1. ABA and GA
2. Auxin and Cytokinin
3. Auxin and GA
4. ABA and Cytokinin

34.

Who, amongst the following, was the first scientist to discover that plants give off oxygen as a result of splitting water molecules during photosynthesis, not carbon dioxide molecules as thought before?
1. C. B. Van Niel
2. T. W. Engelmann
3. Robert Hill
4. Jan Ingenhousz

35.

The numbers of FADH2, ATP, Carbon dioxide and NADH molecules produced in a single turn of citric acid cycle respectively are:
1. One, Two, Three and Four
2. One, One, Two and Three
3. One, Two, Two and Three
4. Two, One Two and Three

Botany - Section B

36.

When parenchyma cells are grown in tissue culture in a medium not containing any PGRs:
1. the cells divide but do not differentiate
2. the cells divide and get differentiated
3. the cells enlarge but do not divide or differentiate
4. the cells die

37.

A plant cell with a solute potential of -0.4 MPa and a pressure potential of 0.2 MPa is placed in a chamber filled with pure water that is pressurized with 0.5 MPa.
1. Water will move out of the cell
2. Water will flow into the cell
3. There would be no movement of water
4. The cell will burst

38.

Water can only pass through the endodermis by:
1. moving within the casparian strips
2. crossing the membrane of endodermal cells twice
3. moving within the non-suberized portions of the cell walls
4. crossing the membrane of endodermal cells twice

39.

In aerobic cellular respiration:
1. all oxygen in water given off comes from the water used in the process
2. all oxygen in water given off comes from the glucose dismantled in the process
3. all oxygen in water given off comes from the oxygen gas acquired from the air during breathing
4. oxygen in water given off comes from both the water used in the process and the glucose dismantled in the process

40.

Two statements are given below. Each statement has an assertion and a reason. Give your answer as
I. At night, transpiration usually does not occur, because most plants have their stomata closed.
II. When there is a high soil moisture level, water will enter plant roots, because the water potential of the roots is lower than in the soil solution.
1. In both statements the reasons given correctly explain the respective assertions.
2. In both statements although the assertions and reasons are true but reasons given do not correctly explain the respective assertions.
3. In both statements only the assertions are true.
4. In both statements neither the assertions nor the reasons given are true

41.

What would be true when comparing the processes of anaerobic respiration and fermentation?
I. Both processes do not use oxygen.
II. An electron transport chain is used in anaerobic respiration but not in fermentation.
1. Only I
2. Only II
3. Neither I nor II
4. Both I and II

42.

Osmotic pressure is the basis of filtering ("reverse osmosis"), a process commonly used in water purification. The water to be purified is placed in a chamber and put under an amount of pressure:
1. greater than the osmotic pressure exerted by the water and the solutes dissolved in it.
2. lesser than the osmotic pressure exerted by the water and the solutes dissolved in it.
3. equal to the osmotic pressure exerted by the water and the solutes dissolved in it.
4. There is no such relation

43.

Consider the two given statements:
I. Turgor pressure is caused by the osmotic flow of water and occurs in plants, fungi, bacteria, and some protist cells but not in animal cells.
II. Animal cells do not have a single, large central vacuole.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

44.

Consider the following two statements:
I. When an air bubble forms within the xylem it can no longer transport water upward from the soil.
II. Water above the bubble will not be pulled up in such cases.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

45.

Consider the given two statements:
I. The term ‘carbohydrate’ meaning ‘hydrated carbon’ is a misnomer.
II. In the synthesis of such molecules, a water molecule is simply attached to each carbon atom.
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 and II is incorrect
4. Both I and II are incorrect

46.

It is thought that the selective breeding (albeit unconscious) of crop strains that were the key drivers of the "green revolution" in the 1960s were deficient in the synthesis of:
1. ABA
2. Gibberellins
3. Auxins
4. Cytokinins

47.

Consider the following two statements:
I. Plants with C_3 pathway have a single type of photosynthetic cell: the mesophyll cell.
II. Their bundle sheath cells do not contain chloroplasts.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

48.

As long as most stomata remain open, transpiration is greatest on a day that is:
1. sunny, warm, moist and windy
2. sunny, warm, dry and windy
3. cloudy, cool, moist and still air
4. sunny, cool, dry and still air

49.

In the citric acid cycle, succinate is oxidized to fumarate by an enzyme located in the:
1. outer mitochondrial membrane
2. intermembrane space
3. inner mitochondrial membrane
4. matrix

50.

Each plant has a different length critical photoperiod, which basically means:
1. critical night length
2. critical day length
3. critical temperature range during the day
4. critical night length in northern hemisphere and critical day length in southern hemisphere

Zoology - Section A

51.

What differentiates kwashiorkor from marasmus?
I. There is sufficient calorie intake in kwashiorkor
II. There is oedema in Kwashiorkor
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

52.

The partial pressures are not equal:
1. for oxygen in deoxygenated blood and tissues
2. for oxygen in alveoli and oxygenated blood
3. for carbon dioxide in alveoli and oxygenated blood
4. for carbon dioxide in deoxygenated blood and tissues

53.

If the heart rate is 60 per minute, the duration of each cardiac cycle will be:
1. 0.8 seconds
2. 0.75 seconds
3. 1.0 second
4. 1.2 second

54.

The trachea is surrounded by 16 to 20 incomplete and C-shaped rings of:
1. Hyaline cartilage
2. Elastic cartilage
3. Fibrous cartilage
4. Calcified cartilage

55.

The tunica media in veins when compared to the tunic media in arteries:
1. is much thinner
2. is much thicker
3. is equally developed
4. is absent

56.

Which of the following is not associated with the mucosal layer in the wall of the human alimentary canal?
1. Brunner’s glands
2. Crypts of Lieberkuhn
3. Gastric glands
4. Goblet cells

57.

Persons with AB blood type can:
1. donate blood to persons with all blood types as neither A nor B antigens are present on their RBCs
2. receive blood from persons with all blood types as neither A nor B antigens are present on their RBCs
3. receive blood from persons with all blood types as neither A nor B antigens are present on their RBCs
4. receive blood from persons with all blood types as neither anti-A nor anti-B antibodies are present on his blood plasma

58.

Both cortisol and insulin:
I. favour protein anabolism
II. Cause proteolysis
III. Reduce the uptake of amino acids by the body cells
1. Only I and II are correct
2. Only I and II are correct
3. I, II and III are correct
4. I, II and III are incorrect

59.

In humans, the systemic circulation begins when the blood leaves the:
1. Right atrium
2. Left atrium
3. Left ventricle
4. Right ventricle

60.

All the following are related to the limbic system in the human brain except:
1. Amygdala
2. Hippocampus
3. Olfactory bulb
4. Corpus callosum

61.

Match the disorder given in Column I with the feature most closely related to the disorder in Column II and select the correct match from the codes given:

	COLUMN I		COLUMN II
A	Asthma	P	Inflammation of bronchi and bronchioles
B	Emphysema	Q	Damage to alveolar walls
C	Occupation lung disease	R	Pulmonary fibrosis

Codes

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

62.

Hypothalamus:
1. is a basal part of the telencephalon, forebrain.
2. contains several groups of neurosecretory cells called nuclei which produce hormones
3. is connected to the neurohypophysis by a portal circulation
4. is the location of the respiratory rhythm center

63.

Identify the correct statement:
1. Unmyelinated neurons in PNS are not surrounded by Schwann cell
2. Electrical synapses, being faster, are more common in the human body
3. Pia mater is in contact with the brain tissue
4. The entire hindbrain and the midbrain constitute the brain stem

64.

The regulation of GFR involves hormonal feedback mechanisms involving all the following except:
1. Heart
2. Lungs
3. Hypothalamus
4. Kidney

65.

If the resting membrane of an excitable cell is made permeable to all ions, which of the following is least likely to happen?
1. Efflux of potassium
2. Influx of sodium
3. Influx of chloride
4. Efflux of sodium

66.

The spine of the scapula bone is located on its:
1. lateral border
2. medial border
3. ventral surface
4. dorsal surface

67.

Which of the following hormones is not a steroid and yet does not act on the target cells through a second messenger?
1. Corticotropin
2. Cortisol
3. Iodothyronines
4. Estrogen

68.

The part of the human respiratory tract that is not included in the conducting zone is the:
1. Pharynx
2. Bronchi
3. Larynx
4. Respiratory bronchiole

69.

Consider the following statements:
I. Impulses travel by visceral nervous system from the CNS to the viscera and from the viscera to the CNS
II. Impulses travel by autonomic nervous system from the CNS to the involuntary organs and smooth muscles of the body
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

70.

Which of the following joints is not expected to allow any movement?
1. Sutures in skull
2. Joint between adjacent vertebra
3. Gliding joint
4. Joint between carpal and metacarpal of thumb

71.

Identify the correct statement:
1. Enterokinase activates all pancreatic proteolytic enzymes
2. Proenzymes are secreted only by the pancreas
3. Bile activates lipases secreted by the liver
4. Disaccharidases are brush border enzymes

72.

Dwarfism can be caused by the deficiency, during childhood, of:
I. Growth hormone
II. Thyroid hormones
1. Only I and the dwarf will have normal mental development
2. Only II and the dwarf will also be mentally retarded
3. Both I and II and in both cases the mental development will be affected
4. Both I and II and mental development will be effected only in II.

73.

Consider the two statements:
I. The retina contains three layers of cells - from outside to inside – ganglion cells, bipolar cells, and photoreceptor cells.
II. The macula of the semicircular canals and the crista of saccule and utricle are receptors of the vestibular apparatus.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

74.

Potassium ions
I. are filtered at the glomerulus
II. are reabsorbed at the PCT
III. are secreted at DCT
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

75.

Identify the correctly matched pair:

	Part of the pituitary	Hormone synthesized
I.	Pars distalis	Gonodotropin releasing hormone
II.	Pars intermedia	Melanocyte stimulating hormone
III.	Pars nervosa	ADH and oxytocin

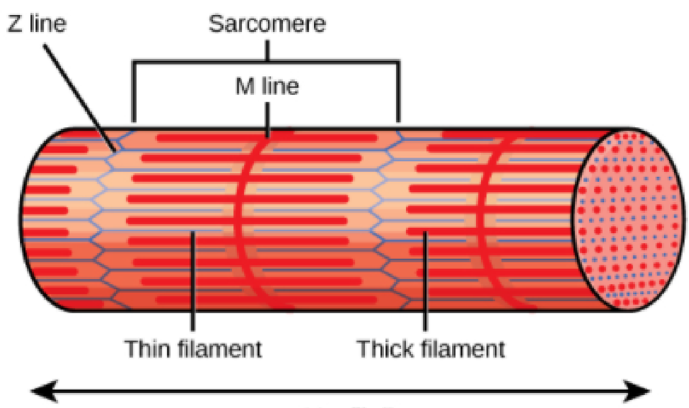
1. Only III
2. Only II
3. Only I and II
4. Only II and III

76.

In the human alimentary canal:
A. Oesophagus opens into the fundic region of stomach
B. Ceacum opens into the colon
C. Ileum opens into the large intestine
1. Only C is correct
2. Only A is correct
3. Both A and C are correct
4. Only B and C are correct

77.

The structure shown in the given diagram is a:



1. Muscle fibre
2. Myofibril
3. Myofilament
4. Myoblasts

78.

A morphological arrangement in which the base of the tooth is completely enclosed in a deep socket of bone is called as:
1. Acrodont
2. Thecodont
3. Pleurodont
4. Heterodont

79.

Consider the two statements:
I. Gastric juice in human adults does not contain rennin.
II. Human adults cannot digest milk protein.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

80.

An abnormal increase in the secretion of aldosterone will lead to:
1. An increased concentration of sodium in the blood and a reduced blood pressure
2. An increased concentration of potassium in the blood and a reduced blood pressure
3. A decreased concentration of sodium in the blood and an elevated blood pressure
4. A decreased concentration of potassium in the blood and an elevated blood pressure

81.

Urea can be used in humans to increase the osmolarity primarily in:
1. Blood
2. Renal cortex
3. Renal medulla
4. Urinary bladder

82.

In haemodialysis, the cleared blood is pumped back to the body:
1. through a vein after adding heparin
2. through a vein after adding anti-heparin
3. through an artery after adding heparin
4. through an artery after adding anti-heparin

83.

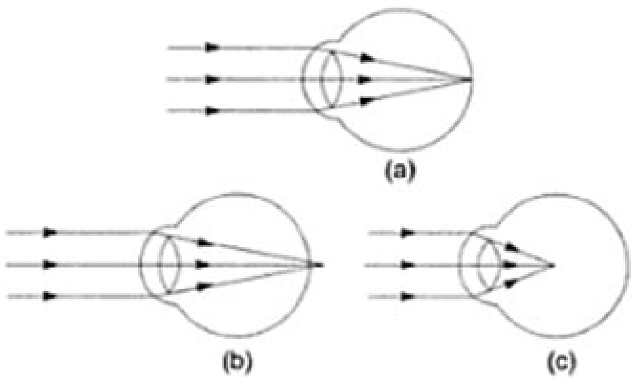
Tissue death (infarction) of the heart muscle (myocardium) caused by ischaemia [the lack of oxygen delivery to myocardial tissue] is called as:
1. Heart attack
2. Heart failure
3. Heart block
4. Cardiac arrest

84.

Each nephron does have its own unique:
1. Bowman's capsule
2. PCT
3. DCT
4. Collecting duct

85.

Study the given diagram and select the correct option:



1. (a) is myopic eye
2. (b) is hypermetropic eye and the vision can be corrected by using a convex lens
3. (c) is normal eye
4. (c) is myopic eye and the vision can be correct by using a bifocal lens

Zoology - Section B

86.

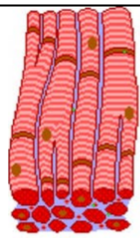
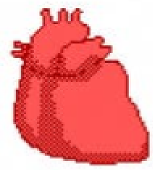
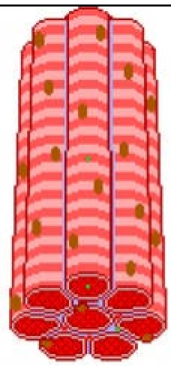
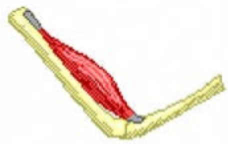
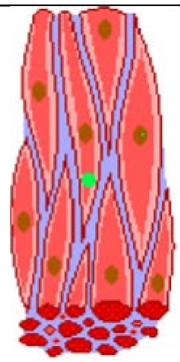
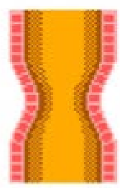
Numbers of molecules of oxygen and carbon dioxide that can bind to haemoglobin respectively are:
1. 1 and 4
2. 4 and 1
3. 4 and 4
4. 4 and 2

87.

If the SA node in the human heart does not function:
1. it will always lead to cardiac arrest
2. the heart rate will be increased due to unopposed sympathetic activity
3. the heart rate will be decreased due to unopposed parasympathetic activity
4. most likely a group of cells further down the heart will become its pacemaker

88.

Match the type of muscle shown in Column I with location in Column II and select the correct match from the codes given:

	COLUMN I		COLUMN II
A		P	
B		Q	
C		R	

Codes:

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

89.

Which of the following diagrams describes a pivot joint?

1.	
2.	
3.	
4.	

90.

What would be the number of intercostal spaces in the human thoracic cage?
1. 11
2. 12
3. 6
4. 3

91.

The hormone that is not primarily regulated by a tropin from the anterior pituitary will be:
1. Thyroxin
2. Cortisol
3. Aldosterone
4. LH

92.

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

	COLUMN I		COLUMN II
A	Heart	P	Synthesis of angiotensinogen
B.	Lungs	Q	Secretion of atrial natriuretic peptide
C.	Kidneys	R	Primary site for conversion of angiotensin I to angiotensin II
4.	Liver	S	Secretion of renin

Codes:

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

93.

Portal circulation present in humans include:
I. Hepatic portal
II. Hypothalamic-hypophyseal
III. Renal
1. Only I
2. Only I and II
3. Only II and III
4. I, II and III

94.

Regarding the source of energy for muscle contraction:
I. The immediate source is ATP
II. Creatine phosphate stores energy but has to be converted to ATP prior to use
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

95.

Which of the following bypasses the hepatic portal system?
1. Glucose
2. Fructose
3. Amino acids
4. Fatty acids

96.

Which of the following hormones, secreted by the anterior pituitary, is unique as it is under predominant inhibitory control of the hypothalamus?
1. Prolactin
2. Growth hormone
3. Corticotropin
4. Thyrotropin

97.

The muscle spindle is a stretch receptor present:
1. within the body of a smooth muscle
2. in the tendon of skeletal muscles
3. within the body of skeletal muscle
4. in the intercalated discs of cardiac muscles

98.

Identify the incorrect match:

1.	Reticular formation	Gatekeeper to consciousness
2.	Thalamus	Major relay centre in diencephalon for messages to the cortex
3.	Superior colliculi	Part of limbic system for emotional behaviour
4.	Pons	Part of hindbrain having nuclei for control of breathing rate

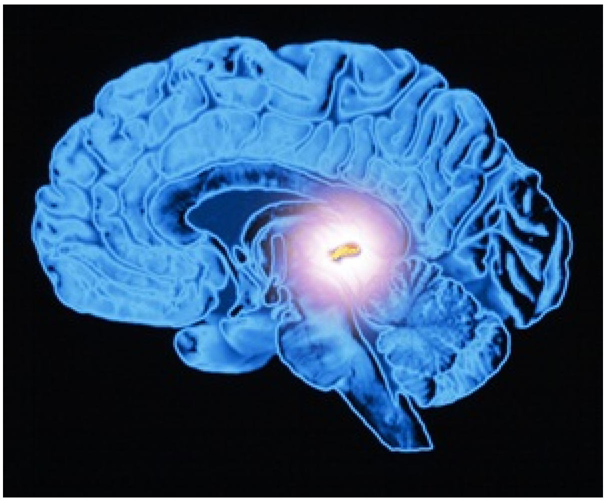
99.

Identify the incorrectly matched pair:

1.	Occipital bone	Cranial bone that has condyles for articulation with superior region of the vertebral column
2.	Ethmoid	Cranial bone forming the superior roof of the nasal cavity
3.	Sphenoid	Cranial bone that has a saddle-like depression, location of pituitary
4.	Frontal bone	An unpaired cranial bone

100.

The structure, shown in the halo in the given diagram, is:



1. is the master endocrine gland
2. is responsible for regulating the body's daily (circadian) clock
3. is the pneumotaxic centre
4. is the thermostat of the human body

Chemistry - Section A

101.

Which of the following metals does not form a hydride?
1. Cr
2. Mo
3. Sc
4. Cu

102.

The strengths of 11.2 volume hydrogen peroxide (of density 1 g/ml) in terms of mass percentage and molarity (M) , respectively, are :
1. 1.7 and 0.25
2. 3.4 and 0.5
3. 1.7 and 0.50
4. 3.4 and 1

103.

The metal that gives hydrogen gas upon treatment with both acid as well as base is
1. Fe
2. Mg
3. Zn
4. Cd

104.

When hard water is reacted with Calgon then Calcium or Magnesium of hard water are removed as
1. Cationic form
2. Anionic form
3. Can be cationic or anionic form
4. Salt

105.

Incorrect order of solubility in water for the following compounds will be

1. $Li_2CO_3 < Na_2CO_3 < K_2CO_3 < Rb_2CO_3$
2. $Be(OH)_2 > Mg(OH)_2 > Ca(OH)_2 > Sr(OH)_2$
3. $BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4$
4. $LiOH > NaOH > KOH > CsOH$

106.

When washing soda (Na_2CO_3 .10 H_2O) is heated below 373 K then how many water of crystallisation are removed by washing soda ?
1. 5
2. 7
3. 9
4. 10

107.

In Solvay process (for the manufacture of Na_2CO_3), the compound added for the recovery of ammonia and the bi-product formed, respectively, are
1. $Ca(OH)_2$ & $CaCl_2$
2. NaOH & NH_4Cl
3. NaCl & NH_4Cl
4. NaOH & $CaCl_2$

108.

In cement clinker , the most abundant constituent is
1. Dicalcium silicate
2. Tricalcium aluminate
3. Tetracalcium aluminoferrite
4. Tricalcium silicate

109.

The correct order of the densities of alkali metals is
1. Li < Na < K < Rb < Cs
2. Li < K < Na < Rb < Cs
3. Li > K < Na < Rb < Cs
4. Li < K < Na < Cs < Rb

110.

On combustion, Lithium, Sodium and Potassium in excess of air , the major oxides formed, respectively, are :
1. Li_2O_2 , Na_2O_2 and K_2O_2
2. Li_2O , Na_2O_2 and K_2O
3. Li_2O , Na_2O_2 and KO_2
4. Li_2O , Na_2O and K_2O_2

111.

The hybridised state of carbon, number of hexagons and number of pentagons in C_{60} (Fullerene), respectively, are
1. sp^2 , 12 & 20
2. sp^3 , 20 & 12
3. sp^3 , 12 & 20
4. sp^2 , 20 & 12

112.

Aluminium chloride exists as dimer, Al_2Cl_6, in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives

1. $Al^{3+} + 3Cl^-$
2. $[Al(H_2O)_6]^{3+} + 3Cl^-$
3. $[Al(OH)_6]^{3-} + 3HCl$
4. $Al_2O_3 + 6HCl$

113.

In the structure of diborane (B_2H_6) , the hybridised state of B & the maximum number of atoms which are present in one plane, respectively, are

1. sp^2 & 4
2. sp^3 & 4
3. sp^2 & 6
4. sp^3 & 6

114.

All elements of 14th group form MX_4 (Tetrahalides) except PbI_4 because

1. Pb^{2+} is a more stable than Pb^{4+}
2. I^- ion is a better reducing agent
3. . Pb^{4+} is most stable
4. I^- ion is an oxidising agent

115.

In a ring silicate, the number of oxygen atoms shared and the general formula, respectively, are

1. 1 & SiO_4^{4-}
2. 2 & $Si_2O_7^{6-}$
3. 2 & $[SiO_3^{2-}]_n$
4. 3 & $[SiO_3^{2-}]_n$

116.

The chain growth of a silicone is stopped by adding-

1. Me_3SiCl
2. Me_2SiCl_2
3. $MeSiCl_3$
4. $SiCl_4$

117.

The number of optical, geometrical and stereoisomers of the following compound, respectively, are

$CH_3 - CH = CH - CH = CH - CH(OH)CH_3$

1. 2, 4 & 6
2. 2, 4 & 8
3. 4, 4 & 8
4. 4, 2 & 8

118.

3-Methylpentane forms all the possible monohalogenated products. Among all monohalogenated products, how many products can show optical isomerism?

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

119.

The number of functional isomers and number of pairs of functional isomers of molecular formula $C_4H_{10}O$, respectively , are

1. 2 & 2
2. 2 &4
3. 2 & 10
4. 2 & 12

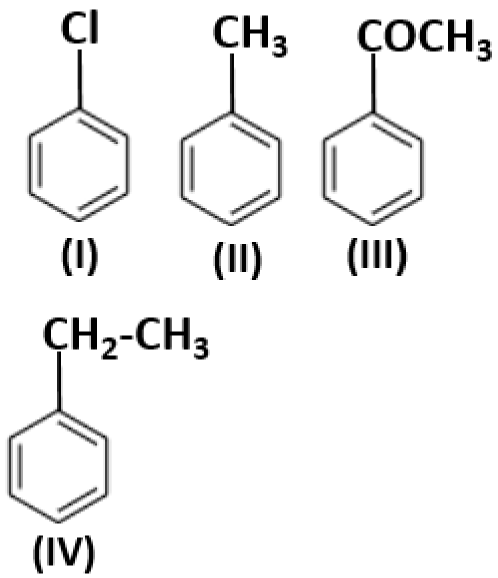
120.

A hydrocarbon has molecular formula C_5H_8 . On ozonolysis , it gives formaldehyde & 2- Ketopropanal only. The name of hydrocarbon is-

1. 2-Methylbuta-1,3-diene
2. 3-Methylbut-1-yne
3. 3-Methylbuta-1,2-diene
4. 2-Methylbut-2-ene

121.

The increasing order of the reactivity of the following compounds towards electrophilic aromatic substitution reaction is :



1. III < I < II < IV
2. III < II < I < IV
3. I < III < IV< II
4. III < I < IV < II

122.

Lassaigne's test for nitrogen is not given by

1. Nitrobenzene
2. Hydroxyl Amine
3. Aniline
4. Pyridine

123.

Assertion : Ozone is destroyed by chlorofluoro Carbon (CFC) in the upper stratosphere
Reason : Ozone holes increase the amount of UV radiation reaching the earth

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 correct explanation of the assertion

3. Assertion is true but reason is false

4. Both assertion and reason are false

124.

Air pollution that occurs in sunlight is called
1. Oxidising smog
2. Reducing smog
3. Fog
4. Acid Rain

125.

Regular use of which of the following fertilizers increases the acidity of soil ?
1. Potassium nitrate
2. Urea
3. Superphosphate of lime
4. Ammonium Sulphate

126.

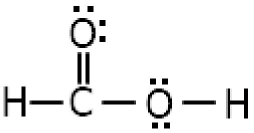
Excessive release of CO_2 into the atmosphere results in :
1. Depletion of ozone
2. Polar vortex
3. Global warming
4. Formation of smog

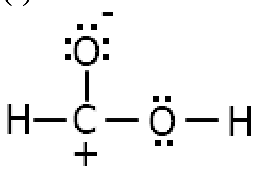
127.

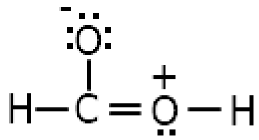
Among isomeric pentanes, which of the following has the highest melting point and the lowest boiling point?
1. n-Pentane
2. Isopentane
3. Neopentane
4. None of the above

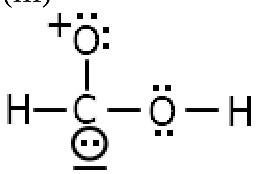
128.

Consider the following resonating structures of formic acid

(I)  (II)



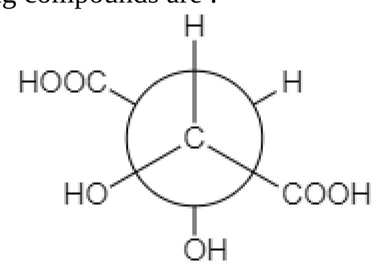
(III)  (IV)



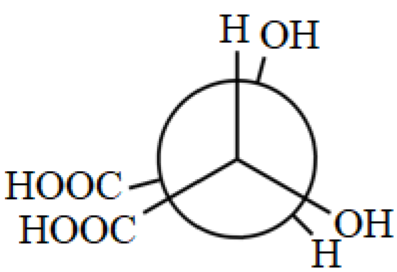
The correct order of the stability of the above resonating structures is
1. I > II > III > IV
2. III > I > II > IV
3. I > III > II > IV
4. I > II > IV > III

129.

Following compounds are :

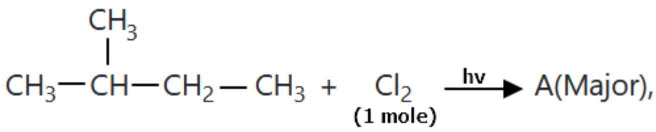


and

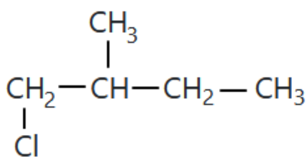


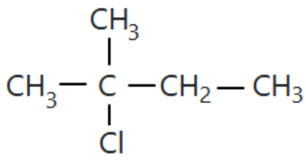
1. Enantiomers
2. Diastereomers
3. Stereomers
4. Position isomers

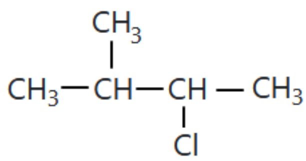
130.

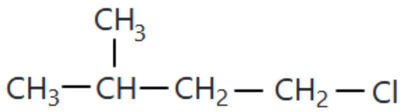


the compound 'A' is:

1. 

2. 

3. 

4. 

131.

How many cyclic isomers are possible for the molecular formula C_5H_{10} ?

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

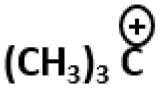
132.

0.75 grams of a nitrogeneous compound is boiled with NaOH resulting in release of ammonia gas. The evolved ammonia is passed into 100 ml $\frac{N}{2}$ H_2SO_4. The excess acid requires 90 ml $\frac{N}{3}$NaOH to neutralise. The percentage of nitrogen in the compound is
1. 25
2. 37.33
3. 57.33
4. 75

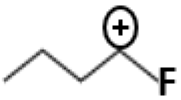
133.

Consider the following carbocations

1. 

2. 

3. 

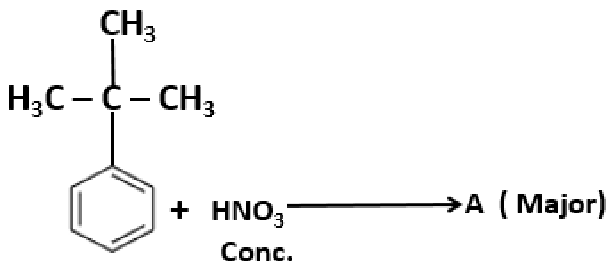
4. 

The correct order of stability of the above listed carbocations is
1. 3 > 1 >2 > 4
2. 2 > 3 > 1 > 4
3. 2 > 3 > 4 > 1
4. 3 > 1 > 4 > 2

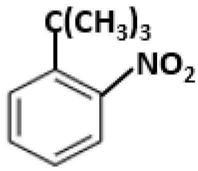
134.

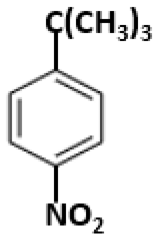
Number of optically active isomers among all the isomers of $C_6H_{13}Br$ are
1. 7
2. 8
3. 9
4. 17

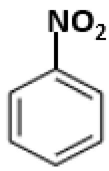
135.



Compound 'A' in the above reaction, possibly, is

1. 

2. 

3. 

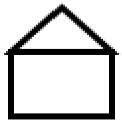
4. Both (1) and (2)

Chemistry - Section B

136.

Hydrogen has three isotopes i.e. Protium , Deuterium and Tritium. If tritium emits one β^- - particle then total number of protons and neutrons in total : in Protium , Deuterium and Tritium, respectively, will be
1. 3 & 3
2. 2 & 4
3. 4 & 2
4. 3 & 2

137.

THe IUPAC name of  is

1. Bicyclo [0,1,2] pentane
2. Spiro [2, 1, 0] pentane
3. Spiro [0,1,2] pentane
4. Bicyclo [2,1,0] pentane

138.

Case Study:

Aromaticity

Aromaticity is a property of conjugated cycloalkenes in which the stabilization of the molecule is enhanced due to the ability of the electrons in the π orbitals to delocalize. This acts as a framework to create a planar molecule.

The three general requirements for a compound to be aromatic are:

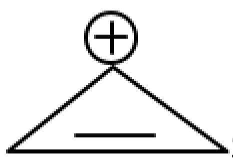
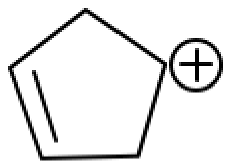
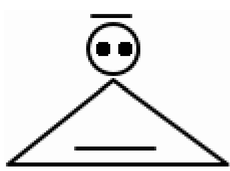
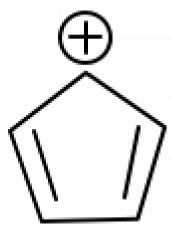
1. The compound must be cyclic.
2. Each element within the ring must have a p-orbital that is perpendicular to the ring, hence the molecule is planar.
3. The compound must follow Hückel's Rule (the ring has to contain 4n+2 p-orbital electrons).

Antiaromaticity

The term 'antiaromaticity' was first proposed by Ronald Breslow in 1967 as "a situation in which a cyclic delocalisation of electrons is destabilising". The IUPAC criteria for antiaromaticity are as follows:

1. The molecule must be cyclic.
2. The molecule must be planar.
3. The molecule must have a complete conjugated π-electron system within the ring.
4. The molecule must have 4n π-electrons where n is any integer within the conjugated π-system. This differs from aromaticity in the fourth criterion: aromatic molecules have (4n+2) π-electrons in the conjugated π system and therefore follow Hückel’s rule. Non-aromatic molecules are either noncyclic, nonplanar, or do not have a complete conjugated π system within the ring.

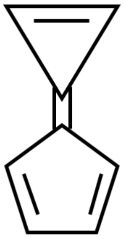
In light of the information given above, which of the following carbocation is antiaromatic in nature ?

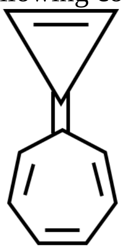
1. 
2. 
3. 
4. 

139.

Please refer to the case study in the previous question and answer the following:

Consider the following compounds


(I)

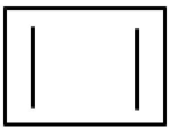
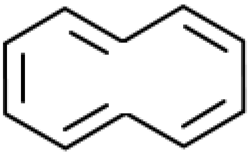
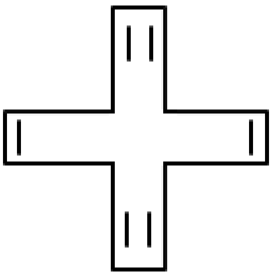
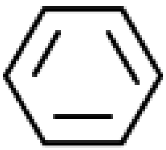

(II)

Which compound has a higher dipole moment?
1. I
2. II
3. Both have the same dipole moment
4. Cannot be predicted

140.

Please refer to the case study in the previous question and answer the following:

Which of the following annulenes is non-aromatic in nature?

1. 
2. 
3. 
4. 

141.

Assertion : The value of the parameter "Biochemical Oxygen Demand (BOD)" is important for the survival of aquatic life
Reason : The optimum value of BOD is 6.5ppm

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 correct explanation of the assertion

3. Assertion is true but reason is false

4. Both assertion and reason are false

142.

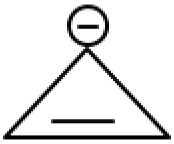
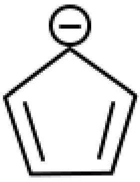
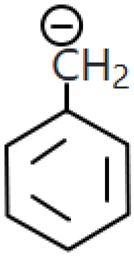
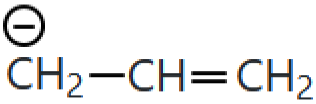
In which of the following compounds is the double bond longest?
1. CH_3 - CH = CH - CH_3
2. CH_2 = CH - $C(CH_3)_3$
3. CH_2= CH - CH_2 - CH_3
4. CH_3 - CH = CH -CH_2 - CH_3

143.

Which conformer of 2-fluoroethanol is most stable ?
1. Anti
2. Partially eclipsed
3. Gauche
4. Fully eclipsed

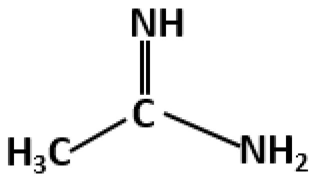
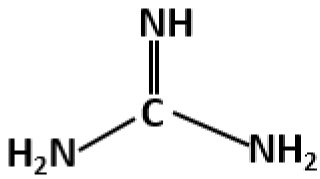
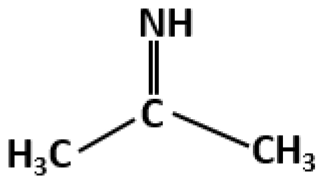
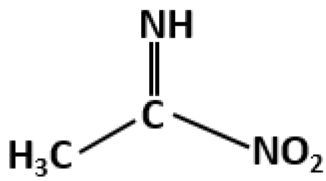
144.

Which of the following carbanion is most stable?

1. 
2. 
3. 
4. 

145.

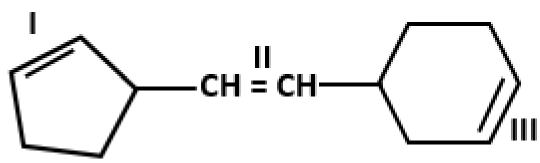
Consider the following compounds

1. 
2. 
3. 
4. 

The correct order of basicity of the above compounds is

1. 3 > 1 > 2 > 4
2. 4 > 2 > 1 > 3
3. 2 >1 > 3 > 4
4. 4 > 3 > 1 > 2

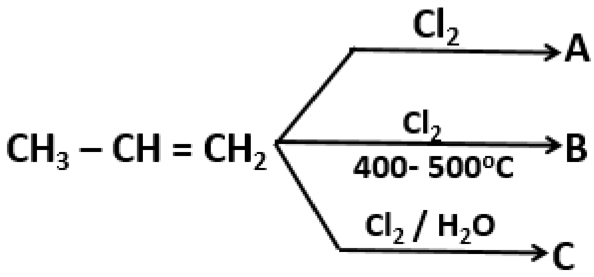
146.



The correct decreasing order of the bond length (I , II and III) is-

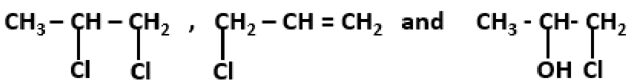
1. I > II > III
2. II > III > I
3. III > II > I
4. III > I > II

147.

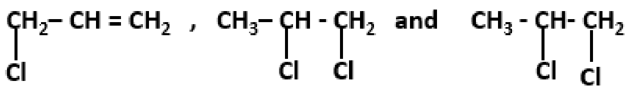


The compounds A , B and C, respectively, are

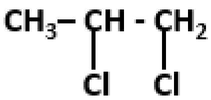
1.



2.



3. All A, B and C are



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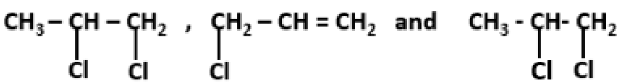
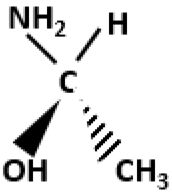
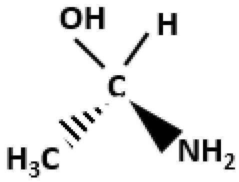
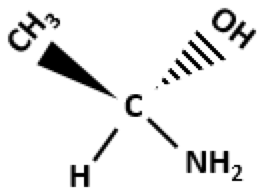


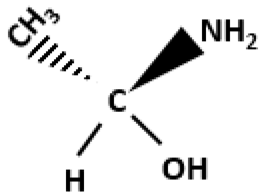
148.

Odd one out among the following is

1. 

2. 

3. 

4. 

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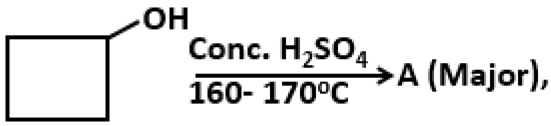
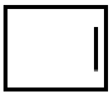
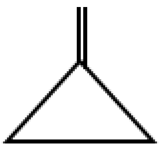
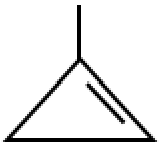
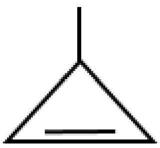


Compound 'A' in the above reaction, possibly, is

1. 
2. 
3. 
4. 

150.

Assertion : When 2-fluorobutane is reacted with alcoholic KOH then but-1-ene is formed as the major product.
Reason : The above reaction follows E2 mechanism and no intermediate is formed

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 correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

Physics - Section A

151.

A wire has a length l_1 when it is under tension T_1, and length l_2 when it is under tension T_2. When it is under a tension T_1+T_2, its length is

1. l_1+l_2
2. $\frac{l_1T_1+l_2T_2}{T_1+T_2}$
3. $\frac{l_1T_1-l_2T_2}{T_1-T_2}$
4. $\frac{l_1T_2+l_2T_1}{T_1+T_2}$

152.

A wire of cross-section A_1 and length l_1 breaks when it is under a tension T_1; a second wire made of the same material but of cross-section A_2 and length l_2 breaks under a tension T_2. A third wire of the same material having cross-section A, length l breaks under a tension $\frac{T_1+T_2}{2}$. Then,

1. $A=\frac{A_1+A_2}{2}$, $l=\frac{l_1+l_2}{2}$
2. $l=\frac{l_1+l_2}{2}$
3. $A=\frac{A_1+A_2}{2}$
4. $A=\frac{A_1T_1+A_2T_2}{2(T_1+T_2)}$, $l=\frac{l_1T_1+l_2T_2}{2(T_1+T_2)}$

153.

Two wires of identical dimensions, but of different materials having Young's moduli Y_1, Y_2 are joined end to end. When the first wire is under a tension T, it elongates by x_1 while the second wire elongates by x_2 under the same tension T. The elongation of the composite wire when it is under the tension T is

1. $x_1 + x_2$

2. $\frac{Y_1 x_1 + Y_2 x_2}{Y_1 + Y_2}$

3. $\frac{x_1 + x_2}{2}$

4. $\frac{Y_1 x_2 + Y_2 x_1}{Y_1 + Y_2}$

154.

A wire connects two blocks of masses M, 2M; both lying on a smooth horizontal plane.

Figure 1

When a force F_1 is applied to 2M as shown in figure 1, the wire just breaks. On the other hand, when F_2 is applied to M as shown in figure 2,

Figure 2

the wire just breaks. Assume that the mass of the wire is negligible. Then

1. $F_1 = F_2$

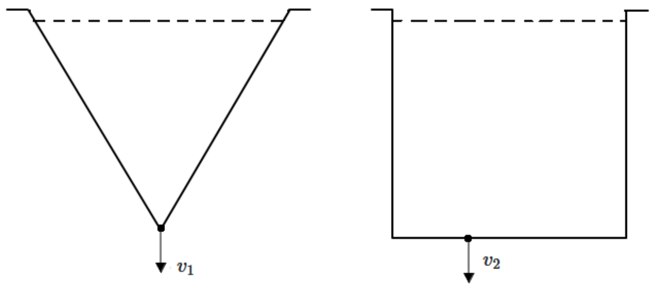
2. $F_1 > F_2$

3. $F_1 < F_2$

4. Any of the above is possible

155.

Water flows out of a conical funnel, with a small-bore, and also out of a rectangular tank with a small-bore: the respective speeds being v_1, v_2. The cross-sectional areas are the same at the top, while the water levels are also the same in both.



Then:

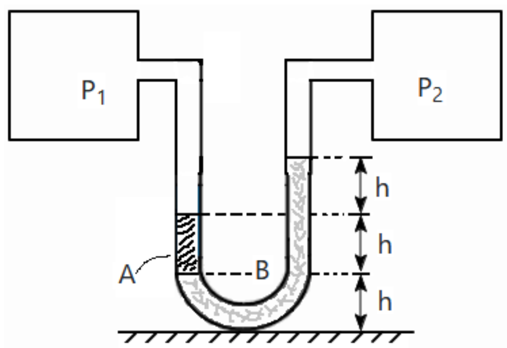
1. $v_1 = v_2$

2. $v_1 = 2v_2$

3. $\frac{v_1}{v_2}$ = extremely large

4. $\frac{v_1}{v_2}$ = extremely small

156.



Two vessels containing gases at pressures P_1, P_2 are connected by a U-tube containing two liquids A, B of densities $3\rho, \rho,$. The levels of the liquids and their contact surfaces are shown in the diagram above. Then,

1. $P_1 - P_2 = \rho g h$

2. $P_2 - P_1 = \rho g h$

3. $P_1 = P_2$

4. $P_1 + P_2 = 7\rho g h$

157.

The loss in weight of a lead block is 3 times in liquid A compared to that in liquid B. In both cases, the block is half immersed. If ρ_A, ρ_B be the densities of the liquids and ρ_L the density of lead, then

1. $3\rho_A = \rho_B$

2. $\frac{3}{2}\rho_A = \rho_B$

3. $\rho_A = \frac{3}{2}\rho_B$

4. $\rho_A = 3\rho_B$

158.

A block of wood is immersed in water (assume that the wood is impervious to water), and it floats half immersed. It is placed in an elevator which is accelerating upward. Then,

1. the block floats, slightly more of it out of the water

2. the block floats, slightly less of it out of the water

3. the block floats, half-immersed

4. the block sinks completely.

159.

Assertion: Water flows through a smooth horizontal tube with a narrowing cross-section and its pressure increases.

Reason: Bernoulli's equation for fluids states that: $P + \frac{1}{2}\rho v^2 + \rho g h =$ constant along a streamline.

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.

160.

Assertion: Insects are observed to walk on the surface of water.

Reason: This is due to the viscous force of water acting on the insect's legs.

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.

161.

100 g water at 20° C is mixed with 300 g water at 100° C in a calorimeter. The mixture is now mixed again with 400 g water at 10° C. The final temperature of the mixture, assuming no loss of heat, is

1. 16° C

2. 30° C

3. 40° C

4. 45° C

162.

A rod A has a coefficient of thermal expansion (α_A) which is twice of that of rod B(α_B). The two rods have length l_A, l_B where $l_A = 2l_B$. If the two rods were joined end-to-end, the average coefficient of thermal expansion is

1. α_A

2. $\frac{2\alpha_A}{6}$

3. $\frac{4\alpha_A}{6}$

4. $\frac{5\alpha_A}{6}$

163.

The ice-point reading on a thermometer scale is found to be 20°, while the steam point is found to be 70°. When this thermometer reads 100°, the actual temperature is

1. 80° C

2. 130° C

3. 160° C

4. 200° C

164.

A gas thermometer measures the temperature by measuring the pressure of a constant volume of gas (considered to be ideal). The pressure is directly proportional to the absolute temperature. The pressure at 27° C is found to be 15 kPa. When the pressure is 20 kPa, the temperature is

1. 20.25° C

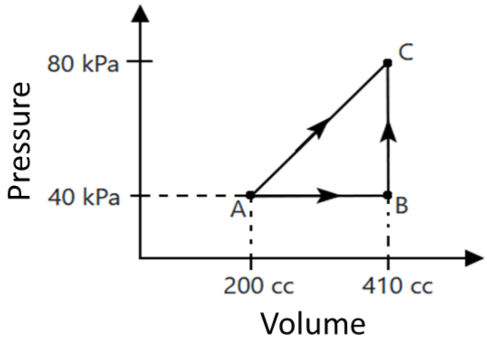
2. 127° C

3. 225° C

4. 36° C

165.

The quantity of heat required to take a system from A to C through the process ABC is 20 cal. The quantity of heat required to go from A to C directly is



1. 20 cal

2. 24.2 cal

3. 21 cal

4. 23 cal

166.

The internal energy of a gas is given by U = 2pV. The gas expands from 100 cc to 200 cc against a constant pressure of 10^5 Pa. The heat absorbed by the gas is

1. 10 J

2. 20 J

3. 30 J

4. 40 J

167.

A metal ball of mass 2 kg is heated by a 30 W heater, in a room at 20° C. The temperature of the metal becomes steady at 50° C. The rate of loss of heat from the ball when the temperature is 50° C is

1. 0 W

2. 50 W

3. 25 W

4. 30 W

168.

A metal ball of mass 2 kg is heated by a 30 W heater, in a room at 20° C. The temperature of the metal becomes steady at 50° C. If the same ball was heated by a 20 W heater in a room at 30° C, the steady temperature of the ball will be

1. 40° C

2. 50° C

3. 60° C

4. 70° C

169.

A metal ball of mass 2 kg is heated by a 30 W heater, in a room at 20° C. The temperature of the metal becomes steady at 50° C. If the ball were kept in a room at 20° C, while maintaining a temperature of 10° C — the rate at which heat must be removed from the ball is

1. 20 W

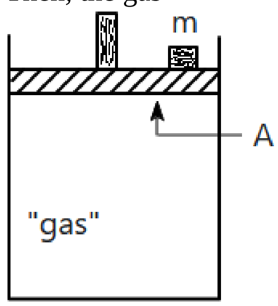
2. 10 W

3. 5 W

4. 1 W

170.

An ideal gas is enclosed in a volume by means of a piston-cylinder arrangement as shown in the adjacent diagram. The piston as well as the walls of the cylinder are non-conducting. The cross-sectional area of the piston is A. 'g' is acting downward. A small block of mass 'm' is placed on top of the piston. There is no atmospheric pressure outside. An amount of thermal energy ΔQ is slowly supplied to the gas, and its temperature rises. Then, the gas



1. expands continuously, making the volume infinite

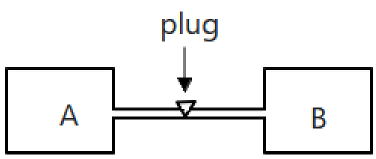
2. first expands and then contracts slightly

3. expands and then reaches a steady-state

4. expands and then contracts to return to its initial volume

171.

Two ideal gases contained in vessels A and B are connected by means of a pipe, and the plug is opened so that the gases mix. The final pressure is p (atm) and temperature is T (Kelvin). Then, $\frac{p}{T}$ = (numerically)



$V_A = 400cc$ $\quad$ $V_B = 800cc$
$P_A = 1.5\ atm$ $\quad$ $P_B = 2\ atm$
$T_A = 300\ K$ $\quad$ $T_B = 400\ K$

1. $\frac{1}{100}$

2. $\frac{1}{200}$

3. $\frac{1}{400}$

4. none of these

172.

Hydrogen gas is contained in a vessel and the rms speed of the gas molecules is v. The gas is heated isobarically so that its volume doubles, then it is compressed isothermally so that it returns to the same volume. The rms speed of the molecules is, finally

1. $2v$

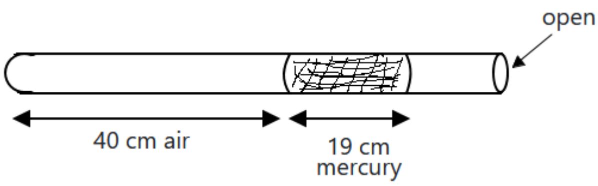
2. $v/2$

3. $v\sqrt{2}$

4. $v/\sqrt{2}$

173.

A small tube containing air at atmospheric pressure (p = 76 cm of Hg) has a mercury column of length 19 cm. The tube is initially horizontal, then it is turned so that the open end is upward and the tube is vertical.



The length of the trapped air column

1. increases by 10 cm

2. decrease by 10 cm

3. increases by 8 cm

4. decreases by 8 cm

174.

The pressure of an ideal gas is written as $p=\frac{2E}{3V}$, where E is the total kinetic energy, V is the volume. This statement is

1. always true

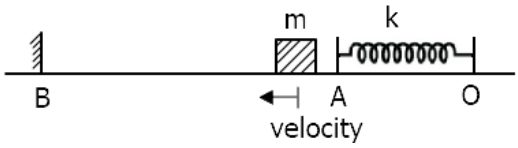
2. true for mono-atomic gases

3. always false

4. true for diatomic gases

175.

The energy of the block is E, and the plane is smooth, the wall at the end B is smooth. Collisions with walls are elastic. The distance AB = l, the spring is ideal and the spring constant is k. The time period of the motion is



1. $2\pi\sqrt{\frac{m}{k}}$

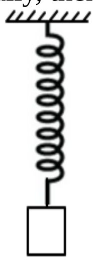
2. $\pi\sqrt{\frac{m}{k}}+l\sqrt{\frac{2m}{E}}$

3. $2\pi\sqrt{\frac{m}{k}}+2l\sqrt{\frac{2m}{E}}$

4. $\pi\sqrt{\frac{m}{k}}+l\sqrt{\frac{m}{2E}}$

176.

A block is connected to a spring and the system is suspended from the ceiling. The extension in the spring is x, in equilibrium. If the system is allowed to oscillate vertically, then its time period is



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

2. $\sqrt{\frac{x}{2g}}$

3. $\sqrt{\frac{\pi^2 x}{g}}$

4. $\sqrt{\frac{4\pi^2 x}{g}}$

177.

The equation of motion of a particle that starts moving at t = 0 is given by x = 5 sin $\left(\frac{\pi t}{2}+\frac{\pi}{3}\right)$ where x is in cm and time t is in second. The time, when the particle first comes to rest, is

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

2. $\frac{7}{6}\ s$

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

4. $\frac{13}{6}\ s$

178.

A graph is plotted with the x-axis representing the position and the y-axis representing the velocity of a particle undergoing S.H.M. along a straight line. The shape of the graph is

1. a straight line with positive slope

2. a straight line with negative slope

3. a circle

4. an ellipse

179.

A particle moves in the x-y plane according to the equation
$x = Acos^2\omega t$
and $y = Asin^2\omega t$
Then, the particle undergoes

1. uniform motion along the line $x+y=A$

2. uniform circular motion along $x^2+y^2=A^2$

3. SHM along the line $x+y=A$

4. SHM along the circle $x^2+y^2=A^2$

180.

A particle of mass m executes SHM along a straight line with an amplitude A and frequency f.

Assertion: The kinetic energy of the particle undergoes oscillation with a frequency 2f.
Reason: This is true because the velocity of the particle, $v=\frac{dx}{dt}$ and its kinetic energy equals $\frac{1}{2}mv^2$ and v oscillates sinusoidally with a frequency f.

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

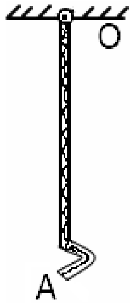
2. Both assertion and reason are true, but reason is not the correct explanation of the assertion.

3. Assertion is true but reason is false.

4. Assertion is false but reason is true.

181.

A rope of uniform mass per unit length μ is suspended from the ceiling, hanging under its own weight. If a small transverse pulse is formed at its lower end A, it travels upward with a local speed $v=\sqrt{\frac{tension}{mass/length}}$.



The speed of the pulse is

1. maximum at A, minimum at O

2. minimum at A, maximum at O

3. uniform

4. minimum at A and O, maximum in the middle.

182.

The intensity $(\mathtt{I})$ of a sound wave depends on the distance (x) from the source as

1. $I \propto x$

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

3. $I \propto \frac{1}{x^2}$

4. None of the above

183.

If the absolute temperature of a gas is increased by 1%, the speed of sound in the gas

1. increases by $\sqrt{1}$%

2. decreases by $\sqrt{1}$%

3. increases by 1%

4. increases by 0.5%

184.

The separation between a node and the next antinode in a vibrating air column is 20 cm. The speed of sound is 320 m/s. The frequency of sound is

1. 128 Hz

2. 256 Hz

3. 400 Hz

4. 800 Hz

185.

When a source of frequency f_o moves with a speed v in air, then the wavelength (λ) of the sound (speed of sound in air = v_s)

1. directly in front is $\frac{v_s - v}{f_o}$

2. directly in front is $\frac{v_s + v}{f_o}$

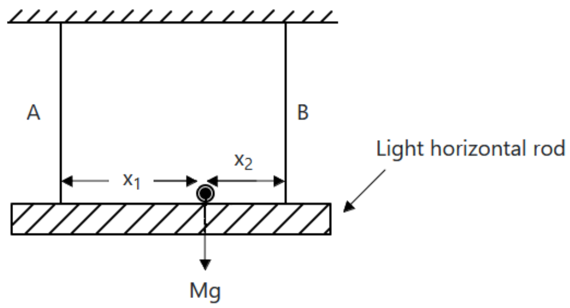
3. directly behind is $\frac{v - v_s}{f_o}$

4. directly behind is $\frac{v_s + v}{2f_o}$

Physics - Section B

186.

Two wires (A, B) of identical lengths have breaking stresses in the ratio 1 : 2, while their cross-sectional areas are the same. When a block of mass M is placed on the horizontal light rod, it is observed that wire A breaks if M is placed slightly to the left, while B breaks if M is placed slightly to right.



Then, $\frac{x_1}{x_2} =$

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

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

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

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

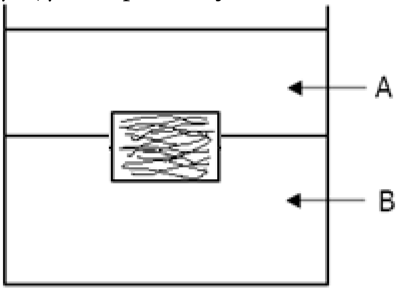
187.

Bernoulli's theorem in fluid mechanics is based on

1. conservation of momentum
2. conservation of force
3. conservation of angular momentum
4. Work-Energy theorem

188.

A metal block floats at the interface of two liquids, with $\frac{1}{3}$ of its volume in the upper liquid (A) and $\frac{2}{3}$ in the lower liquid (B). The densities of the metal, liquid A, liquid B are ρ, ρ_A, ρ_B respectively. Then,



1. $\rho_B = 2\rho_A$

2. $\rho = \frac{1}{3}\rho_A + \frac{2}{3}\rho_B$

3. $\rho = \frac{2}{3}\rho_A + \frac{1}{3}\rho_B$

4. $\rho = \frac{1}{3}\sqrt{\rho_A \rho_B}$

189.

A beaker containing water is placed in an elevator and the absolute pressure is measured at a depth of 10 cm below the water level.

1. If the elevator accelerates up, the pressure decreases

2. If the elevator moves up with uniform velocity, the pressure decreases

3. If the elevator accelerates down, the pressure decreases

4. If the elevator moves down with uniform velocity, pressure increases

190.

The temperature at which the Celsius and Fahrenheit thermometers agree (to give the same numerical value) is

1. -40°

2. 40°

3. 0°

4. 50°

191.

The ratio $C_P/C_V = 1.5$ for a certain ideal gas. The gas is taken at an initial pressure of 2 kPa and compressed suddenly to $\frac{1}{4}$ of its initial volume. The final pressure is

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

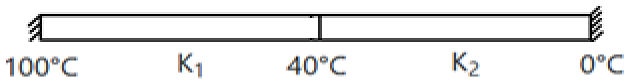
2. 4 kPa

3. 8 kPa

4. 16 kPa

192.

Two rods of identical dimensions are joined end-to-end, and the ends of the composite rod are kept at 0° C and 100° C (as shown in the diagram). The temperature of the joint is found to be 40° C. Assuming no loss of heat through the sides of the rods, the ratio of the conductivities of the rods K_1/K_2 is



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

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

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

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

193.

In a reversible process, the change in internal energy U of an ideal gas $(C_P/C_V = \gamma)$ is zero, while the volume increases from V to 2V. If the initial pressure is p, the final pressure is

1. 2 p

2. $\frac{p}{2}$

3. p

4. $\frac{p}{2^\gamma}$

194.

Pressure exerted by a gas enclosed within a room is due to

1. collisions of the gas molecules with the walls of the room

2. repulsive force between molecules of the gas

3. weight of the molecules of the gas

4. angular momentum of the molecules

195.

A simple pendulum of time period T_0 is taken in a rocket which is accelerating upwards initially and then, after some time, it moves with uniform velocity upward. The time period of the pendulum is observed within the rocket and is found to be $2T_0$. The rocket, at that time, must be at a distance (above the earth's surface) of (radius of earth = R)
Hint: $g = \frac{GM}{r^2}$

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

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

3. R

4. 4R

196.

The maximum speed and acceleration of particle undergoing SHM are v_o and a_o, respectively. The time period of the SHM is

1. $\frac{2\pi v_0}{a_0}$

2. $\frac{2\pi a_0}{v_0}$

3. $\frac{v_0}{a_0}$

4. $\frac{2v_0}{a_0}$

197.

A uniform rod of length l is suspended by an end and is made to undergo small oscillations. The time period of small oscillation is T. Then, the acceleration due to gravity at this place is

1. $4\pi^2 \frac{l}{T^2}$

2. $\frac{4\pi^2}{3} \frac{l}{T^2}$

3. $\frac{8\pi^2}{3} \frac{l}{T^2}$

4. $\frac{12\pi^2 l}{T^2}$

198.

Assertion: Sound waves in a gas are pressure waves, but these are also accompanied by changes in local temperature.

Reason: This is due to the fact that sound waves are propagated in a gas through an adiabatic process, and hence accompanied by temperature variations.

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.

199.

An engine driver driving a train sounds a whistle, of frequency f_o. A man standing on the platform, which the train is passing through, hears the whistle at a higher frequency $f_o + \delta$, if he is directly in front and the train is coming towards him. After the train passes him, he hears a frequency, $f_o + \delta'$.
Then,

1. $\delta = \delta'$

2. $\delta = -\delta'$

3. $|\delta| > |\delta'|$

4. $|\delta| < |\delta'|$

200.

The first overtone of a closed organ pipe of length l_1 matches the fundamental frequency of an open pipe of length l_2. Then,

1. $l_1 = 2l_2$

2. $l_2 = 2l_1$

3. $2l_1 = 3l_2$

4. $2l_2 = 3l_1$

Fill OMR Sheet*

*If above link doesn't work, please go to test link from where you got the pdf and fill OMR from there