

## SOLVED PAPER 2020

### BIOLOGY

1. Identify the wrong statement with reference to transport of oxygen.

- (a) Partial pressure of  $\text{CO}_2$  can interfere with  $\text{O}_2$  binding with haemoglobin
- (b) Higher  $\text{H}^+$  concentration in alveoli favours the formation of oxyhaemoglobin
- (c) Low  $p\text{CO}_2$  in alveoli favours the formation of oxyhaemoglobin
- (d) Binding of oxygen with haemoglobin is mainly related to partial pressure of  $\text{O}_2$

2. Which of the following refer to correct example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

- I. Darwin's Finches of Galapagos islands.
- II. Herbicide resistant weeds.
- III. Drug resistant eukaryotes.
- IV. Man-created breeds of domesticated animals like dogs.

- (a) I and III
- (b) II, III and IV
- (c) Only IV
- (d) Only I

3. Which of the following is not an inhibitory substance governing seed dormancy?

- (a) Abscisic acid
- (b) Phenolic acid
- (c) Para-ascorbic acid
- (d) Gibberellic acid

4. Match the following diseases with the causative organism and select the correct option.

Column I	Column II
A. Typhoid	1. <i>Wuchereria</i>
B. Pneumonia	2. <i>Plasmodium</i>
C. Filariasis	3. <i>Salmonella</i>
D. Malaria	4. <i>Haemophilus</i>

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 3 | 4 | 1 | 2 |
| (b) | 2 | 1 | 3 | 4 |
| (c) | 4 | 1 | 2 | 3 |
| (d) | 1 | 3 | 2 | 4 |

5. Select the correct events that occur during inspiration.

- I. Contraction of diaphragm.
- II. Contraction of external inter-costal muscles.
- III. Pulmonary volume decreases.
- IV. Intra pulmonary pressure increases.

- (a) III and IV
- (b) I, II and IV
- (c) Only IV
- (d) I and II

6. The oxygenation activity of RuBisCO enzyme in photorespiration leads to the formation of

- (a) 1 molecule of 3-C compound
- (b) 1 molecule of 6-C compound
- (c) 1 molecule of 4-C compound and 1 molecule of 2-C compound
- (d) 2 molecules of 3-C compound

7. In light reaction, plastoquinone facilitates the transfer of electrons from

- (a) Cyt- $b_6/f$  complex to PS-I
- (b) PS-I to  $\text{NADP}^+$
- (c) PS-I to ATP synthase
- (d) PS-II to Cyt- $b_6/f$  complex

8. In gel electrophoresis, separated DNA fragments can be visualised with the help of

- (a) ethidium bromide in UV radiation
- (b) acetocarmine in UV radiation
- (c) ethidium bromide in infrared radiation
- (d) acetocarmine in bright blue light

9. The QRS complex in a standard ECG represents

- (a) depolarisation of auricles
- (b) depolarisation of ventricles

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- (c) repolarisation of ventricles  
(d) repolarisation of auricles
- 10.** The plant part which consists of two generations, one within the other
- Pollen grains inside the anther.
  - Germinated pollen grain with two male gametes.
  - Seed inside the fruit.
  - Embryo sac inside the ovule.
- (a) I, II and III                      (b) III and IV  
(c) I and IV                            (d) Only I
- 11.** The infectious stage of *Plasmodium* that enters the human body is
- (a) sporozoites                      (b) female gametocytes  
(c) male gametocytes              (d) trophozoites
- 12.** Identify the incorrect statement.
- (a) Sapwood is involved in the conduction of water and minerals from root to leaf  
(b) Sapwood is the innermost secondary xylem and is lighter in colour  
(c) Due to deposition of tannins, resins, oils, etc., heartwood is dark in colour  
(d) Heartwood does not conduct water but gives mechanical support
- 13.** Flippers of penguins and dolphins are examples of
- (a) convergent evolution      (b) industrial melanism  
(c) natural selection            (d) adaptive radiation
- 14.** Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
- (a) A person will have only two of the three alleles  
(b) When I<sup>A</sup> and I<sup>B</sup> are present together, they express same type of sugar  
(c) Allele 'i' does not produce any sugar  
(d) The gene (I) has three alleles
- 15.** Which of the following statements are true for the phylum—Chordata?
- In Urochordata notochord extends from head to tail and it is present throughout their life.
  - In Vertebrata, notochord is present during the embryonic period only.
  - Central nervous system is dorsal and hollow.
- IV. Chordata is divided into 3 subphyla, Hemichordata, Tunicata and Cephalochordata.
- (a) III and I                            (b) I and II  
(c) II and III                            (d) IV and III
- 16.** Presence of which of the following conditions in urine are indicative of diabetes mellitus?
- (a) Uremia and Renal calculi  
(b) Ketonuria and Glycosuria  
(c) Renal calculi and Hyperglycaemia  
(d) Uremia and Ketonuria
- 17.** The first phase of translation is
- (a) recognition of DNA molecule  
(b) aminoacylation of tRNA  
(c) recognition of an anti-codon  
(d) binding of mRNA to ribosome
- 18.** Ray florets have
- (a) superior ovary                      (b) hypogynous ovary  
(c) half inferior ovary                (d) inferior ovary
- 19.** The process of growth is maximum during
- (a) lag phase                            (b) senescence  
(c) dormancy                            (d) log phase
- 20.** The roots that originate from the base of the stem are
- (a) primary roots                      (b) prop roots  
(c) lateral roots                        (d) fibrous roots
- 21.** In water hyacinth and water lily, pollination takes place by
- (a) water currents only              (b) wind and water  
(c) insects and water                (d) insects or wind
- 22.** Which of the following is put into anaerobic sludge digester for further sewage treatment?
- (a) Floating debris  
(b) Effluents of primary treatment  
(c) Activated sludge  
(d) Primary sludge
- 23.** Bilaterally symmetrical and acoelomate animals are exemplified by
- (a) Platyhelminthes                    (b) Aschelminthes  
(c) Annelida                              (d) Ctenophora
- 24.** Identify the basic amino acid from the following.
- (a) Glutamic acid                      (b) Lysine  
(c) Valine                                (d) Tyrosine

- 25.** In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?  
 (a) GIFT and ZIFT (b) ICSI and ZIFT  
 (c) GIFT and ICSI (d) ZIFT and IUT
- 26.** Which of the following statements about inclusion bodies is incorrect?  
 (a) These are involved in ingestion of food particles  
 (b) They lie free in the cytoplasm  
 (c) These represent reserve material in cytoplasm  
 (d) They are not bound by any membrane
- 27.** Experimental verification of the chromosomal theory of inheritance was done by  
 (a) Sutton (b) Boveri  
 (c) Morgan (d) Mendel
- 28.** Select the option including all sexually transmitted diseases.  
 (a) Gonorrhoea, Malaria, Genital herpes  
 (b) AIDS, Malaria, Filaria  
 (c) Cancer, AIDS, Syphilis  
 (d) Gonorrhoea, Syphilis, Genital herpes
- 29.** Which of the following statements is not correct?  
 (a) The proinsulin has an extra peptide called C-peptide  
 (b) The functional insulin has A and B chains linked together by hydrogen bonds  
 (c) Genetically engineered insulin is produced in *E-coli*  
 (d) In man, insulin is synthesised as a proinsulin
- 30.** Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?  
 (a) Peroxisomes (b) Golgi bodies  
 (c) Polysomes (d) Endoplasmic reticulum

- 31.** Match the following columns and select the correct option.

Column I	Column II
A. <i>Clostridium butylicum</i>	1. Cyclosporin-A
B. <i>Trichoderma polysporum</i>	2. Butyric acid
C. <i>Monascus purpureus</i>	3. Citric acid
D. <i>Aspergillus niger</i>	4. Blood cholesterol lowering agent

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	4	3
(c)	4	3	2	1
(d)	3	4	2	1

- 32.** Embryological support for evolution was disapproved by  
 (a) Alfred Wallace (b) Charles Darwin  
 (c) Oparin (d) Karl Ernst von Baer
- 33.** The sequence that controls the copy number of the linked DNA in the vector, is termed  
 (a) *Ori* site (b) palindromic sequence  
 (c) recognition site (d) selectable marker
- 34.** Which of the following is correct about viroids?  
 (a) They have free RNA without protein coat  
 (b) They have DNA with protein coat  
 (c) They have free DNA without protein coat  
 (d) They have RNA with protein coat
- 35.** Montreal protocol was signed in 1987 for control of  
 (a) emission of ozone depleting substances  
 (b) release of green house gases  
 (c) disposal of e-wastes  
 (d) transport of genetically modified organisms from one country to another
- 36.** The number of substrate level phosphorylation in one turn of citric acid cycle is  
 (a) one (b) two  
 (c) three (d) zero
- 37.** Which of the following hormone levels will cause release of ovum (ovulation) from the Graafian follicle?  
 (a) High concentration of progesterone  
 (b) Low concentration of LH  
 (c) Low concentration of FSH  
 (d) High concentration of oestrogen
- 38.** Select the correct match.  
 (a) Phenylketonuria – Autosomal dominant trait  
 (b) Sickle-cell anaemia – Autosomal recessive trait, chromosome-11  
 (c) Thalassemia – X-linked  
 (d) Haemophilia – Y-linked

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- 39.** Cuboidal epithelium with brush border of microvilli is found in
- ducts of salivary glands
  - proximal convoluted tubule of nephron
  - Eustachian tube
  - lining of intestine
- 40.** Snow blindness in Antarctic region is due to
- inflammation of cornea due to high dose of UV-B radiation
  - high reflection of light from snow
  - damage to retina caused by infrared rays
  - freezing of fluids in the eye by low temperature
- 41** Which of the following pairs is of unicellular algae?
- Gelidium* and *Gracilaria*
  - Anabaena* and *Volvox*
  - Chlorella* and *Spirulina*
  - Laminaria* and *Sargassum*
- 42.** The transverse section of a plant shows following anatomical features.
- Large number of scattered vascular bundles surrounded by bundle sheath.
  - Large conspicuous parenchymatous ground tissue.
  - Vascular bundles conjoint and closed.
  - Phloem parenchyma absent.
- Identify the category of plant and its part.
- Monocotyledonous root
  - Dicotyledonous stem
  - Dicotyledonous root
  - Monocotyledonous stem
- 43.** How many true breeding pea plant varieties did Mendel select as pairs, which were similar except in one character with contrasting traits?
- 2
  - 14
  - 8
  - 4
- 44.** Floridean starch has structure similar to
- amylopectin and glycogen
  - mannitol and algin
  - laminarin and cellulose
  - starch and cellulose
- 45.** Identify the correct statement with regard to G<sub>1</sub>-phase (Gap 1) of interphase.
- Reorganisation of all cell components, takes place
  - Cell is metabolically active, grows but does not replicate its DNA
  - Nuclear division takes place
  - DNA synthesis or replication takes place
- 46.** By which method was a new breed 'Hisardale' of sheep formed by using Bikaneri ewes and Marino rams?
- Mutational breeding
  - Cross breeding
  - Inbreeding
  - Outcrossing
- 47.** Identify the wrong statement with reference to immunity.
- When readymade antibodies are directly given, it is called 'passive immunity'
  - Active immunity is quick and gives full response
  - Foetus receives some antibodies from mother, it is an example for passive immunity
  - When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called 'active immunity'
- 48.** The specific palindromic sequence which is recognised by *EcoRI* is
- |                      |                      |
|----------------------|----------------------|
| (a) 5' - GGAACC - 3' | (b) 5' - CTTAAG - 3' |
| 3' - CCTTGG - 5'     | 3' - GAATTC - 5'     |
| (c) 5' - GGATCC - 3' | (d) 5' - GAATTC - 3' |
| 3' - CCTAGG - 5'     | 3' - CTTAAG - 5'     |
- 49.** If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is  $6.6 \times 10^9$  bp, then the length of the DNA is approximately
- 2.5 meters
  - 2.2 meters
  - 2.7 meters
  - 2.0 meters
- 50.** If the head of cockroach is removed, it may live for few days because
- the cockroach does not have nervous system
  - the head holds a small proportion of a nervous system, while the rest is situated along the ventral part of its body
  - the head holds a 1/3rd of a nervous system, while the rest is situated along the dorsal part of its body.
  - the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen

51. Match the trophic levels with their correct species examples in grassland ecosystem.

Column I	Column II
A. Fourth trophic level	1. Crow
B. Second trophic level	2. Vulture
C. First trophic level	3. Rabbit
D. Third trophic level	4. Grass

Select the correct option.

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 2 | 1 | 4 |
| (b) | 4 | 3 | 2 | 1 |
| (c) | 1 | 2 | 3 | 4 |
| (d) | 2 | 3 | 4 | 1 |

52. The enzyme enterokinase helps in conversion of

- trypsinogen into trypsin
- caseinogen into casein
- pepsinogen into pepsin
- protein into polypeptides

53. Identify the correct statement with reference to human digestive system.

- Serosa is the innermost layer of the alimentary canal
- Ileum is a highly coiled part
- Vermiform appendix arises from duodenum
- Ileum opens into small intestine

54. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop.

- Gibberellin
- Ethylene
- Abscisic acid
- Cytokinin

55. Identify the wrong statement with regard to restriction enzymes.

- They cut the strand of DNA at palindromic sites
- They are useful in genetic engineering
- Sticky ends can be joined by using DNA ligases
- Each restriction enzyme functions by inspecting the length of a DNA sequence

56. Match the following columns.

Column I	Column II
A. Inhibitor of catalytic activity	1. Ricin
B. Possess peptide bonds	2. Malonate
C. Cell wall material in fungi	3. Chitin
D. Secondary metabolite	4. Collagen

Choose the correct option.

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 1 | 4 | 2 |
| (b) | 3 | 4 | 1 | 2 |
| (c) | 2 | 3 | 1 | 4 |
| (d) | 2 | 4 | 3 | 1 |

57. Goblet cells of alimentary canal are modified from

- columnar epithelial cells
- chondrocytes
- compound epithelial cells
- squamous epithelial cells

58. Match the following columns and select the correct option.

Column I	Column II
A. 6-15 pairs of gill slits	1. <i>Trygon</i>
B. Heterocercal caudal fin	2. Cyclostomes
C. Air bladder	3. Chondrichthyes
D. Poison sting	4. Osteichthyes

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 4 | 1 | 2 |
| (b) | 4 | 2 | 3 | 1 |
| (c) | 1 | 4 | 3 | 2 |
| (d) | 2 | 3 | 4 | 1 |

59. Dissolution of the synaptonemal complex occurs during

- |               |               |
|---------------|---------------|
| (a) zygotene  | (b) diplotene |
| (c) leptotene | (d) pachytene |

60. Name the enzyme that facilitates opening of DNA helix during transcription.

- |                    |                    |
|--------------------|--------------------|
| (a) DNA helicase   | (b) DNA polymerase |
| (c) RNA polymerase | (d) DNA ligase     |

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61. Which of the following statements is correct?

- (a) Adenine pairs with thymine through one H-bond
- (b) Adenine pairs with thymine through three H-bonds
- (c) Adenine does not pair with thymine
- (d) Adenine pairs with thymine through two H-bonds

62. Which of the following regions of the globe exhibits highest species diversity?

- (a) Madagascar
- (b) Himalayas
- (c) Amazon forests
- (d) Western Ghats of India

63. Match the following columns and select the correct option.

Column I	Column II
A. Pituitary gland	1. Grave's disease
B. Thyroid gland	2. Diabetes mellitus
C. Adrenal gland	3. Diabetes insipidus
D. Pancreas	4. Addison's disease

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 3 | 2 | 1 | 4 |
| (b) | 3 | 1 | 4 | 2 |
| (c) | 2 | 1 | 4 | 3 |
| (d) | 4 | 3 | 1 | 2 |

64. The product(s) of reaction catalysed by nitrogenase in root nodules of leguminous plants is/are

- (a) nitrate only
- (b) ammonia and oxygen
- (c) ammonia and hydrogen
- (d) ammonia only

65. Match the following concerning essential elements and their functions in plants.

Column I	Column II
A. Iron	1. Photolysis of water
B. Zinc	2. Pollen germination
C. Boron	3. Required for chlorophyll biosynthesis
D. Manganese	4. IAA biosynthesis

Select the correct option.

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 4 | 3 | 2 | 1 |
| (b) | 3 | 4 | 2 | 1 |
| (c) | 4 | 1 | 2 | 3 |
| (d) | 2 | 1 | 4 | 3 |

66. Which of the following would help in prevention of diuresis?

- (a) Reabsorption of  $\text{Na}^+$  and water from renal tubules due to aldosterone
- (b) Atrial natriuretic factor causes vasoconstriction
- (c) Decrease in the secretion of renin by JG cells
- (d) More water reabsorption due to undersecretion of ADH

67. Meiotic division of the secondary oocyte completed

- (a) at the time of copulation
- (b) after zygote formation
- (c) at the time of fusion of a sperm with an ovum
- (d) prior to ovulation

68. Match the following columns and select the correct option.

Column I	Column II
A. Gregarious, polyphagous pest	1. <i>Asterias</i>
B. Adult with radi symmetry and larva with bilateral symmetry	2. Scorpion
C. Book lungs	3. <i>Ctenoplana</i>
D. Bioluminescence	4. <i>Locusta</i>

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 4 | 1 | 2 | 3 |
| (b) | 3 | 2 | 1 | 4 |
| (c) | 2 | 1 | 3 | 4 |
| (d) | 1 | 3 | 2 | 4 |

69. Match the following columns and select the correct option.

Column I	Column II
A. Floating ribs	1. Located between second and seventh ribs
B. Acromion	2. Head of the humerus
C. Scapula	3. Clavicle
D. Glenoid cavity	4. Do not connect with the sternum

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 1 | 3 | 2 | 4 |
| (b) | 3 | 2 | 4 | 1 |
| (c) | 4 | 3 | 1 | 2 |
| (d) | 2 | 4 | 1 | 3 |

70. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their

- (a) growth response (b) defence action  
(c) effect on reproduction (d) nutritive value

71. Match the following columns and select the correct option.

Column I	Column II
A. <i>Bt</i> cotton	1. Gene therapy
B. Adenosine deaminase deficiency	2. Cellular defence
C. RNAi	3. Detection of HIV infection
D. PCR	4. <i>Bacillus thuringiensis</i>

- A B C D  
(a) 3 2 1 4  
(b) 2 3 4 1  
(c) 1 2 3 4  
(d) 4 1 2 3

72. From his experiments, SL Miller produced amino acids by mixing the following in a closed flask.

- (a) CH<sub>3</sub>,H<sub>2</sub>,NH<sub>4</sub> and water vapour at 800°C  
(b) CH<sub>4</sub>,H<sub>2</sub>,NH<sub>3</sub> and water vapour at 600°C  
(c) CH<sub>3</sub>,H<sub>2</sub>,NH<sub>3</sub> and water vapour at 600°C  
(d) CH<sub>4</sub>,H<sub>2</sub>,NH<sub>3</sub> and water vapour at 800°C

73. Match the organism with its use in biotechnology.

Column I	Column II
A. <i>Bacillus thuringiensis</i>	1. Cloning vector
B. <i>Thermus aquaticus</i>	2. Construction of first rDNA molecule
C. <i>Agrobacterium tumefaciens</i>	3. DNA polymerase
D. <i>Salmonella typhimurium</i>	4. Cry proteins

Select the correct option.

- A B C D  
(a) 4 3 1 2  
(b) 3 2 4 1  
(c) 3 4 1 2  
(d) 2 4 3 1

74. *Bt* cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis*(*Bt*) is resistant to

- (a) fungal diseases (b) plant nematodes  
(c) insect predators (d) insect pests

75. Choose the correct pair from the following.

(a) Polymerases	Break the DNA into fragments
(b) Nucleases	Separate the two strands of DNA
(c) Exonucleases	Make cuts at specific positions within DNA
(d) Ligases	Join the two DNA molecules

76. The body of the ovule is fused within the funicle at

- (a) micropyle (b) nucellus  
(c) chalaza (d) hilum

77. Strobili or cones are found in

- (a) *Pteris* (b) *Marchantia*  
(c) *Equisetum* (d) *Salvinia*

78. Match the following columns and select the correct option.

Column I	Column II
A. Eosinophils	1. Immune response
B. Basophils	2. Phagocytosis
C. Neutrophils	3. Release histaminase destructive enzymes
D. Lymphocytes	4. Release granules containing histamine

- A B C D  
(a) 4 1 2 3  
(b) 1 2 4 3  
(c) 2 1 3 4  
(d) 3 4 2 1

79. Identify the substances having glycosidic bond and peptide bond, respectively in their structure.

- (a) Glycerol, trypsin  
(b) Cellulose, lecithin  
(c) Inulin, insulin  
(d) Chitin, cholesterol

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**80.** In relation to gross primary productivity and net primary productivity of an ecosystem, which one of the following statements is correct?

- (a) Gross primary productivity is always more than net primary productivity
- (b) Gross primary productivity and net primary productivity are one and same
- (c) There is no relationship between gross primary productivity and net primary productivity
- (d) Gross primary productivity is always less than net primary productivity

**81.** Match the following columns and select the correct option.

Column I	Column II
A. Placenta	1. Androgens
B. Zona pellucida	2. Human Chorionic Gonadotropin (hCG)
C. Bulbourethral glands	3. Layer of the ovum
D. Leydig cells	4. Lubrication of the penis

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 1 | 4 | 2 | 3 |
| (b) | 3 | 2 | 4 | 1 |
| (c) | 2 | 3 | 4 | 1 |
| (d) | 4 | 3 | 1 | 2 |

**82.** Which of the following is not an attribute of a population?

- (a) Natalty
- (b) Mortality
- (c) Species interaction
- (d) Sex ratio

**83.** Match the following columns and select the correct option.

Column I	Column II
A. Organ of Corti	1. Connects middle ear and pharynx
B. Cochlea	2. Coiled part of the labyrinth
C. Eustachian tube	3. Attached to the oval window
D. Stapes	4. Located on the basilar membrane

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 3 | 1 | 4 | 2 |
| (b) | 4 | 2 | 1 | 3 |
| (c) | 1 | 2 | 4 | 3 |
| (d) | 2 | 3 | 1 | 4 |

**84.** Which one of the following is the most abundant protein in the animals?

- (a) Collagen
- (b) Lectin
- (c) Insulin
- (d) Haemoglobin

**85.** Match the following columns with respect to meiosis.

Column I	Column II
A. Zygotene	1. Terminalisation
B. Pachytene	2. Chiasmata
C. Diplotene	3. Crossing over
D. Diakinesis	4. Synapsis

Select the correct option.

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 4 | 3 | 2 | 1 |
| (b) | 1 | 2 | 4 | 3 |
| (c) | 2 | 4 | 3 | 1 |
| (d) | 3 | 4 | 1 | 2 |

**86.** According to Robert May, the global species diversity is about

- (a) 20 million
- (b) 50 million
- (c) 7 million
- (d) 1.5 million

**87.** The ovary is half inferior in

- (a) mustard
- (b) sunflower
- (c) plum
- (d) brinjal

**88.** Select the correct statement.

- (a) Glucagon is associated with hypoglycemia
- (b) Insulin acts on pancreatic cells and adipocytes
- (c) Insulin is associated with hyperglycemia
- (d) Glucocorticoids stimulate gluconeogenesis

**89.** The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is

- (a) root pressure
- (b) imbibition
- (c) plasmolysis
- (d) transpiration

**90.** Some dividing cells exist the cell cycle and enter vegetative inactive stage. This is called quiescent stage ( $G_0$ ). This process occurs at the end of

- (a)  $G_1$ -phase
- (b) S-phase
- (c)  $G_2$ -phase
- (d) M-phase



## PHYSICS

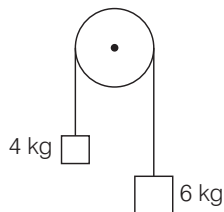
91. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is

- (a)  $\frac{3\pi}{2}$  rad (b)  $\frac{\pi}{2}$  rad  
(c) zero (d)  $\pi$  rad

92. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of solenoid is (Take,  $\mu_0 = 4\pi \times 10^{-7}$  T m A<sup>-1</sup>)

- (a)  $3.14 \times 10^{-4}$  T (b)  $6.28 \times 10^{-5}$  T  
(c)  $3.14 \times 10^{-5}$  T (d)  $6.28 \times 10^{-4}$  T

93. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity  $g$  is



- (a)  $g/2$  (b)  $g/5$  (c)  $g/10$  (d)  $g$

94. The ratio of contributions made by the electric field and magnetic field components, to the intensity of an electromagnetic wave is (where,  $c$  = speed of electromagnetic waves)

- (a) 1 : 1 (b) 1 :  $c$  (c) 1 :  $c^2$  (d)  $c$  : 1

95. In a certain region of space with volume  $0.2 \text{ m}^3$ , the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is

- (a) 0.5 N/C (b) 1 N/C  
(c) 5 N/C (d) zero

96. The average thermal energy for a monoatomic gas is (where,  $k_B$  is Boltzmann constant and  $T$  is absolute temperature.)

- (a)  $\frac{3}{2}k_B T$  (b)  $\frac{5}{2}k_B T$   
(c)  $\frac{7}{2}k_B T$  (d)  $\frac{1}{2}k_B T$

97. Find the torque about the origin when a force of  $3\hat{j}$  N acts on the particle whose position vector is  $2\hat{k}$  m.

- (a)  $6\hat{j}$  N-m (b)  $-6\hat{i}$  N-m  
(c)  $6\hat{k}$  N-m (d)  $6\hat{i}$  N-m

98. The mean free path  $\lambda$  for a gas, with molecular diameter  $d$  and number density  $n$  can be expressed as

- (a)  $\frac{1}{\sqrt{2} n \pi d^2}$  (b)  $\frac{1}{\sqrt{2} n^2 \pi d^2}$   
(c)  $\frac{1}{\sqrt{2} n^2 \pi^2 d^2}$  (d)  $\frac{1}{\sqrt{2} n \pi d}$

99. The energy equivalent of 0.5 g of a substance is

- (a)  $4.5 \times 10^{13}$  J  
(b)  $1.5 \times 10^{13}$  J  
(c)  $0.5 \times 10^{13}$  J  
(d)  $4.5 \times 10^{16}$  J

100. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale.

The pitch of the screw gauge is

- (a) 0.25 mm (b) 0.5 mm  
(c) 1.0 mm (d) 0.01 mm

101. Two cylinders  $A$  and  $B$  of equal capacity are connected to each other *via* a stop cock.  $A$  contains an ideal gas at standard temperature and pressure.  $B$  is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is

- (a) adiabatic (b) isochoric  
(c) isobaric (d) isothermal

102. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature 27°C.

Its density is ( $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$ )

- (a) 0.2 kg/m<sup>3</sup> (b) 0.1 kg/m<sup>3</sup>  
(c) 0.02 kg/m<sup>3</sup> (d) 0.5 kg/m<sup>3</sup>

103. When a uranium isotope  ${}_{92}^{235}\text{U}$  is bombarded with a neutron, it generates  ${}_{36}^{89}\text{Kr}$ , three neutrons and

- (a)  ${}_{40}^{91}\text{Zr}$  (b)  ${}_{36}^{101}\text{Kr}$   
(c)  ${}_{36}^{103}\text{Kr}$  (d)  ${}_{56}^{144}\text{Ba}$

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- 104.** A charged particle having drift velocity of  $7.5 \times 10^{-4} \text{ ms}^{-1}$  in an electric field of  $3 \times 10^{-10} \text{ Vm}^{-1}$ , has a mobility (in  $\text{m}^2\text{V}^{-1}\text{s}^{-1}$ ) of  
 (a)  $2.5 \times 10^6$  (b)  $2.5 \times 10^{-6}$   
 (c)  $2.25 \times 10^{-15}$  (d)  $2.25 \times 10^{15}$

- 105.** Taking into account of the significant figures, what is the value of  $9.99 \text{ m} - 0.0099 \text{ m}$ ?  
 (a) 9.98 m (b) 9.980 m  
 (c) 9.9 m (d) 9.9801 m

- 106.** An iron rod of susceptibility 599 is subjected to a magnetising field of  $1200 \text{ A m}^{-1}$ . The permeability of the material of the rod is (Take,  $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$ )  
 (a)  $8.0 \times 10^{-5} \text{ T m A}^{-1}$   
 (b)  $2.4\pi \times 10^{-5} \text{ T m A}^{-1}$   
 (c)  $2.4\pi \times 10^{-7} \text{ T m A}^{-1}$   
 (d)  $2.4\pi \times 10^{-4} \text{ T m A}^{-1}$

- 107.** A spherical conductor of radius 10 cm has a charge of  $3.2 \times 10^{-7} \text{ C}$  distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?  
 $\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2 \right)$

- (a)  $1.28 \times 10^5 \text{ N/C}$  (b)  $1.28 \times 10^6 \text{ N/C}$   
 (c)  $1.28 \times 10^7 \text{ N/C}$  (d)  $1.28 \times 10^4 \text{ N/C}$

- 108.** A series  $L$ - $C$ - $R$  circuit is connected to an AC voltage source. When  $L$  is removed from the circuit, the phase difference between current and voltage is  $\frac{\pi}{3}$ . If instead  $C$  is removed from

the circuit, the phase difference is again  $\frac{\pi}{3}$  between current and voltage. The power factor of the circuit is

- (a) 0.5 (b) 1.0  
 (c) -1.0 (d) zero

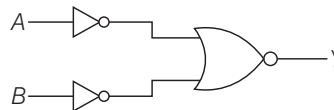
- 109.** A capillary tube of radius  $r$  is immersed in water and water rises in it to a height  $h$ . The mass of the water in the capillary tube is 5 g. Another capillary tube of radius  $2r$  is immersed in water. The mass of water that will rise in this tube is

- (a) 5.0 g (b) 10.0 g  
 (c) 20.0 g (d) 2.5 g

- 110.** In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes

- (a) half (b) four times  
 (c) one-fourth (d) double

- 111.** For the logic circuit shown, the truth table is



(a)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(b)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(c)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

(d)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

- 112.** The color code of a resistance is given below



The values of resistance and tolerance respectively, are

- (a) 47 k $\Omega$ , 10% (b) 4.7 k $\Omega$ , 5%  
 (c) 470  $\Omega$ , 5% (d) 470 k $\Omega$ , 5%

- 113.** The capacitance of a parallel plate capacitor with air as medium is  $6 \mu\text{F}$ . With the introduction of a dielectric medium, the capacitance becomes  $30 \mu\text{F}$ . The permittivity of the medium is  
 $(\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2})$   
 (a)  $1.77 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$   
 (b)  $0.44 \times 10^{-10} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$   
 (c)  $5.00 \text{ C}^2\text{N}^{-1}\text{m}^{-2}$   
 (d)  $0.44 \times 10^{-13} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$
- 114.** A ball is thrown vertically downward with a velocity of  $20 \text{ m/s}$  from the top of a tower. It hits the ground after some time with a velocity of  $80 \text{ m/s}$ . The height of the tower is ( $g = 10 \text{ m/s}^2$ )  
 (a)  $340 \text{ m}$  (b)  $320 \text{ m}$   
 (c)  $300 \text{ m}$  (d)  $360 \text{ m}$
- 115.** A body weighs  $72 \text{ N}$  on the surface of the earth. What is the gravitational force on it, at a height equal to half of radius of the earth?  
 (a)  $32 \text{ N}$  (b)  $30 \text{ N}$   
 (c)  $24 \text{ N}$  (d)  $48 \text{ N}$
- 116.** Two particles of mass  $5 \text{ kg}$  and  $10 \text{ kg}$  respectively are attached to the two ends of a rigid rod of length  $1 \text{ m}$  with negligible mass. The centre of mass of the system from the  $5 \text{ kg}$  particle is nearly at a distance of  
 (a)  $50 \text{ cm}$  (b)  $67 \text{ cm}$   
 (c)  $80 \text{ cm}$  (d)  $33 \text{ cm}$
- 117.** The increase in the width of the depletion region in a  $p$ - $n$  junction diode is due to  
 (a) reverse bias only  
 (b) both forward bias and reverse bias  
 (c) increase in forward current  
 (d) forward bias only
- 118.** Light of frequency  $1.5$  times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled?  
 (a) Four times  
 (b) One-fourth  
 (c) Zero  
 (d) Doubled
- 119.** Assume that, light of wavelength  $600 \text{ nm}$  is coming from a star. The limit of resolution of telescope whose objective has a diameter of  $2 \text{ m}$  is  
 (a)  $1.83 \times 10^{-7} \text{ rad}$  (b)  $7.32 \times 10^{-7} \text{ rad}$   
 (c)  $6.00 \times 10^{-7} \text{ rad}$  (d)  $3.66 \times 10^{-7} \text{ rad}$
- 120.** A resistance wire connected in the left gap of a metre bridge balances a  $10 \Omega$  resistance in the right gap at a point which divides the bridge wire in the ratio  $3 : 2$ . If the length of the resistance wire is  $1.5 \text{ m}$ , then the length of  $1 \Omega$  of the resistance wire is  
 (a)  $1.0 \times 10^{-1} \text{ m}$  (b)  $1.5 \times 10^{-1} \text{ m}$   
 (c)  $1.5 \times 10^{-2} \text{ m}$  (d)  $1.0 \times 10^{-2} \text{ m}$
- 121.** Light with an average flux of  $20 \text{ W/cm}^2$  falls on a non-reflecting surface at normal incidence having surface area  $20 \text{ cm}^2$ . The energy received by the surface during time span of  $1 \text{ min}$  is  
 (a)  $12 \times 10^3 \text{ J}$  (b)  $24 \times 10^3 \text{ J}$   
 (c)  $48 \times 10^3 \text{ J}$  (d)  $10 \times 10^3 \text{ J}$
- 122.** A ray is incident at an angle of incidence  $i$  on one surface of a small angle prism (with angle of prism  $A$ ) and emerges normally from the opposite surface. If the refractive index of the material of the prism is  $\mu$ , then the angle of incidence is nearly equal to  
 (a)  $\frac{2A}{\mu}$  (b)  $\mu A$   
 (c)  $\frac{\mu A}{2}$  (d)  $\frac{A}{2\mu}$
- 123.** A  $40 \mu\text{F}$  capacitor is connected to a  $200 \text{ V}$ ,  $50 \text{ Hz}$  AC supply. The rms value of the current in the circuit is, nearly  
 (a)  $2.05 \text{ A}$  (b)  $2.5 \text{ A}$   
 (c)  $25.1 \text{ A}$  (d)  $1.7 \text{ A}$
- 124.** Dimensions of stress are  
 (a)  $[\text{ML}^2\text{T}^{-2}]$  (b)  $[\text{ML}^0\text{T}^{-2}]$   
 (c)  $[\text{ML}^{-1}\text{T}^{-2}]$  (d)  $[\text{MLT}^{-2}]$
- 125.** The Brewster's angle  $i_b$  for an interface should be  
 (a)  $30^\circ < i_b < 45^\circ$  (b)  $45^\circ < i_b < 90^\circ$   
 (c)  $i_b = 90^\circ$  (d)  $0^\circ < i_b < 30^\circ$

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**126.** A wire of length  $L$ , area of cross-section  $A$  is hanging from a fixed support. The length of the wire changes to  $L_1$  when mass  $M$  is suspended from its free end. The expression for Young's modulus is

- (a)  $\frac{Mg(L_1 - L)}{AL}$  (b)  $\frac{MgL}{AL_1}$   
 (c)  $\frac{MgL}{A(L_1 - L)}$  (d)  $\frac{MgL_1}{AL}$

**127.** A short electric dipole has a dipole moment of  $16 \times 10^{-9}$  C-m. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of  $60^\circ$  with the dipole axis is

$$\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2 \right)$$

- (a) 200 V (b) 400 V  
 (c) zero (d) 50 V

**128.** In a guitar, two strings  $A$  and  $B$  made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in  $B$  is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of  $A$  is 530 Hz, the original frequency of  $B$  will be

- (a) 524 Hz (b) 536 Hz  
 (c) 537 Hz (d) 523 Hz

**129.** An electron is accelerated from rest through a potential difference of  $V$  volt. If the de-Broglie wavelength of the electron is  $1.227 \times 10^{-2}$  nm, the potential difference is

- (a)  $10^2$  V (b)  $10^3$  V  
 (c)  $10^4$  V (d) 10 V

**130.** The solids which have the negative temperature coefficient of resistance are

- (a) insulator only  
 (b) semiconductors only  
 (c) insulators and semiconductors  
 (d) metals

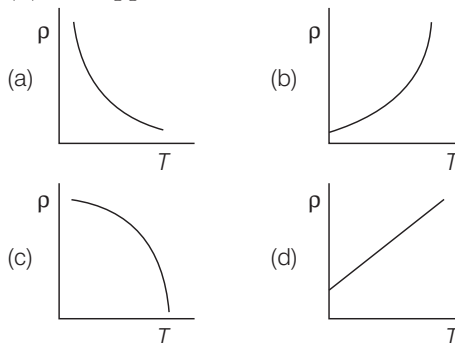
**131.** The energy required to break one bond in DNA is  $10^{-20}$  J. This value (in eV) is nearly

- (a) 0.6 (b) 0.06  
 (c) 0.006 (d) 6

**132.** The quantities of heat required to raise the temperature of two solid copper spheres of radii  $r_1$  and  $r_2$  ( $r_1 = 1.5 r_2$ ) through 1 K are in the ratio

- (a)  $\frac{9}{4}$  (b)  $\frac{3}{2}$   
 (c)  $\frac{5}{3}$  (d)  $\frac{27}{8}$

**133.** Which of the following graph represents the variation of resistivity ( $\rho$ ) with temperature ( $T$ ) for copper?



**134.** For transistor action, which of the following statements is correct?

- (a) Base, emitter and collector regions should have same size.  
 (b) Both emitter junction as well as the collector junction are forward biased.  
 (c) The base region must be very thin and lightly doped.  
 (d) Base, emitter and collector regions should have same doping concentrations.

**135.** For which one of the following, Bohr model is not valid?

- (a) Singly ionised helium atom ( $\text{He}^+$ )  
 (b) Deuteron atom  
 (c) Singly ionised neon atom ( $\text{Ne}^+$ )  
 (d) Hydrogen atom

## CHEMISTRY

**136.** What is the change in oxidation number of carbon in the following reaction?



- (a) 0 to + 4  
 (b) - 4 to + 4  
 (c) 0 to - 4  
 (d) + 4 to + 4

- 137.** On electrolysis of dilute sulphuric acid using platinum (Pt) electrode, the product obtained at anode will be  
 (a) oxygen gas (b)  $\text{H}_2\text{S}$  gas  
 (c)  $\text{SO}_2$  gas (d) hydrogen gas
- 138.** An increase in the concentration of the reactants of a reaction leads to the change in  
 (a) heat of reaction (b) threshold energy  
 (c) collision frequency (d) activation energy
- 139.** Reaction between benzaldehyde and acetophenone in presence of dilute NaOH is known as  
 (a) Cannizzaro's reaction  
 (b) Cross Cannizzaro's reaction  
 (c) Cross aldol condensation  
 (d) Aldol condensation
- 140.** Which of the following alkane cannot be made in good yield by Wurtz reaction?  
 (a) 2, 3-dimethylbutane (b) *n*-heptane  
 (c) *n*-butane (d) *n*-hexane
- 141.** Which of the following is a natural polymer?  
 (a) Poly (Butadiene-styrene)  
 (b) Polybutadiene  
 (c) Poly (Butadiene-acrylonitrile)  
 (d) *Cis*-1, 4-polyisoprene
- 142.** A mixture of  $\text{N}_2$  and Ar gases in a cylinder contains 7 g of  $\text{N}_2$  and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of  $\text{N}_2$  is [Use atomic masses (in  $\text{g mol}^{-1}$ ): N = 14, Ar = 40]  
 (a) 12 bar (b) 15 bar  
 (c) 18 bar (d) 9 bar
- 143.** Match the following and identify the correct option.
- |                                   |       |   |
|-----------------------------------|-------|---|
| A. $\text{CO}(g) + \text{H}_2(g)$ | (i)   | $\text{Mg}(\text{HCO}_3)_2 + \text{Ca}(\text{HCO}_3)_2$ |
| B. Temporary hardness of water    | (ii)  | An electron deficient hydride                           |
| C. $\text{B}_2\text{H}_6$         | (iii) | Synthesis gas   |
| D. $\text{H}_2\text{O}_2$         | (iv)  | Non-planar structure                                    |
- |     | A     | B    | C    | D    | A   | B     | C    | D    |      |
|-----|-------|------|------|------|-----|-------|------|------|------|
| (a) | (iii) | (ii) | (i)  | (iv) | (b) | (iii) | (iv) | (ii) | (i)  |
| (c) | (i)   | (ii) | (ii) | (iv) | (d) | (iii) | (i)  | (ii) | (iv) |
- 144.** For the reaction,  $2\text{Cl}(g) \longrightarrow \text{Cl}_2(g)$ , the correct option is  
 (a)  $\Delta_r H > 0$  and  $\Delta_r S < 0$   
 (b)  $\Delta_r H < 0$  and  $\Delta_r S > 0$   
 (c)  $\Delta_r H < 0$  and  $\Delta_r S < 0$   
 (d)  $\Delta_r H > 0$  and  $\Delta_r S > 0$
- 145.** An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is  
 (a)  $\frac{\sqrt{2}}{4} \times 288$  pm (b)  $\frac{4}{\sqrt{3}} \times 288$  pm  
 (c)  $\frac{4}{\sqrt{2}} \times 288$  pm (d)  $\frac{\sqrt{3}}{4} \times 288$  pm
- 146.** Urea reacts with water to form A which will decompose to form B. B when passed through  $\text{Cu}^{2+}$  (aq), deep blue colour solution C is formed. What is the formula of C from the following?  
 (a)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  (b)  $\text{Cu}(\text{OH})_2$   
 (c)  $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$  (d)  $\text{CuSO}_4$
- 147.** Reaction between acetone and methylmagnesium chloride followed by hydrolysis will give  
 (a) secondary butyl alcohol  
 (b) *tert* butyl alcohol  
 (c) isobutyl alcohol  
 (d) isopropyl alcohol
- 148.** The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals  
 (a) copper (b) calcium  
 (c) potassium (d) iron
- 149.** The number of protons, neutrons and electrons in  $^{175}_{71}\text{Lu}$ , respectively, are  
 (a) 104, 71 and 71 (b) 71, 71 and 104  
 (c) 175, 104 and 71 (d) 71, 104 and 71
- 150.** Which of the following set of molecules will have zero dipole moment?  
 (a) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1,3-dichlorobenzene  
 (b) Nitrogen trifluoride, beryllium difluoride, water, 1,3-dichlorobenzene

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- (c) Boron trifluoride, beryllium difluoride, carbon dioxide, 1, 4-dichlorobenzene  
 (d) Ammonia, beryllium difluoride, water, 1,4-dichlorobenzene

**151.** Identify a molecule which does not exist.

- (a)  $\text{Li}_2$  (b)  $\text{C}_2$   
 (c)  $\text{O}_2$  (d)  $\text{He}_2$

**152.** Identify the incorrect match.

Name	IUPAC official name
(A) Unnilunium	(i) Mendeleevium
(B) Unniltrium	(ii) Lawrencium
(C) Unnihexium	(iii) Seaborgium
(D) Unununnium	(iv) Darmstadtium

- (a) (B), (ii) (b) (C), (iii)  
 (c) (D), (iv) (d) (A), (i)

**153.** The rate constant for a first order reaction is  $4.606 \times 10^{-3} \text{ s}^{-1}$ . The time required to reduce 2.0 g of the reactant to 0.2 g is

- (a) 200 s (b) 500 s  
 (c) 1000 s (d) 100 s

**154.** Identify the correct statement from the following:

- (a) Blister copper has blistered appearance due to evolution of  $\text{CO}_2$ .  
 (b) Vapour phase refining is carried out for nickel by van Arkel method.  
 (c) Pig iron can be moulded into a variety of shapes.  
 (d) Wrought iron is impure iron with 4% carbon.

**155.** Measuring zeta potential is useful in determining which property of colloidal solution?

- (a) Solubility  
 (b) Stability of the colloidal particles  
 (c) Size of the colloidal particles  
 (d) Viscosity

**156.** Which of the following oxoacid of sulphur has  $\text{—O—O—}$  linkage?

- (a)  $\text{H}_2\text{SO}_4$ , sulphuric acid  
 (b)  $\text{H}_2\text{S}_2\text{O}_8$ , peroxodisulphuric acid  
 (c)  $\text{H}_2\text{S}_2\text{O}_7$ , pyrosulphuric acid  
 (d)  $\text{H}_2\text{SO}_3$ , sulphurous acid

**157.** Elimination reaction of 2-bromo-pentane to form pent-2-ene is

- $\beta$ -elimination reaction.
- Follows Zaitsev rule.
- Dehydrohalogenation reaction.
- Dehydration reaction.

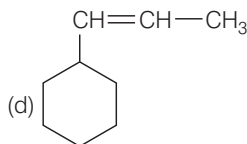
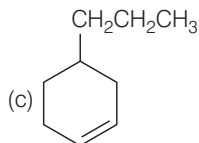
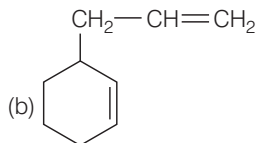
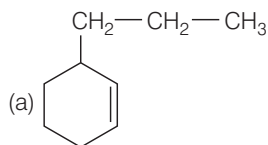
- (a) (1), (3), (4) (b) (2), (3), (4)  
 (c) (1), (2), (4) (d) (1), (2), (3)

**158.** Identify the correct statements from the following:

- $\text{CO}_2(g)$  is used as refrigerant for ice-cream and frozen food.
- The structure of  $\text{C}_{60}$  contains twelve six carbon rings and twenty five carbon rings.
- ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
- CO is colourless and odourless gas.

- (a) (1) and (3) only (b) (2) and (3) only  
 (c) (3) and (4) only (d) (1), (2) and (3) only

**159.** An alkene on ozonolysis gives methanal as one of the product. Its structure is



**160.** Paper chromatography is an example of

- (a) partition chromatography  
 (b) thin layer chromatography  
 (c) column chromatography  
 (d) adsorption chromatography

161. Match the following.

Oxide	Nature
A. CO	(i) Basic
B. BaO	(ii) Neutral
C. Al <sub>2</sub> O <sub>3</sub>	(iii) Acidic
D. Cl <sub>2</sub> O <sub>7</sub>	(iv) Amphoteric

Which of the following is correct option?

	A	B	C	D
(a)	(ii)	(i)	(iv)	(iii)
(b)	(iii)	(iv)	(i)	(ii)
(c)	(iv)	(iii)	(ii)	(i)
(d)	(i)	(ii)	(iii)	(iv)

162. Which one of the followings has maximum number of atoms?

- (a) 1 g of Mg(s) [Atomic mass of Mg = 24]  
 (b) 1 g of O<sub>2</sub>(g) [Atomic mass of O = 16]  
 (c) 1 g of Li(s) [Atomic mass of Li = 7]  
 (d) 1 g of Ag(s) [Atomic mass of Ag = 108]

163. Which of the following is a basic amino acid?

- (a) Alanine (b) Tyrosine  
 (c) Lysine (d) Serine

164. The calculated spin only magnetic moment of Cr<sup>2+</sup> ion is

- (a) 4.90 BM (b) 5.92 BM  
 (c) 2.84 BM (d) 3.87 BM

165. Sucrose on hydrolysis gives

- (a) α-D-glucose + β-D-glucose  
 (b) α-D-glucose + β-D-fructose  
 (c) α-D-fructose + β-D-fructose  
 (d) β-D-glucose + α-D-fructose

166. The mixture which shows positive deviation from Raoult's law is

- (a) Benzene + toluene  
 (b) Acetone + chloroform  
 (c) Chloroethane + bromoethane  
 (d) Ethanol + acetone

167. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?

- (a) +R-effect of —CH<sub>3</sub> groups  
 (b) -R-effect of —CH<sub>3</sub> groups  
 (c) Hyperconjugation  
 (d) -I-effect of —CH<sub>3</sub> groups

168. Find out the solubility of Ni(OH)<sub>2</sub> in 0.1 M NaOH. Given, that the ionic product of Ni(OH)<sub>2</sub> is  $2 \times 10^{-15}$ .

- (a)  $2 \times 10^{-8}$  M (b)  $1 \times 10^{-13}$  M  
 (c)  $1 \times 10^8$  M (d)  $2 \times 10^{-13}$  M

169. Which of the following is a cationic detergent ?

- (a) Sodium stearate  
 (b) Cetyltrimethyl ammonium bromide  
 (c) Sodium dodecyl benzene sulphonate  
 (d) Sodium lauryl sulphate

170. The freezing point depression constant ( $K_f$ ) of benzene is 5.12 K kg mol<sup>-1</sup>. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places)

- (a) 0.80 K (b) 0.40 K  
 (c) 0.60 K (d) 0.20 K

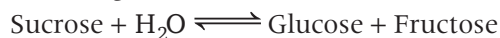
171. Identify the incorrect statement.

- (a) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.  
 (b) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.  
 (c) The oxidation states of chromium in CrO<sub>4</sub><sup>2-</sup> and Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> are not the same.  
 (d) Cr<sup>2+</sup> ( $d^4$ ) is a stronger reducing agent than Fe<sup>2+</sup> ( $d^6$ ) in water.

172. Which of the following statements is not correct about carbon monoxide?

- (a) It reduces oxygen carrying ability of blood.  
 (b) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.  
 (c) It is produced due to incomplete combustion.  
 (d) It forms carboxyhaemoglobin.

173. Hydrolysis of sucrose is given by the following reaction.



If the equilibrium constant ( $K_c$ ) is  $2 \times 10^{13}$  at 300 K, the value of  $\Delta_r G^\ominus$  at the same temperature will be

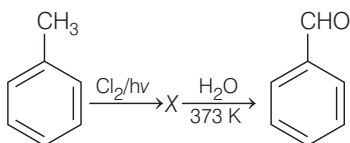
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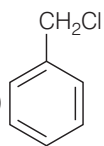
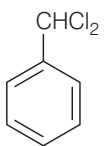
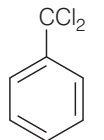
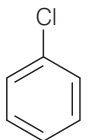
- (a)  $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$   
 (b)  $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$   
 (c)  $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$   
 (d)  $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

**174.** Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?

- (a)  $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$   
 (b)  $\text{F}^- < \text{SCN}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$   
 (c)  $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$   
 (d)  $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$

**175.** Identify compound *X* in the following sequence of reactions.



- (a)  (b)   
 (c)  (d) 

**176.** The correct option for free expansion of an ideal gas under the adiabatic condition is

- (a)  $q = 0, \Delta T < 0$  and  $w > 0$   
 (b)  $q < 0, \Delta T < 0$  and  $w = 0$   
 (c)  $q > 0, \Delta T < 0$  and  $w > 0$   
 (d)  $q = 0, \Delta T = 0$  and  $w = 0$

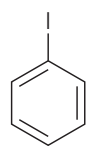
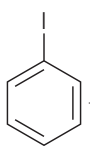
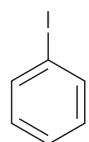
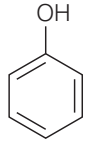
**177.** The number of Faradays (*F*) required to produce 20 g of calcium from molten  $\text{CaCl}_2$  (Atomic mass of Ca = 40 g mol<sup>-1</sup>) is

- (a) 2 (b) 3  
 (c) 4 (d) 1

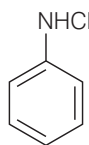
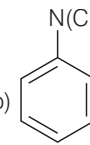
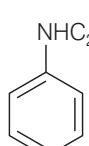
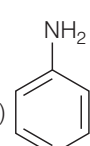
**178.** HCl was passed through a solution of  $\text{CaCl}_2$ ,  $\text{MgCl}_2$  and NaCl. Which of the following compound(s) crystallise(s)?

- (a) Only NaCl  
 (b) Only  $\text{MgCl}_2$   
 (c) NaCl,  $\text{MgCl}_2$  and  $\text{CaCl}_2$   
 (d) Both  $\text{MgCl}_2$  and  $\text{CaCl}_2$

**179.** Anisole on cleavage with HI gives:

- (a)  +  $\text{CH}_3\text{OH}$  (b)  +  $\text{C}_2\text{H}_5\text{I}$   
 (c)  +  $\text{C}_2\text{H}_5\text{OH}$  (d)  +  $\text{CH}_3\text{I}$

**180.** Which of the following amine will give the carbylamine test?

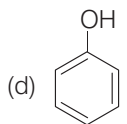
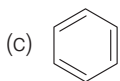
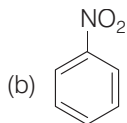
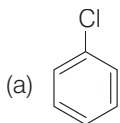
- (a)  (b)   
 (c)  (d) 



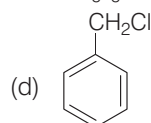
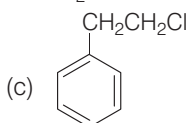
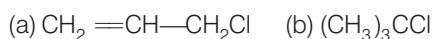
## SOLVED PAPER 2020

### CHEMISTRY

- Which of the following statement is not true about acid rain?
  - It is due to reaction of  $\text{SO}_2$ ,  $\text{NO}_2$  and  $\text{CO}_2$  with rain water.
  - Causes no damage to monuments like Taj Mahal.
  - It is harmful for plants.
  - Its pH is less than 5.6
- The oxidation number of the underlined atom in the following species
  - $\text{Cu}_2\underline{\text{O}}$  is  $-1$
  - $\underline{\text{Cl}}\text{O}_3^-$  is  $+5$
  - $\text{K}_2\underline{\text{Cr}}_2\text{O}_7$  is  $+6$
  - $\text{H}\underline{\text{Au}}\text{Cl}_4$  is  $+3$
 Identify the incorrect option.
- Reaction of propanamide with ethanolic sodium hydroxide and bromine will give
  - ethylamine
  - methylamine
  - propylamine
  - aniline
- A liquid compound (x) can be purified by steam distillation only if it is
  - steam volatile, immiscible with water
  - not steam volatile, miscible with water
  - steam volatile, miscible with water
  - not steam volatile, immiscible with water
- Among the compounds shown below which one revealed a linear structure?
  - $\text{NO}_2$
  - $\text{HOCl}$
  - $\text{O}_3$
  - $\text{N}_2\text{O}$
- Which of the following compound is most reactive in electrophilic aromatic substitution?



- Which of the following will not undergo  $\text{S}_{\text{N}}1$  reaction with  $\text{OH}^-$



- Which of the following is not true about chloramphenicol?
  - It inhibits the growth of only gram-positive bacteria
  - It is a broad spectrum antibiotic
  - It is not bactericidal
  - It is bacteriostatic
- Which of the following statement is correct about bakelite?
  - It is a cross linked polymer.
  - It is an addition polymer.
  - It is a branched chain polymer.
  - It is a linear polymer.
- If for a certain reaction  $\Delta_r H$  is  $30 \text{ kJ mol}^{-1}$  at  $450 \text{ K}$ , the value of  $\Delta_r S$  (in  $\text{JK}^{-1} \text{ mol}^{-1}$ ) for which the same reaction will be spontaneous at the same temperature is
  - 70
  - $-33$
  - 33
  - $-70$
- Match the element in column I with that in column II.

Column I	Column II
A. Copper	I. Non-metal
B. Fluorine	II. Transition metal
C. Silicon	III. Lanthanoid
D. Cerium	IV. Metalloid

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Identify the correct match.

	A	B	C	D
(a)	II	IV	I	III
(b)	II	I	IV	III
(c)	IV	III	I	II
(d)	I	II	III	IV

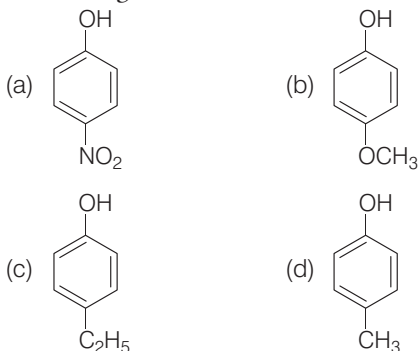
12. Which of the following is a free radical substitution reaction?

- (a) Benzene with  $\text{Br}_2 / \text{AlCl}_3$   
 (b) Acetylene with  $\text{HBr}$   
 (c) Methane with  $\text{Br}_2/h\nu$   
 (d) Propene with  $\text{HBr}/(\text{C}_6\text{H}_5\text{COO})_2$

13. The reaction of concentrated sulphuric acid with carbohydrates ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) is an example of

- (a) dehydration  
 (b) oxidation  
 (c) reduction  
 (d) sulphonation

14. Which of the following substituted phenols is the strongest acid?



15. Match the compounds of Xe in column I with the molecular structure in column II.

Column I	Column II
A. $\text{XeF}_2$	I. Square planar
B. $\text{XeF}_4$	II. Linear
C. $\text{XeO}_3$	III. Square pyramidal
D. $\text{XeOF}_4$	IV. Pyramidal

	A	B	C	D
(a)	II	I	III	IV
(b)	II	IV	III	I
(c)	II	III	I	IV
(d)	II	I	IV	III

16. The half-life for a zero order reaction having 0.02 M initial concentration of reactant is 100 s. The rate constant (in  $\text{mol L}^{-1} \text{s}^{-1}$ ) for the reaction is

- (a)  $1.0 \times 10^{-4}$  (b)  $2.0 \times 10^{-4}$   
 (c)  $2.0 \times 10^{-3}$  (d)  $1.0 \times 10^{-2}$

17. Identify the incorrect statement from the following.

- (a) Zirconium and hafnium have identical radii of 160 pm and 159 pm, respectively as a consequence of lanthanoid contraction.  
 (b) Lanthanoids reveal only +3 oxidation state.  
 (c) The lanthanoid ions other than the  $f^0$  type and the  $f^{14}$  type are all paramagnetic.  
 (d) The overall decrease in atomic and ionic radii from lanthanum to lutetium is called lanthanoid contraction.

18. Match the followings aspects with the respective metal.

Aspects	Metal
A. The metal which reveals a maximum number of oxidation states	I. Scandium
B. The metal although placed in 3d block is considered not as a transition element.	II. Copper
C. The metal which does not exhibit variable oxidation states	III. Manganese
D. The metal which in +1 oxidation state in aqueous solution undergoes disproportionation	IV. Zinc

Select the correct option.

	A	B	C	D
(a)	I	IV	II	III
(b)	III	IV	I	II
(c)	III	I	IV	II
(d)	II	IV	I	III

19. If 8 g of a non-electrolyte solute is dissolved in 114 g of *n*-octane to reduce its vapour pressure to 80%, the molar mass (in  $\text{g mol}^{-1}$ ) of the solute is

- [Given that, molar mass of *n*-octane is  $114 \text{ g mol}^{-1}$ ]  
 (a) 40 (b) 60 (c) 80 (d) 20

20. Match the coordination number and type of hybridisation with distribution of hybrid orbitals in space based on valence bond theory.

	Coordination number and type of hybridisation		Distribution of hybrid orbitals in space
A.	4, $sp^3$	I.	trigonal bipyramidal
B.	4, $dsp^2$	II.	octahedral
C.	5, $sp^3d$	III.	tetrahedral
D.	6, $d^2sp^3$	IV.	square planar

Select the correct option.

	A	B	C	D		A	B	C	D
(a)	II	III	IV	I	(b)	III	IV	I	II
(c)	IV	I	II	III	(d)	III	I	IV	II

21. The number of angular nodes and radial nodes in 3s orbital are

- (a) 0 and 2, respectively  
 (b) 1 and 0, respectively  
 (c) 3 and 0, respectively  
 (d) 0 and 1, respectively

22. Identify the correct statement from the following.

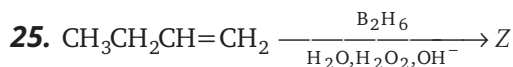
- (a) The order of hydration enthalpies of alkaline earth cations.  
 $Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$   
 (b) Lithium and magnesium show some similarities in their physical properties as they are diagonally placed in periodic table.  
 (c) Lithium is softer among all alkali metals.  
 (d) Lithium chloride is deliquescent and crystallises as a hydrate,  $LiCl \cdot H_2O$ .

23. Deficiency of which vitamin causes osteomalacia?

- (a) Vitamin A  
 (b) Vitamin D  
 (c) Vitamin K  
 (d) Vitamin E

24. Identify the wrongly matched pair.

Molecule	Shape of geometry of molecule
(a) $PCl_5$	Trigonal planar
(b) $SF_6$	Octahedral
(c) $BeCl_2$	Linear
(d) $NH_3$	Trigonal pyramidal



what is Z?

- (a)  $CH_3CH_2CH_2CH_2OH$  (b)  $CH_3CH_2\underset{\substack{| \\ OH}}{CH}CH_3$   
 (c)  $CH_3CH_2CH_2CHO$  (d)  $CH_3CH_2CH_2CH_3$

26. Identify the reaction from following having top position in EMF series (Standard reduction potential) according to their electrode potential at 298 K.

- (a)  $Mg^{2+} + 2e^- \longrightarrow Mg(s)$   
 (b)  $Fe^{2+} + 2e^- \longrightarrow Fe(s)$   
 (c)  $Au^{3+} + 2e^- \longrightarrow Au(s)$   
 (d)  $K^+ + 1e^- \longrightarrow K(s)$

27. Match the elements in Column I with methods of purification in Column II.

Column I	Column II
A. Boron	I. van-Arkel method
B. Tin	II. Mond's process
C. Zirconium	III. Liquefaction
D. Nickel	IV. Zone refining

	A	B	C	D		A	B	C	D
(a)	IV	III	I	II	(b)	IV	III	II	I
(c)	II	I	IV	III	(d)	III	IV	I	II

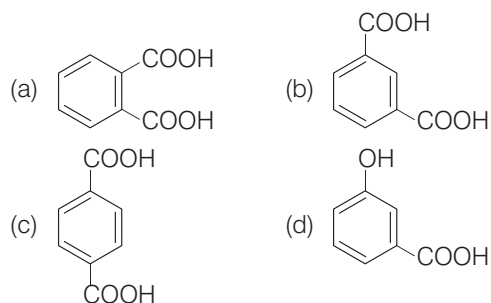
28. Which among the following salt solutions is basic in nature?

- (a) Ammonium chloride (b) Ammonium sulphate  
 (c) Ammonium nitrate (d) Sodium acetate

29. In which of the sols, the colloidal particles are with negative charge?

- (a)  $TiO_2$  (b) Haemoglobin  
 (c) Starch (d) Hydrated  $Al_2O_3$

30. Which of the following acid will form an (i) anhydride on heating and (ii) acid imide on strong heating with ammonia?



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31. In a typical fuel cell, the reactants ( $R$ ) and product ( $P$ ) are

- (a)  $R = \text{H}_2(g), \text{O}_2(g); P = \text{H}_2\text{O}_2(l)$   
 (b)  $R = \text{H}_2(g), \text{O}_2(g); P = \text{H}_2\text{O}(l)$   
 (c)  $R = \text{H}_2(g), \text{O}_2(g), \text{Cl}_2(g); P = \text{HClO}_4(aq)$   
 (d)  $R = \text{H}_2(g), \text{N}_2(g); P = \text{NH}_3(aq)$

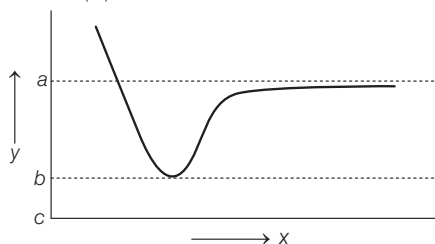
32. In collision theory of chemical reaction,  $Z_{AB}$  represents

- (a) the fraction of molecules with energies greater than  $E_a$   
 (b) the collision frequency of reactants, A and B  
 (c) steric factor  
 (d) the fraction of molecules with energies equal to  $E_a$

33. Which of the following statements is not true about glucose?

- (a) It is an aldohexose.  
 (b) It contains five hydroxyl groups.  
 (c) It is a reducing sugar.  
 (d) It is an aldopentose.

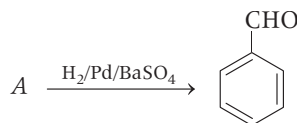
34. The potential energy ( $y$ ) curve for  $\text{H}_2$  formation as a function of internuclear distance ( $x$ ) of the H-atoms is shown below.



The bond energy of  $\text{H}_2$  is

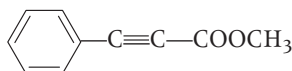
- (a)  $(b - a)$  (b)  $\frac{(c - a)}{2}$  (c)  $\frac{(b - a)}{2}$  (d)  $(c - a)$

35. Identify compound (A) in the following reaction.



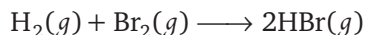
- (a) Benzoyl chloride (b) Toluene  
 (c) Acetophenone (d) Benzoic acid

36. How many (i)  $sp^2$  hybridised carbon atoms and (ii)  $\pi$  bonds are present in the following compound?



- (a) 7, 5 (b) 8, 6 (c) 7, 6 (d) 8, 5

37. At standard conditions, if the change in the enthalpy for the following reaction is  $-109 \text{ kJ mol}^{-1}$ .



Given that, bond energy of  $\text{H}_2$  and  $\text{Br}_2$  is  $435 \text{ kJ mol}^{-1}$  and  $192 \text{ kJ mol}^{-1}$  respectively, what is the bond energy (in  $\text{kJ mol}^{-1}$ ) of  $\text{HBr}$ ?  
 (a) 368 (b) 736 (c) 518 (d) 259

38. The minimum pressure required to compress  $600 \text{ dm}^3$  of a gas at 1 bar to  $150 \text{ dm}^3$  at  $40^\circ\text{C}$  is  
 (a) 4.0 bar (b) 0.2 bar (c) 1.0 bar (d) 2.5 bar

39. What is the role of gypsum,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  in setting of cement? Identify the correct option from the following.

- (a) to fasten the setting process  
 (b) to provide water molecules for hydration process  
 (c) to help to remove water molecules  
 (d) to slow down the setting process

40. Which of the following oxide is amphoteric in nature?

- (a)  $\text{SnO}_2$  (b)  $\text{SiO}_2$   
 (c)  $\text{GeO}_2$  (d)  $\text{CO}_2$

41. Which one of the following reactions does not come under hydrolysis type reaction?

- (a)  $\text{SiCl}_4(l) + 2\text{H}_2\text{O}(l) \longrightarrow \text{SiO}_2(s) + 4\text{HCl}(aq)$   
 (b)  $\text{Li}_3\text{N}(s) + 3\text{H}_2\text{O}(l) \longrightarrow \text{NH}_3(g) + 3\text{LiOH}(aq)$   
 (c)  $2\text{F}_2(g) + 2\text{H}_2\text{O}(l) \longrightarrow 4\text{HF}(aq) + \text{O}_2(g)$   
 (d)  $\text{P}_4\text{O}_{10}(s) + 6\text{H}_2\text{O}(l) \longrightarrow 4\text{H}_3\text{PO}_4(aq)$

42. Which one of the following compounds show both, Frenkel as well as Schottky defects?

- (a)  $\text{AgBr}$  (b)  $\text{AgI}$   
 (c)  $\text{NaCl}$  (d)  $\text{ZnS}$

43. One mole of carbon atom weighs 12 g, the number of atoms in it is equal to, (Mass of carbon -12 is  $1.9926 \times 10^{-23} \text{ g}$ )

- (a)  $1.2 \times 10^{23}$  (b)  $6.022 \times 10^{22}$   
 (c)  $12 \times 10^{22}$  (d)  $6.022 \times 10^{23}$

44. Isotonic solutions have same

- (a) vapour pressure  
 (b) freezing temperature  
 (c) osmotic pressure  
 (d) boiling temperature

45. The solubility product for a salt of the type  $AB$  is  $4 \times 10^{-8}$ . What is the molarity of its standard solution?

- (a)  $2 \times 10^{-4}$  mol/L      (b)  $16 \times 10^{-16}$  mol/L  
(c)  $2 \times 10^{-16}$  mol/L      (d)  $2 \times 10^{-4}$  mol/L

## BIOLOGY

46. In some plants thalamus contributes to fruit formation. Such fruits are termed as

- (a) false fruits      (b) aggregate fruits  
(c) true fruits      (d) parthenocarpic fruit

47. First discovered restriction endonuclease that always cuts DNA molecule at a particular point by recognising a specific sequence of six base pairs is

- (a) *Eco* RI  
(b) Adenosine deaminase  
(c) Thermostable DNA polymerase  
(d) *Hind* II

48. Which of the following statements is incorrect?

- (a) Biomass decreases from first to fourth trophic level  
(b) Energy content gradually increases from first to fourth trophic level  
(c) Number of individuals decreases from first trophic level to fourth trophic level  
(d) Energy content gradually decreases from first to fourth trophic level

49. The term 'Nuclein' for the genetic material was used by

- (a) Franklin      (b) Meischer  
(c) Chargaff      (d) Mendel

50. Chromosomal theory of inheritance was proposed by

- (a) Sutton and Boveri      (b) Bateson and Punnett  
(c) TH Morgan      (d) Watson and Crick

51. Phycoerythrin is the major pigment in

- (a) red algae      (b) blue-green algae  
(c) green algae      (d) brown algae

52. Identify the statement which is incorrect.

- (a) Sulphur is an integral part of cysteine  
(b) Glycine is an example of lipids  
(c) Lecithin contains phosphorus atom in its structure  
(d) Tyrosine possesses aromatic ring in its structure

53. Which of the following statements is incorrect about gymnosperms?

- (a) They are heterosporous  
(b) Male and female gametophytes are free living  
(c) Most of them have narrow leaves with thick cuticle  
(d) Their seeds are not covered

54. A species which was introduced for ornamentation but has become a trouble some weed in India

- (a) *Parthenium hysterophorus*  
(b) *Eichhornia crassipes*  
(c) *Prosopis juliflora*  
(d) *Trapa spinosa*

55. Correct position of floral parts over thalamus in mustard plant is

- (a) gynoecium occupies the highest position, while the other parts are situated below it  
(b) margin of the thalamus grows upward, enclosing the ovary completely and other parts arise below the ovary  
(c) gynoecium is present in the centre and other parts cover it partially  
(d) gynoecium is situated in the centre and other parts of the flower are located at the rim of the thalamus, at the same level

56. In recombinant DNA technology antibiotics are used

- (a) to keep medium bacteria-free  
(b) to detect alien DNA  
(c) to impart disease-resistance to the host plant  
(d) as selectable markers

57. According to Alexander von Humboldt

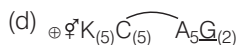
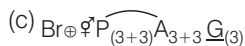
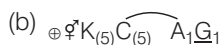
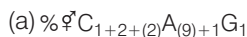
- (a) species richness decreases with increasing area of exploration  
(b) species richness increases with increasing area, but only up to limit  
(c) there is no relationship between species richness and area explored  
(d) species richness goes on increasing with increasing area of exploration

58. Which of the following is incorrect for wind pollinated plants?

- (a) Well exposed stamens and stigma  
(b) Many ovules in each ovary  
(c) Flowers are small and not brightly coloured  
(d) Pollen grains are light and non-sticky

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59. Which of the following is the correct floral formula of Liliaceae?



60. In the polynucleotide chain of DNA, a nitrogenous base is linked to the -OH of

- (a) 2' C pentose sugar      (b) 3' C pentose sugar  
(c) 5' C pentose sugar      (d) 1' C pentose sugar

61. In *Glycine max*, the product of biological nitrogen fixation is transported from the root nodules to other parts as

- (a) ammonia                      (b) glutamate  
(c) nitrates                        (d) ureides

62. The number of contrasting characters studied by Mendel for his experiments was

- (a) 14                                (b) 4  
(c) 2                                 (d) 7

63. Attachment of spindle fibres to kinetochores of chromosomes becomes evident in

- (a) anaphase                        (b) telophase  
(c) prophase                        (d) metaphase

64. Match the items in **Column I** with those in **Column II**.

Column I		Column II
A. Herbivores-Plants	(i)	Commensalism
B. Mycorrhiza-Plants	(ii)	Mutualism
C. Sheep-Cattle	(iii)	Predation
D. Orchid-Tree	(iv)	Competition

Select the correct option.

A B C D

- (a) (iv), (ii), (i), (iii)  
(b) (iii), (ii), (iv), (i)  
(c) (ii), (i), (iii), (iv)  
(d) (i), (iii), (iv), (ii)

65. Vegetative propagule in *Agave* is termed as

- (a) rhizome                        (b) bulbil  
(c) offset                         (d) eye

66. Match the items in **Column I** with those in **Column II**.

Column I		Column II
A. Aquaporin	(i)	Amide
B. Asparagine	(ii)	Polysaccharide
C. Abscisic acid	(iii)	Polypeptide
D. Chitin	(iv)	Carotenoids

Select the correct option.

A B C D                                A B C D

- (a) (iii), (i), (iv), (ii)              (b) (ii), (iii), (iv), (i)  
(c) (ii), (i), (iv), (iii)              (d) (iii), (i), (ii), (iv)

67. Which of the following elements helps in maintaining the structure of ribosomes?

- (a) Magnesium                      (b) Zinc  
(c) Copper                            (d) Molybdenum

68. Who coined the term 'Kinetin'?

- (a) Skoog and Miller                (b) Darwin  
(c) Went                                (d) Kurosawa

69. In the following in each set a conservation approach and an example of method of conservation are given

- (1) *In situ* conservation–Biosphere reserve  
(2) *Ex situ* conservation–Sacred groves  
(3) *In situ* conservation–Seed bank  
(4) *Ex situ* conservation–Cryopreservation

Select the option with correct match of approach and method.

- (a) (1) and (3)                        (b) (1) and (4)  
(c) (2) and (4)                        (d) (1) and (2)

70. Embryological support for evolution was proposed by

- (a) Ernst Heckel                      (b) Karl Ernst von Baer  
(c) Charles Darwin                    (d) Alfred Wallace

71. During non-cyclic photophosphorylation, when electrons are lost from the reaction centre at PS-II, what is the source which replaces these electrons?

- (a) Oxygen                              (b) Water  
(c) Carbon dioxide                    (d) Light

- 72.** In a mitotic cycle, the correct sequence of phases is  
 (a) S, G<sub>1</sub>, G<sub>2</sub>, M (b) G<sub>1</sub>, S, G<sub>2</sub>, M  
 (c) M, G<sub>1</sub>, G<sub>2</sub>, S (d) G<sub>1</sub>, G<sub>2</sub>, S, M
- 73.** Inclusion bodies of blue-green, purple and green photosynthetic bacteria are  
 (a) contractile vacuoles  
 (b) gas vacuoles  
 (c) centrioles  
 (d) microtubules
- 74.** Large, empty colourless cells of the adaxial epidermis along the veins of grass leaves are  
 (a) lenticels (b) guard cells  
 (c) bundle sheath cells (d) bulliform cells
- 75.** The biosynthesis of ribosomal RNA occurs in  
 (a) ribosomes (b) Golgi apparatus  
 (c) microbodies (d) nucleolus
- 76.** Which of the following is incorrect about cyanobacteria?  
 (a) They are photoautotrophs  
 (b) They lack heterocysts  
 (c) They often form blooms in polluted water bodies  
 (d) They have chlorophyll-a similar to green plants
- 77.** Which of the following statements about cork cambium is incorrect?  
 (a) It forms secondary cortex on its outside  
 (b) It forms a part of periderm  
 (c) It is responsible for the formation of lenticels  
 (d) It is a couple of layers thick
- 78.** Select the incorrect statement.  
 (a) Transport of molecules in phloem can be bidirectional  
 (b) Movement of minerals in xylem is unidirectional  
 (c) Unloading of sucrose at sink does not involve the utilisation of ATP  
 (d) Elements most easily mobilised in plants from one region to another are phosphorus, sulphur, nitrogen and potassium
- 79.** Air (Prevention and Control of Pollution) Act was amended in 1987 to include among pollutants  
 (a) vehicular exhaust  
 (b) allergy causing pollen  
 (c) noise  
 (d) particulates of size 2.5 micrometer or below

- 80.** Inhibitory substances in dormant seeds cannot be removed by subjecting seeds to  
 (a) gibberellic acid (b) nitrate  
 (c) ascorbic acid (d) chilling conditions

- 81.** Match the following techniques or instruments with their usage.

Column I	Column II
A. Bioreactor	(i) Separation of DNA fragments
B. Electrophoresis	(ii) Production of large quantities of products
C. PCR	(iii) Detection of pathogen, based on antigen-antibody reaction
D. ELISA	(iv) Amplification of nucleic acids

Select the correct option.

- |     | A                      | B   | C                      | D |
|-----|------------------------|-----|------------------------|---|
| (a) | (iii), (ii), (iv), (i) | (b) | (ii), (i), (iv), (iii) |   |
| (c) | (iv), (iii), (ii), (i) | (d) | (ii), (i), (iii), (iv) |   |

- 82.** Which of the following statements is incorrect?  
 (a) RuBisCO is a bifunctional enzyme  
 (b) In C<sub>4</sub> plants the site of RuBisCO activity is mesophyll cell  
 (c) The substrate molecule for RuBisCO activity is a 5-carbon compound  
 (d) RuBisCO action requires ATP and NADPH
- 83.** Which of the following statements is incorrect regarding the phosphorus cycle?  
 (a) Phosphates are the major form of phosphorus reservoir  
 (b) Phosphorus solubilising bacteria facilitate the release of phosphorus from organic remains  
 (c) There is appreciable respiratory release of phosphorus into atmosphere  
 (d) It is sedimentary cycle
- 84.** After about how many years of formation of earth, life appeared on this planet?  
 (a) 500 billion years (b) 50 million years  
 (c) 500 million years (d) 50 billion years
- 85.** In a mixture, DNA fragments are separated by  
 (a) bioprocess engineering  
 (b) restriction digestion  
 (c) electrophoresis  
 (d) polymerase chain reaction

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**86.** Identify the correct features of mango and coconut fruits.

- (i) In both fruit is a drupe.
- (ii) Endocarp is edible in both.
- (iii) Mesocarp in coconut is fibrous and in mango it is fleshy.
- (iv) In both, fruit develops from monocarpellary ovary.

Select the correct option.

- (a) (i), (iii) and (iv)
- (b) (i), (ii) and (iii)
- (c) (i) and (iv)
- (d) (i) and (ii)

**87.** The impact of immigration on population density is

- (a) negative
- (b) Both positive and negative
- (c) neutralised by natality
- (d) positive

**88.** Male and female gametophytes do not have an independent free-living existence in

- (a) pteridophytes
- (b) algae
- (c) angiosperms
- (d) bryophytes

**89.** Match the following concerning the activity/function and the phytohormone involved.

Column I		Column II	
A. Fruit ripener	(i)	Abscisic acid	
B. Herbicide	(ii)	GA <sub>3</sub>	
C. Bolting agent	(iii)	2, 4-D	
D. Stress hormone	(iv)	Ethephone	

Select the correct option.

- |     |      |       |           |     |       |      |            |
|-----|------|-------|-----------|-----|-------|------|------------|
| A   | B    | C     | D         | A   | B     | C    | D          |
| (a) | (ii) | (iii) | (iv), (i) | (b) | (iii) | (iv) | (ii), (i)  |
| (c) | (iv) | (iii) | (ii), (i) | (d) | (iv)  | (ii) | (i), (iii) |

**90.** Pyruvate dehydrogenase activity during aerobic respiration requires

- (a) calcium
- (b) iron
- (c) cobalt
- (d) magnesium

**91.** The rate of decomposition is faster in the ecosystem due to following factors except

- (a) detritus rich in sugars
- (b) warm and moist environment
- (c) presence of aerobic soil microbes
- (d) detritus richer in lignin and chitin

**92.** For the commercial and industrial production of citric acid, which of the following microbes is used?

- (a) *Aspergillus niger*
- (b) *Lactobacillus* sp
- (c) *Saccharomyces cerevisiae*
- (d) *Clostridium butylicum*

**93.** Which of the following STDs are not curable?

- (a) Genital herpes, hepatitis-B, HIV infection
- (b) Chlamydia, Syphilis, genital warts
- (c) HIV, gonorrhoea, trichomoniasis
- (d) Gonorrhoea, trichomoniasis, hepatitis-B

**94.** Spooling is

- (a) amplification of DNA
- (b) cutting of separated DNA bands from the agarose gel
- (c) transfer of separated DNA fragments to synthetic membranes
- (d) collection of isolated DNA

**95.** The phenomenon of evolution of different species in a given geographical area starting from a point and spreading to other habitats is called

- (a) saltation
- (b) co-evolution
- (c) natural selection
- (d) adaptive radiation

**96.** The best example for pleiotropy is

- (a) skin colour
- (b) phenylketonuria
- (c) colour blindness
- (d) ABO blood group

**97.** In cockroach, identify the parts of the foregut in correct sequence.

- (a) Mouth → Oesophagus → Pharynx → Crop → Gizzard
- (b) Mouth → Crop → Pharynx → Oesophagus → Gizzard
- (c) Mouth → Gizzard → Crop → Pharynx → Oesophagus
- (d) Mouth → Pharynx → Oesophagus → Crop → Gizzard

**98.** Match the following columns and select the correct option from the codes given below.

Column I		Column II	
A. Pituitary hormone	1.	Steroid	
B. Epinephrine	2.	Neuropeptides	
C. Endorphins	3.	Peptides, proteins	
D. Cortisol	4.	Biogenic amines	



- A B C D  
 (a) 4 1 2 3  
 (b) 3 4 2 1  
 (c) 4 3 1 2  
 (d) 3 4 1 2

**99.** Which of the following options does correctly represent the characteristic features of phylum–Annelida?

- (a) Triploblastic, unsegmented body and bilaterally symmetrical  
 (b) Triploblastic, segmented body and bilaterally symmetrical  
 (c) Triploblastic, flattened body and acoelomate condition  
 (d) Diploblastic, mostly marine and radially symmetrical

**100.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Dragonflies	1. Biocontrol agents of several plant pathogens
B. <i>Bacillus thuringiensis</i>	2. Get rid of Aphids and mosquitoes
C. <i>Glomus</i>	3. Narrow spectrum Insecticidal applications
D. Baculoviruses	4. Biocontrol agents of lepidopteran plant pests
	5. Absorb phosphorus from soil

**Codes**

- A B C D                      A B C D  
 (a) 3 5 4 1                      (b) 2 1 3 4  
 (c) 2 3 4 5                      (d) 2 4 5 3

**101.** Intrinsic factor that helps in the absorption of vitamin-B<sub>12</sub> is secreted by

- (a) goblet cells                      (b) hepatic cells  
 (c) oxyntic cells                      (d) chief cells

**102.** Hormones stored and released from neurohypophysis are

- (a) thyroid stimulating hormone and oxytocin  
 (b) oxytocin and vasopressin  
 (c) follicle stimulating hormone and leutinizing hormone  
 (d) prolactin and vasopressin

**103.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Typhoid	1. <i>Haemophilus influenzae</i>
B. Malaria	2. <i>Wuchereria bancrofti</i>
C. Pneumonia	3. <i>Plasmodium vivax</i>
D. Filariasis	4. <i>Salmonella typhi</i>

**Codes**

- A B C D                      A B C D  
 (a) 4 3 1 2                      (b) 3 4 2 1  
 (c) 1 3 2 4                      (d) 1 2 4 3

**104.** In human beings, at the end of 12 weeks (first trimester) of pregnancy, the following is observed.

- (a) Eyelids and eyelashes are formed  
 (b) Most of the major organ systems are formed  
 (c) The head is covered with fine hair  
 (d) Movement of the foetus

**105.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Rods and cones	1. Absence of photoreceptor cells
B. Blind spot	2. Cones are densely packed
C. Fovea	3. Photoreceptor cells
D. Iris	4. Visible coloured portion of the eye

**Codes**

- A B C D                      A B C D  
 (a) 3 1 2 4                      (b) 2 3 1 4  
 (c) 3 4 2 1                      (d) 2 4 3 1

**106.** The size of Pleuropneumonia Like Organism (PPLO) is

- (a) 0.02 μm                      (b) 1-2 μm  
 (c) 10–20 μm                      (d) 0.1 μm

**107.** The proteolytic enzyme renin is found in

- (a) intestinal juice                      (b) bile juice  
 (c) gastric juice                      (d) pancreatic juice

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- 108.** Match the following (Columns) group of organisms with their respective distinctive characteristics and select the correct option from the codes given belows

Column-I (Organisms)	Column-II (Characteristics)
A. Platyhelminthes	1. Cylindrical body with no segmentation
B. Echinoderms	2. Warm blooded animals with direct development
C. Hemichordates	3. Bilateral symmetry with incomplete digestive system
D. Aves	4. Radial symmetry with indirect development

### Codes

A	B	C	D	A	B	C	D		
(a)	3	4	1	2	(b)	2	3	4	1
(c)	4	1	2	3	(d)	1	2	3	4

- 109.** Cyclosporin\*A used as immunosuppression agent, is produced from
- Monascus purpureus*
  - Saccharomyces cerevisiae*
  - Penicillium notatum*
  - Trichoderma polysporum*
- 110.** Select the correct statement from the following.
- Gel electrophoresis is used for amplification of a DNA segment
  - The polymerase enzyme joins the gene of interest and the vector DNA
  - Restriction enzyme digestions are performed by incubating purified DNA molecules with the restriction enzymes of optimum conditions
  - PCR is used for isolation and separation of gene of interest

- 111.** The increase in osmolarity from outer to inner medullary interstitium is maintained due to

- close proximity between Henle's loop and vasa recta
- counter-current mechanism
- selective secretion of  $\text{HCO}_3^-$  and hydrogen ions in PCT.

IV. higher blood pressure in glomerular capillaries

- Only II
- III and IV
- I, II and III
- I and II

- 112.** The yellowish fluid 'colostrum' secreted by mammary glands of mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant. This type of immunity is called as

- passive immunity
- active immunity
- acquired immunity
- autoimmunity

- 113.** Match the following columns with reference to cockroach and select the correct option from the codes given belows.

Column I	Column II
A. Grinding of the food particles	1. Hepatic caecal
B. Secrete gastric juice	2. 10th segment
C. 10 pairs	3. Proventriculus
D. Anal cerci	4. Spiracles
	5. Alary muscles

### Codes

A	B	C	D	
(a)	3	1	4	2
(b)	4	3	5	2
(c)	1	4	3	2
(d)	2	3	1	4

- 114.** RNA interference is used for which of the following purposes in the field of biotechnology?
- to develop a plant tolerant to abiotic stresses
  - to develop a pest resistant plant against infestation by nematode
  - to enhance the mineral usage by the plant
  - to reduce post harvest losses

- 115.** *E. coli* has only  $4.6 \times 10^6$  base pairs and completes the process of replication within 18 minutes, then the average rate of polymerisation is approximately

- 2000 bp/s
- 3000 bp/s
- 4000 bp/s
- 1000 bp/s

**116.** Progestogens alone or in combination with oestrogens can be used as a contraceptive in the form of

- (a) implants only
- (b) injections only
- (c) pills, injections and implants
- (d) pills only

**117.** According to Central Pollution Control Board (CPCB) what size (in diameter) of particulate is responsible for causing greater harm to human health?

- (a) 3.5 micrometers
- (b) 2.5 micrometers
- (c) 4.0 micrometers
- (d) 3.0 micrometers

**118.** The Total Lung Capacity (TLC) is the total volume of air accommodated in the lungs at the end of a forced inspiration. This includes

- (a) RV, IC (Inspiratory Capacity), EC (Expiratory Capacity) and ERV
- (b) RV, ERV, IC and EC
- (c) RV, ERV, VC (Vital Capacity) and FRC (Functional Residual Capacity)
- (d) RV (Residual Volume), ERV (Expiratory Reserve Volume), TV (Tidal Volume) and IRV (Inspiratory Reserve Volume)

**119.** Select the correct option of haploid cells from the following groups.

- (a) Primary oocyte, secondary oocyte, spermatid
- (b) Secondary spermatocyte, first polar body, ovum
- (c) Spermatogonia, primary spermatocyte, spermatid
- (d) Primary spermatocyte, secondary spermatocyte, second polar body

**120.** During meiosis I, in which stage synapsis takes place?

- (a) Pachytene
- (b) Zygotene
- (c) Diplotene
- (d) Leptotene

**121.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Smooth Endoplasmic Reticulum	1. Protein synthesis
B. Rough endoplasmic reticulum	2. Lipid synthesis
C. Golgi complex	3. Glycosylation
D. Centriole	4. Spindle formation

**Codes**

	A	B	C	D		A	B	C	D
(a)	2	1	3	4	(b)	3	1	2	4
(c)	4	2	1	3	(d)	1	2	3	4

**122.** Select the correct statement.

- (a) Atrial Natriuretic Factor increases the blood pressure
- (b) Angiotensin II is a powerful vasodilator
- (c) Counter-current pattern of blood flow is not observed in vasa recta
- (d) Reduction in Glomerular Filtration Rate (GFR) activities JG cells to release renin

**123.** Which of the following is associated with decrease in cardiac output?

- (a) Sympathetic nerves
- (b) Parasympathetic neural signals
- (c) Pneumotaxic centre
- (d) Adrenal medullary hormones

**124.** Inbreeding depression is

- (a) reduced motility and immunity due to close inbreeding.
- (b) decreased productivity due to mating of superior male and inferior female
- (c) decrease in body mass of progeny due to continued close inbreeding
- (d) reduced fertility and productivity due to continued close inbreeding

**125.** Select the incorrectly matched pair from following.

- (a) Chondrocytes–Smooth muscle cells
- (b) Neurons–Nerve cells
- (c) Fibroblast–Areolar tissue
- (d) Osteocytes–Bone cells

**126.** The laws and rules to prevent unauthorised exploitation of bioresources are termed as

- (a) biopatenting
- (b) bioethics
- (c) bioengineering
- (d) biopiracy

**127.** Match the following columns and select the correct option from the codes given belows

Column I	Column II
A. Ovary	1. Human chorionic gonadotropin
B. Placenta	2. oestrogen and progesterone
C. Corpus luteum	3. Androgens
D. Leydig cells	4. Progesterone only

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### Codes

A	B	C	D	A	B	C	D
(a) 4	3	2	1	(b) 1	2	3	4
(c) 1	3	2	4	(d) 2	1	4	3

- 128.** Match the following columns and select the correct option from the codes given belows.

Column I	Column II
A. <i>Aptenodytes</i>	1. Flying fox
B. <i>Pteropus</i>	2. Angel fish
C. <i>Pterophyllum</i>	3. Lamprey
D. <i>Petromyzon</i>	4. Penguin

### Codes

A	B	C	D
(a) 3	4	2	1
(b) 3	4	1	2
(c) 4	1	2	3
(d) 2	1	4	3

- 129.** A hominid fossil discovered in Java in 1891, now extinct having cranial capacity of about 900 cc was
- Homo erectus*
  - Neanderthal man
  - Homo sapiens*
  - Australopithecus*

- 130.** Match the following (Columns) events that occur in their respective phases of cell cycle and select the correct option from the codes given below.

Column I	Column II
A. G <sub>1</sub> -phase	1. Cell grows and organelle duplication
B. S phase	2. DNA replication and chromosome duplication
C. G <sub>2</sub> -phase	3. Cytoplasmic growth
D. Metaphase in M-phase	4. Alignment of chromosomes

### Codes

A	B	C	D
(a) 2	3	4	1
(b) 3	4	1	2
(c) 4	1	2	3
(d) 1	2	3	4

- 131.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Pneumotaxic centre	1. Alveoli
B. O <sub>2</sub> dissociation curve	2. Pons region of brain
C. Carbonic anhydrase	3. Haemoglobin
D. Primary site of exchange of gases	4. RBC

### Codes

A	B	C	D	A	B	C	D
(a) 1	3	2	4	(b) 2	3	4	1
(c) 3	2	4	1	(d) 4	1	3	2

- 132.** Which is the basis of genetic mapping of human genome as well as DNA fingerprinting?
- Polymorphism in DNA sequence
  - Single nucleotide polymorphism
  - Polymorphism in *hnRNA* sequence
  - Polymorphism in RNA sequence

- 133.** Which of the following conditions causes erythroblastosis foetalis?
- Mother Rh+ve and foetus Rh-ve
  - Mother Rh-ve and foetus Rh+ve
  - Both mother and foetus Rh-ve
  - Both mother and foetus Rh+ve

- 134.** All vertebrates are chordates, but all chordates are not vertebrates, why?
- Notochord is replaced by vertebral column in adult of some chordates
  - Ventral hollow nerve cord remains throughout life in some chordates
  - All chordates possess vertebral column
  - All chordates possess notochord throughout their life

- 135.** Match the following columns and select the correct option from the codes given below.

Column I	Column II
A. Gout	1. Decreased levels of estrogen
B. Osteoporosis	2. Low Ca <sup>2+</sup> ions in the blood
C. Tetany	3. Accumulation of uric acid crystals
D. Muscular dystrophy	4. Autoimmune disorder

### Codes

A	B	C	D	A	B	C	D
(a) 2	1	3	4	(b) 3	1	2	4
(c) 4	3	1	2	(d) 1	2	3	4

**PHYSICS**

**136.** The electromagnetic wave with shortest wavelength among the following is

- (a) UV-rays
- (b) X-rays
- (c)  $\gamma$ -rays
- (d) microwaves

**137.** The angular speed of the wheel of a vehicle is increased from 360 rpm to 1200 rpm in 14 s.

- Its angular acceleration is
- (a)  $2\pi \text{ rad/s}^2$
  - (b)  $28\pi \text{ rad/s}^2$
  - (c)  $120\pi \text{ rad/s}^2$
  - (d)  $1 \text{ rad/s}^2$

**138.** What happens to the mass number and atomic number of an element when it emits  $\gamma$ -radiation?

- (a) Mass number decreases by four and atomic number decreases by two.
- (b) Mass number and atomic number remain unchanged.
- (c) Mass number remains unchanged, while atomic number decreases by one.
- (d) Mass number increases by four and atomic number increases by two.

**139.** The angle of 1' (minute of arc) in radian is nearly equal to

- (a)  $2.91 \times 10^{-4} \text{ rad}$
- (b)  $4.85 \times 10^{-4} \text{ rad}$
- (c)  $4.80 \times 10^{-6} \text{ rad}$
- (d)  $1.75 \times 10^{-2} \text{ rad}$

**140.** The magnetic flux linked with a coil (in Wb) is given by the equation  $\phi = 5t^2 + 3t + 16$

The magnitude of induced emf in the coil at the fourth second will be

- (a) 33 V
- (b) 43 V
- (c) 108 V
- (d) 10 V

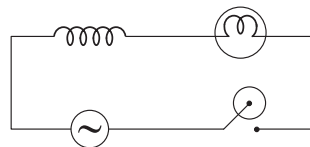
**141.** The electric field at a point on the equatorial plane at a distance  $r$  from the centre of a dipole having dipole moment  $\vec{P}$  is given by ( $r \gg$  separation of two charges forming the dipole,  $\epsilon_0 =$  permittivity of free space)

- (a)  $\mathbf{E} = \frac{\mathbf{P}}{4\pi\epsilon_0 r^3}$
- (b)  $\mathbf{E} = \frac{2\mathbf{P}}{4\pi\epsilon_0 r^3}$
- (c)  $\mathbf{E} = -\frac{\mathbf{P}}{4\pi\epsilon_0 r^2}$
- (d)  $\mathbf{E} = -\frac{\mathbf{P}}{4\pi\epsilon_0 r^3}$

**142.** A plano-convex lens of unknown material and unknown focal length is given. With the help of a spherometer we can measure the

- (a) focal length of the lens
- (b) radius of curvature of the curved surface
- (c) aperture of the lens
- (d) refractive index of the material

**143.** A light bulb and an inductor coil are connected to AC ac source through a key as shown in the figure below. The key is closed and after sometime an iron rod is inserted into the interior of the inductor. The glow of the light bulb



- (a) decreases
- (b) remains unchanged
- (c) will fluctuate
- (d) increases

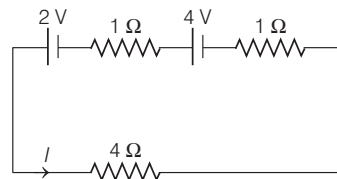
**144.** The efficiency of a Carnot engine depends upon

- (a) the temperature of the sink only
- (b) the temperatures of the source and sink
- (c) the volume of the cylinder of the engine
- (d) the temperature of the source only

**145.** Out of the following which one is a forward biased diode?

- (a)  $-4 \text{ V}$  connected to the p-region,  $-2 \text{ V}$  to the n-region
- (b)  $2 \text{ V}$  connected to the p-region,  $5 \text{ V}$  to the n-region
- (c)  $-2 \text{ V}$  connected to the p-region,  $+2 \text{ V}$  to the n-region
- (d)  $0 \text{ V}$  connected to the p-region,  $-3 \text{ V}$  to the n-region

**146.** For the circuit shown in the figure, the current  $I$  will be



- (a) 0.75 A
- (b) 1 A
- (c) 1.5 A
- (d) 0.5 A

**147.** Two coherent sources of light interfere and produce fringe pattern on a screen. For central maximum, the phase difference between the two waves will be

- (a) zero
- (b)  $\pi$
- (c)  $3\pi/2$
- (d)  $\pi/2$

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**148.** The total energy of an electron in the  $n$ th stationary orbit of the hydrogen atom can be obtained by

- (a)  $E_n = \frac{13.6}{n^2}$  eV      (b)  $E_n = -\frac{13.6}{n^2}$  eV  
 (c)  $E_n = -\frac{1.36}{n^2}$  eV      (d)  $E_n = -13.6 \times n^2$  eV

**149.** Identify the function which represents a periodic motion.

- (a)  $e^{\omega t}$       (b)  $\log_e(\omega t)$   
 (c)  $\sin \omega t + \cos \omega t$       (d)  $e^{-\omega t}$

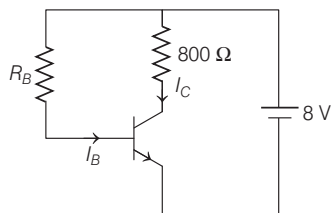
**150.** The de-Broglie wavelength of an electron moving with kinetic energy of 144 eV is nearly

- (a)  $102 \times 10^{-3}$  nm      (b)  $102 \times 10^{-4}$  nm  
 (c)  $102 \times 10^{-5}$  nm      (d)  $102 \times 10^{-2}$  nm

**151.** The mean free path  $l$  for a gas molecule depends upon diameter,  $d$  of the molecule as

- (a)  $l \propto \frac{1}{d^2}$       (b)  $l \propto d$       (c)  $l \propto d^2$       (d)  $l \propto \frac{1}{d}$

**152.** A  $n$ - $p$ - $n$  transistor is connected in common emitter configuration (see figure) in which collector voltage drop across load resistance ( $800 \Omega$ ) connected to the collector circuit is 0.8 V. The collector current is



- (a) 2 mA      (b) 0.1 mA  
 (c) 1 mA      (d) 0.2 mA

**153.** A person sitting in the ground floor of a building notices through the window of height 1.5 m, a ball dropped from the roof of the building crosses the window in 0.1 s. What is the velocity of the ball when it is at the topmost point of the window?

- ( $g = 10 \text{ m/s}^2$ )  
 (a) 15.5 m/s      (b) 14.5 m/s  
 (c) 4.5 m/s      (d) 20 m/s

**154.** The magnetic field in a plane electromagnetic wave is given by

$$B_y = 2 \times 10^{-7} \sin(\pi \times 10^3 x + 3\pi \times 10^{11} t) \text{ T}$$

Calculate the wavelength.

- (a)  $\pi \times 10^3$  m      (b)  $2 \times 10^{-3}$  m  
 (c)  $2 \times 10^3$  m      (d)  $\pi \times 10^{-3}$  m

**155.** The length of the string of a musical instrument is 90 cm and has a fundamental frequency of 120 Hz. Where should it be pressed to produce fundamental frequency of 180 Hz?

- (a) 75 cm      (b) 60 cm      (c) 45 cm      (d) 80 cm

**156.** The acceleration of an electron due to the mutual attraction between the electron and a proton when they are  $1.6 \text{ \AA}$  apart is, ( $m_e \approx 9 \times 10^{-31} \text{ kg}$ ,  $e = 1.6 \times 10^{-19} \text{ C}$ )

$$\left( \text{take, } \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2} \right)$$

- (a)  $10^{24} \text{ m/s}^2$       (b)  $10^{23} \text{ m/s}^2$   
 (c)  $10^{22} \text{ m/s}^2$       (d)  $10^{25} \text{ m/s}^2$

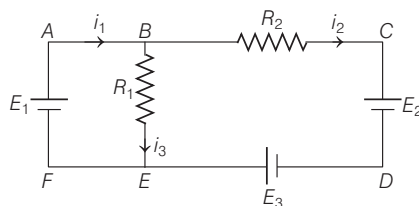
**157.** The wave nature of electrons was experimentally verified by

- (a) de-Broglie      (b) Hertz  
 (c) Einstein      (d) Davisson and Germer

**158.** Two solid conductors are made up of same material, have same length and same resistance. One of them has a circular cross-section of area  $A_1$  and the other one has a square cross-section of area  $A_2$ . The ratio  $A_1/A_2$  is

(a) 1.5      (b) 1      (c) 0.8      (d) 2

**159.** For the circuit given below, the Kirchoff's loop rule for the loop BCDEB is given by the equation



- (a)  $-i_2 R_2 + E_2 - E_3 + i_3 R_1 = 0$   
 (b)  $i_2 R_2 + E_2 - E_3 - i_3 R_1 = 0$   
 (c)  $i_2 R_2 + E_2 + E_3 + i_3 R_1 = 0$   
 (d)  $-i_2 R_2 + E_2 + E_3 + i_3 R_1 = 0$

**160.** Three stars  $A, B, C$  have surface temperatures  $T_A, T_B, T_C$ , respectively. Star  $A$  appears bluish, star  $B$  appears reddish and star  $C$  yellowish. Hence

- (a)  $T_A > T_B > T_C$                       (b)  $T_B > T_C > T_A$   
 (c)  $T_C > T_B > T_A$                       (d)  $T_A > T_C > T_B$

**161.** A liquid does not wet the solid surface if angle of contact is

- (a) equal to  $45^\circ$                       (b) equal to  $60^\circ$   
 (c) greater than  $90^\circ$                       (d) zero

**162.** A point mass  $m$  is moved in a vertical circle of radius  $r$  with the help of a string. The velocity of the mass is  $\sqrt{7gr}$  at the lowest point. The tension in the string at the lowest point is

- (a)  $6mg$     (b)  $7mg$     (c)  $8mg$     (d)  $1mg$

**163.** An object is placed on the principal axis of a concave mirror at a distance of  $1.5f$  ( $f$  is the focal length). The image will be at

- (a)  $-3f$     (b)  $1.5f$     (c)  $-1.5f$     (d)  $3f$

**164.** The half-life of a radioactive sample undergoing  $\alpha$ -decay is  $1.4 \times 10^{17}$  s. If the number of nuclei in the sample is  $2.0 \times 10^{21}$ . The activity of the sample is nearly

- (a)  $10^4 \text{Bq}$     (b)  $10^5 \text{Bq}$     (c)  $10^6 \text{Bq}$     (d)  $10^3 \text{Bq}$

**165.** If the critical angle for total internal reflection from a medium to vacuum is  $45^\circ$ , then velocity of light in the medium is

- (a)  $1.5 \times 10^8 \text{ m/s}$                       (b)  $\frac{3}{\sqrt{2}} \times 10^8 \text{ m/s}$   
 (c)  $\sqrt{2} \times 10^8 \text{ m/s}$                       (d)  $3 \times 10^8 \text{ m/s}$

**166.** A wheel with 20 metallic spokes each 1 m long is rotated with a speed of 120 rpm in a plane perpendicular to a magnetic field of 0.4 G. The induced emf between the axle and rim of the wheel will be ( $1 \text{ G} = 10^{-4} \text{ T}$ )

- (a)  $2.51 \times 10^{-4} \text{ V}$                       (b)  $2.51 \times 10^{-5} \text{ V}$   
 (c)  $4.0 \times 10^{-5} \text{ V}$                       (d)  $2.51 \text{ V}$

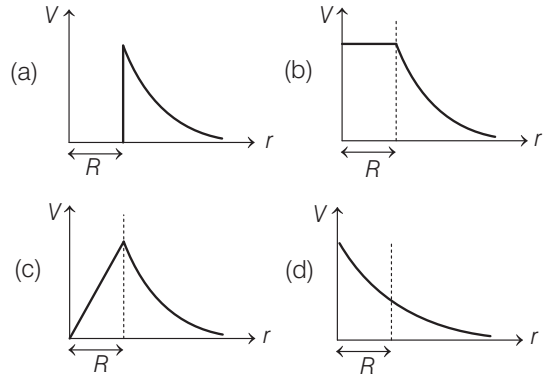
**167.** An ideal gas equation can be written as

$$p = \frac{\rho RT}{M_0}$$

where,  $\rho$  and  $M_0$  are respectively,

- (a) mass density, mass of the gas  
 (b) number density, molar mass  
 (c) mass density, molar mass  
 (d) number density, mass of the gas

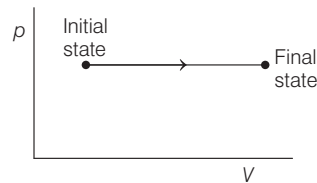
**168.** The variation of electrostatic potential with radial distance  $r$  from the centre of a positively charged metallic thin shell of radius  $R$  is given by the graph



**169.** Which of the following gate is called universal gate?

- (a) OR gate                      (b) AND gate  
 (c) NAND gate                      (d) NOT gate

**170.** The  $p$ - $V$  diagram for an ideal gas in a piston cylinder assembly undergoing a thermodynamic process is shown in the figure. The process is



- (a) adiabatic                      (b) isochoric  
 (c) isobaric                      (d) isothermal

**171.** The power of a biconvex lens is 10 D and the radius of curvature of each surface is 10 cm. Then, the refractive index of the material of the lens is

- (a)  $\frac{4}{3}$     (b)  $\frac{9}{8}$     (c)  $\frac{5}{3}$     (d)  $\frac{3}{2}$

**172.** An intrinsic semiconductor is converted into  $n$ -type extrinsic semiconductor by doping it with

- (a) phosphorous                      (b) aluminium  
 (c) silver                      (d) germanium

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**173.** A barometer is constructed using a liquid (density =  $760 \text{ kg/m}^3$ ). What would be the height of the liquid column, when a mercury barometer reads 76 cm?

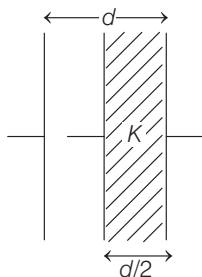
(Density of mercury =  $13600 \text{ kg/m}^3$ )

- (a) 1.36 m (b) 13.6 m (c) 136 m (d) 0.76 m

**174.** A wire of length  $L$  metre carrying a current of  $I$  ampere is bent in the form of a circle. Its magnetic moment is

- (a)  $IL^2/4Am^2$  (b)  $I\pi L^2/4Am^2$   
(c)  $2IL^2/\pi Am^2$  (d)  $IL^2/4\pi Am^2$

**175.** A parallel plate capacitor having cross-sectional area  $A$  and separation  $d$  has air in between the plates. Now, an insulating slab of same area but thickness  $d/2$  is inserted between the plates as shown in figure having dielectric constant  $K(=4)$ . The ratio of new capacitance to its original capacitance will be



- (a) 2 : 1 (b) 8 : 5  
(c) 6 : 5 (d) 4 : 1

**176.** What is the depth at which the value of acceleration due to gravity becomes  $1/n$  times the value that the surface of earth? (Radius of earth =  $R$ )

- (a)  $R/n^2$  (b)  $R(n-1)/n$   
(c)  $Rn/(n-1)$  (d)  $R/n$

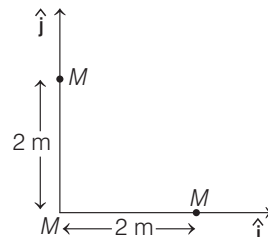
**177.** Time intervals measured by a clock give the following readings

1.25 s, 1.24 s, 1.27 s, 1.21 s and 1.28 s.

What is the percentage relative error of the observations?

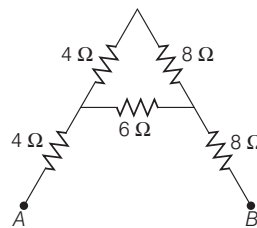
- (a) 2% (b) 4%  
(c) 16% (d) 1.6%

**178.** Three identical spheres, each of mass  $M$ , are placed at the corners of a right angle triangle with the mutually perpendicular sides equal to 2 m (see figure). Taking the point of intersection of the two mutually perpendicular sides as the origin, find the position vector of centre of mass.



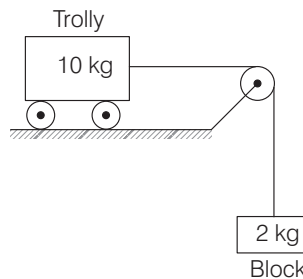
- (a)  $2(\hat{i} + \hat{j})$  (b)  $(\hat{i} + \hat{j})$   
(c)  $\frac{2}{3}(\hat{i} + \hat{j})$  (d)  $\frac{4}{3}(\hat{i} + \hat{j})$

**179.** The equivalent resistance between  $A$  and  $B$  for the mesh shown in the figure is



- (a)  $7.2\Omega$  (b)  $16\Omega$   
(c)  $30\Omega$  (d)  $4.8\Omega$

**180.** Calculate the acceleration of the block and trolley system shown in the figure. The coefficient of kinetic friction between the trolley and the surface is 0.05. ( $g = 10 \text{ m/s}^2$ , mass of the string is negligible and no other friction exists).



- (a)  $1.25 \text{ m/s}^2$  (b)  $1.50 \text{ m/s}^2$   
(c)  $1.66 \text{ m/s}^2$  (d)  $1.00 \text{ m/s}^2$