Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.

2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total score. The maximum marks are 720.

3. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.

6. The CODE for this Booklet is R1. Make sure that the CODE printed on Side-2 of the Answer Sheet is the same as that on this Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.

7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet Answer Sheet.

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat during the test.

11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet second time will be deemed not to have handed over the Answer Sheet and deal with as an unfair means case.

12. Use of Electronic/Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.
Match the following genes of the Lac operon with their respective products:
(a) i gene (ii) β-galactosidase
(b) z gene (iii) Permease
(c) a gene (iii) Repressor
(d) y gene (iv) Transacetylase
Select the correct option.
(1) (iii) (iv) (i) (ii)
(2) (i) (iii) (ii) (iv)
(3) (iii) (i) (ii) (iv)
(4) (iii) (i), (iv) (ii)

Match the following structures with their respective location in organs:
(a) Crypts of Lieberkühn (i) Pancreas
(b) Glisson’s Capsule (ii) Duodenum
(c) Islets of Langerhans (iii) Small intestine
(d) Brunner’s Glands (iv) Liver
Select the correct option from the following:
(1) (iii) (ii) (i) (iv)
(2) (ii) (i) (iii) (iv)
(3) (iii) (iv) (i) (ii)
(4) (iii) (iv) (i) (ii)

What is the direction of movement of sugars in phloem?
(1) Bi-directional
(2) Non-multidirectional
(3) Upward
(4) Downward

The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in:
(1) Bronchioles and Fallopian tubes
(2) Bile duct and Bronchioles
(3) Fallopian tubes and Pancreatic duct
(4) Eustachian tube and Salivary duct

Which of the following is the most important cause for animals and plants being driven to extinction?
(1) Alien species invasion
(2) Habitat loss and fragmentation
(3) Drought and floods
(4) Economic exploitation

Which of the following contraceptive methods involve a role of hormone?
(1) Pills, Emergency contraceptives, Barrier methods
(2) Lactational amenorrhea, Pills, Emergency contraceptives
(3) Barrier method, Lactational amenorrhea, Pills
(4) Contraceptive pills, Emergency contraceptives

Which of the following pair of organelles does not contain DNA?
(1) Nuclear envelope and Mitochondria
(2) Mitochondria and Lysosomes
(3) Chloroplast and Vacuoles
(4) Lysosomes and Vacuoles

Placentation, in which ovules develop on the inner wall of the ovary or in peripheral part, is:
(1) Free central
(2) Basal
(3) Axile
(4) Parietal

The Earth Summit held in Rio de Janeiro in 1992 was called:
(1) for immediate steps to discontinue use of CFCs that were damaging the ozone layer
(2) to reduce CO₂ emissions and global warming
(3) for conservation of biodiversity and sustainable utilization of its benefits
(4) to assess threat posed to native species by invasive weed species

Purines found both in DNA and RNA are:
(1) Cytosine and thymine
(2) Adenine and thymine
(3) Adenine and guanine
(4) Guanine and cytosine
Match the following hormones with the respective disease:

(a) Insulin  (ii) Addison's disease
(b) Thyroxin  (iii) Diabetes insipidus
(c) Corticoids  (iv) Acromegaly
(d) Growth Hormone  (v) Goitre
(vi) Diabetes mellitus

Select the correct option:

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

2. The correct sequence of phases of cell cycle is:
   (1) G1 → S → G2 → M
   (2) M → G1 → G2 → S
   (3) G1 → G2 → S → M
   (4) S → G1 → G2 → M

3. Which of the following sexually transmitted diseases is not completely curable?
   (1) Chlamydiass
   (2) Gonorrhoea
   (3) Genital warts
   (4) Genital herpes

4. Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for:
   (1) making tubes and pipes
   (2) making plastic sacks
   (3) use as a fertilizer
   (4) construction of roads

5. The shorter and longer arms of a submetacentric chromosome are referred to as:
   (1) q-arm and p-arm respectively
   (2) s-arm and l-arm respectively
   (3) p-arm and q-arm respectively
   (4) m-arm and n-arm respectively

6. Following statements describe the characteristics of the enzyme Restriction Endonuclease. Identify the incorrect statement.
   (1) The enzyme recognizes a specific palindromic nucleotide sequence in the DNA.
   (2) The enzyme cuts DNA molecule at identified position within the DNA.
   (3) The enzyme binds DNA at specific sites and cuts only one of the two strands.
   (4) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.

7. Persistent mericell in the seed is known as:
   (1) Tegmen
   (2) Chalaza
   (3) Perisperm
   (4) Hilum

8. Identify the cells whose secretion protects the lining of gastro-intestinal tract from various enzymes.
   (1) Duodenal Cells
   (2) Chief Cells
   (3) Goblet Cells
   (4) Oxystic Cells

9. Which of the following statements is not correct?
   (1) Lysosomes are formed by the process of packaging in the endoplasmic reticulum.
   (2) Lysosomes have numerous hydrolytic enzymes.
   (3) The hydrolytic enzymes of lysosomes are active under acidic pH.
   (4) Lysosomes are membrane-bound structures.

10. Match the following organisms with the products they produce:
    (a) Lactobacillus  (i) Cheese
     (b) Saccharomyces  (ii) Curd
       cerevisiae
     (c) Aspergillus niger  (iii) Citric Acid
     (d) Acetobacter acetii  (iv) Bread
       (v) Acetic Acid

Select the correct option:

   (a) (b) (c) (d)
   (1) (i) (ii) (iii) (v)
   (2) (ii) (iv) (v) (iii)
   (3) (ii) (iv) (iii) (v)
   (4) (iii) (iv) (v) (i)
21. Which part of the brain is responsible for thermoregulation?

A) Medulla oblongata
B) Cerebrum
C) Hypothalamus
D) Corpus callosum

22. In Antirrhinum (Snapdragon), a red flower was crossed with a white flower and in F1 generation, pink flowers were obtained. When pink flowers were selfed, the F2 generation showed white, red and pink flowers. Choose the incorrect statement from the following:

A) Law of Segregation does not apply in this experiment.
B) This experiment does not follow the Principle of Dominance.
C) Pink colour in F1 is due to incomplete dominance.
D) Ratio of F2 is 1/4 (Red) : 2/4 (Pink) : 1/4 (White)

23. Which of the following can be used as a biocontrol agent in the treatment of plant disease?

A) Lactobacillus
B) Trichoderma
C) Chlorella
D) Anaeroba

24. Select the correct group of biocontrol agents.

A) Nostoc, Azospirillum, Nucleopolyhedrovirus
B) Bacillus thuringiensis, Tobacco mosaic virus, Aphids
C) Trichoderma, Bacillus sp., Bacillus thuringiensis
D) Oscillatoria, Rhizobium, Trichoderma

25. The frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes was explained by:

A) Sutton Boveri
B) T.H. Morgan
C) Gregor J. Mendel
D) Alfred Sturtevant

26. Respiratory Quotient (RQ) value of tripalmitin is:

A) 0.9
B) 0.7
C) 0.8
D) 0.75

27. What would be the heart rate of a bird whose cardiac output is 5 L, blood volume in body at the end of diastole is 100 mL and ventricle systole is 50 mL?

A) 125 beats per minute
B) 50 beats per minute
C) 75 beats per minute
D) 100 beats per minute

28. From an evolutionary point of view, musky female gametophyte with developing spores on the parent sporophyte for some time observed in:

A) Gymnospermae
B) Liverworts
C) Mosses
D) Pteridophytes

29. Which of the following ecological pyramid is generally inverted?

A) Pyramid of biomass in a sea
B) Pyramid of numbers in grassland
C) Pyramid of energy
D) Pyramid of biomass in a forest

30. Colostrum, the yellowish fluid, secreted during the initial days of lactation, is very rich to impart immunity to the newborn infant. It contains:

A) Immunoglobulin A
B) Natural killer cells
C) Monocytes
D) Macrophages

31. Phloem in gymnosperms lacks:

A) Both sieve tubes and companion cells
B) Albuminous cells and sieve cells
C) Sieve tubes only
D) Companion cells only

32. Match the following organisms with respective characteristics:

(a) Pila
(b) Bombys
(c) Pleurobranchus
(d) Taenia

(i) Flame cells
(ii) Comb plates
(iii) Radula
(iv) Malphigian tubules

Select the correct option from the following:

A) (a) (i) (b) (ii) (c) (iii) (d) (iv)
B) (a) (ii) (b) (i) (c) (iv) (d) (iii)
C) (a) (iii) (b) (iv) (c) (i) (d) (ii)
D) (a) (iv) (b) (iii) (c) (ii) (d) (i)
37. Which of the statements given below is not true about formation of Annual Rings in trees?

(1) Annual rings are not prominent in trees of temperate region.
(2) Annual ring is a combination of spring wood and autumn wood produced in a year.
(3) Differential activity of cambium causes light and dark bands of tissue - early and late wood respectively.
(4) Activity of cambium depends upon variation in climate.

38. Thiobacillus is a group of bacteria helpful in carrying out:

(1) Denitrification
(2) Nitrogen fixation
(3) Chemoautotrophic fixation
(4) Nitrification

39. Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to:

(1) Reduction in the secretion of surfactants by pneumocytes.
(2) Benign growth on mucous lining of nasal cavity.
(3) Inflammation of bronchi and bronchioles.
(4) Proliferation of fibrous tissues and damage of the alveolar walls.

40. In some plants, the female gamete develops into embryo without fertilization. This phenomenon is known as:

(1) Parthenogenesis
(2) Autogamy
(3) Parthenocarpy
(4) Syngamy

41. Select the correct option.

(1) There are seven pairs of vertebral, three pairs of vertebrochordal and two pairs of vertebral ribs.
(2) 8th, 9th and 10th pairs of ribs articulate directly with the sternum.
(3) 11th and 12th pairs of ribs are connected to the sternum with the help of hyaline cartilage.
(4) Each rib is a flat thin bone and all the ribs are connected dorsally, to the thoracic vertebrae and ventrally to the sternum.
42. How does steroid hormone influence the cellular activities?
(1) Using aquaporin channels as second messenger.
(2) Changing the permeability of the cell membrane.
✓ Binding to DNA and forming a gene-hormone complex.
(4) Activating cyclic AMP located on the cell membrane.

Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus:
(1) Mangifera Indica
(2) Mangifera indica Car. Linn.
✓ Mangifera indica Linn.
(4) Mangifera indica

44. What map unit (Centimorgan) is adopted in the construction of genetic maps?
(1) A unit of distance between genes on chromosomes, representing 50% cross-over.
(2) A unit of distance between two expressed genes, representing 10% cross-over.
(3) A unit of distance between two expressed genes, representing 100% cross-over.
(4) A unit of distance between genes on chromosomes, representing 1% cross-over.

Cells in G0 phase:
(1) terminate the cell cycle
✓ exit the cell cycle
(3) enter the cell cycle
(4) suspend the cell cycle

46. Which one of the following statements regarding post-fertilization development in flowering plants is incorrect?
✓ Ovules develop into embryo sac
(2) Ovary develops into fruit
(3) Zygote develops into embryo
(4) Central cell develops into endosperm

47. Which of the following features of genetic recombination allow bacteria to produce human insulin using recombinant DNA technology?
(1) Genetic code is specific
(2) Genetic code is not ambiguous
(3) Genetic code is redundant
(4) Genetic code is nearly universal

48. Which of the following glucose transporters are insulin-dependent?
(1) GLUT IV
(2) GLUT 1
(3) GLUT II
(4) GLUT III

49. Under which of the following conditions will there be no change in the reading frame of full mRNA?
5' AACAGCGGCU GCUA AUU 3'
(1) Deletion of GGU from 7th, 8th positions
(2) Insertion of G at 5th position
(3) Deletion of G from 5th position
(4) Insertion of A and G at 4th and 5th positions respectively

50. Select the hormone-releasing Intra-Uterine Devices.
(1) Lippes Loop, Multiload 375
(2) Vault, LNG-20
(3) Multiload 375, Progestasert
✓ (4) Progestasert, LNG-20

51. Variations caused by mutation, as proposed by Hugo de Vries, are:
(1) small and directionless
(2) random and directional
(3) random and directionless
(4) small and directional

52. Expressed Sequence Tags (ESTs) refers to:
(1) Novel DNA sequences
(2) Genes expressed as mRNA
✓ (3) Polypeptide expression
(4) DNA polymorphism
54. What triggers activation of protoxin to active Bt toxin of *Bacillus thuringiensis* in boll worm?

(1) Acidic pH of stomach
(2) Body temperature
(3) Moist surface of midgut
(4) Alkaline pH of gut

55. Match the hominids with their correct brain size:

(a) *Homo habilis* (i) 900 cc
(b) *Homo neanderthalensis* (ii) 1350 cc
(c) *Homo erectus* (iii) 650 - 800 cc
(d) *Homo sapiens* (iv) 1400 cc

Select the correct option.

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

56. Which of the following pairs of gases is mainly responsible for green house effect?

(1) Carbon dioxide and Methane
(2) Ozone and Ammonia
(3) Oxygen and Nitrogen
(4) Nitrogen and Sulphur dioxide

**57.** Which of the following is true for Golden rice?

(I) It has yellow grains, because of a gene introduced from a primitive variety of rice.
(II) It is Vitamin A enriched, with a gene from daffodil.
(III) It is pest resistant, with a gene from *Bacillus thuringiensis*.
(IV) It is drought tolerant, developed using *Agrobacterium* vector.

58. What is the genetic disorder in which an individual has an overall masculine development, gynaecomastia, and is sterile?

(I) Down's syndrome
(II) Turner's syndrome
(III) Klinefelter's syndrome
(IV) Edward syndrome

59. Extrusion of second polar body from egg nucleus occurs:

(I) simultaneously with first cleavage
(II) after entry of sperm but before fertilization
(III) after fertilization
(IV) before entry of sperm into ovum

60. A gene locus has two alleles A, a. If the frequency of dominant allele A is 0.4, then what will be the frequency of homozygous dominant, heterozygous and homozygous recessive individuals in the population?

(I) 0.16 (AA); 0.36 (Aa); 0.48 (aa)
(II) 0.36 (AA); 0.48 (Aa); 0.16 (aa)
(III) 0.36 (AA); 0.24 (Aa); 0.36 (aa)
(IV) 0.16 (AA); 0.48 (Aa); 0.36 (aa)

61. What is the fate of the male gametes discharged in the syngygid?

(I) One fuses with the egg and other fuses with central cell nuclei.
(II) One fuses with the egg, other(s) degenerate in the syngygid.
(III) All fuse with the egg.
(IV) None of the above.
62. In a species, the weight of newborn ranges from 2 to 5 kg. 97% of the newborn with an average weight between 3 to 3.3 kg survive whereas 99% of the infants born with weights from 2 to 2.5 kg or 4.5 to 5 kg die. Which type of selection process is taking place?

(1) Cyclical selection
(2) Directional selection
(3) Stabilizing selection
(4) Disruptive selection

63. Which of the following muscular disorders is inherited?

(1) Botulism
(2) Tetany
(3) Muscular dystrophy
(4) Myasthenia gravis

64. Which of the following protocols did aim for reducing emission of chlorofluorocarbons into the atmosphere?

(1) Geneva Protocol
(2) Montreal Protocol
(3) Kyoto Protocol
(4) Gothenberg Protocol

67. Pinus seed cannot germinate and dies without fungal association. This is because

(1) its seeds contain inhibitors that prevent germination.
(2) its embryo is immature.
(3) it has obligate association with mycorrhiza.
(4) it has very hard seed coat.

68. Select the correct sequence of organs in the alimentary canal of cockroach starting from the mouth:

(1) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum
(2) Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
(3) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon → Rectum
(4) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum

69. Which of the following statements regarding mitochondria is incorrect?

(1) Mitochondrial matrix contains six circular DNA molecule and ribosomes.
(2) Outer membrane is permeable to monomers, carbohydrates, fats and proteins.
(3) Enzymes of electron transport are embedded in outer membrane.
(4) Inner membrane is convoluted with infoldings.

70. Drug called 'Heroin' is synthesized by:

(1) nitration of morphine
(2) methylation of morphine
(3) acetylation of morphine
(4) glycosylation of morphine

71. Conversion of glucose to glucose-6-phosphate by:

(1) Phosphofructokinase
(2) Aldolase
(3) Hexokinase
(4) Enolase
DNA precipitation out of a mixture of biomolecules can be achieved by treatment with:

1. Chilled chloroform
2. Isopropanol
3. Chilled ethanol
4. Methanol at room temperature

Which of the following is a commercial blood cholesterol lowering agent?

1. Lipase
2. Cyclosporin A
3. Statin
4. Streptokinase

Which one of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes?

1. Bactojar
2. BOD incubator
3. Stadlo digester
4. Industrial oven

Which of the following statements is incorrect?

1. Prions consist of abnormally folded proteins.
2. Viroids lack a protein coat.
3. Viruses are obligate parasites.
4. Infectious constituent in viruses is the protein coat.

Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following:

1. Tylosis in vessels
2. Closure of stomata
3. Plasma of bulliform cells
4. Shrinkage of air spaces in spongy mesophyll

Xylem translocates:

1. Water, mineral salts, some organic nitrogen and hormones
2. Water only
3. Water and mineral salts only
4. Water, mineral salts and some organic nitrogen only

Select the correct sequence for transport of sperm cells in male reproductive system.

1. Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus
2. Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra
3. Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus
4. Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra

Which of these following methods is the most suitable for disposal of nuclear waste?

1. Bury the waste within rocks deep below the Earth’s surface
2. Shoot the waste into space
3. Bury the waste under Antarctic ice-cover
4. Dump the waste within rocks under deep ocean

Which of the following immune responses is responsible for rejection of kidney graft?

1. Cell-mediated immune response
2. Auto-immune response
3. Humoral immune response
4. Inflammatory immune response

What is the site of perception of photoperiod necessary for induction of flowering in plants?

1. Leaves
2. Lateral buds
3. Pulvinus
4. Shoot apex

Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.

1. Salmonella typhi / Widal test
2. Plasmodium vivax / UTI test
3. Streptococcus pneumoniae / Widal test
4. Salmonella typhi / Anthrone test
Concanavalin A is:
(1) a pigment
(2) an alkaloid
(3) an essential oil
(4) a lectin

It takes very long time for pineapple plants to produce flowers. Which combination of hormones can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield?
(1) Cytokinin and Abscisic acid
(2) Auxin and Ethylene
(3) Gibberellin and Cytokinin
(4) Gibberellin and Abscisic acid

Select the incorrect statement:
(1) Inbreeding helps in accumulation of superior genes and elimination of undesirable genes.
(2) Inbreeding increases homozygosity.
(3) Inbreeding is essential to evolve pure lines in any animal.
(4) Inbreeding selects harmful recessive genes that reduce fertility and productivity.

Which of the following statements is incorrect?
(1) Yeasts have filamentous bodies with long thread-like hyphae.
(2) Morels and truffles are edible delicacies.
(3) Claviceps is a source of many alkaloids and LSD.
(4) Conidia are produced exogenously and ascospores endogenously.

Tidal Volume and Expiratory Reserve Volume of an athlete is 500 mL and 1000 mL respectively. What will be his Expiratory Capacity if the Residual Volume is 1200 mL?
(1) 2700 mL
(2) 1500 mL
(3) 1700 mL
(4) 2200 mL

Which one of the following is **not** a measure of in-situ conservation of biodiversity?
(1) Sacred Grove
(2) Biosphere Reserves
(3) Wildlife Sanctuary
(4) Botanical Garden

Which of the following factors is responsible for the formation of concentrated urine?
(1) Hydrosotatic pressure during glomerular filtration.
(2) Low levels of antidiuretic hormone.
(3) Maintaining hyperosmolarity towards medullary interstitium in the kidney.
(4) Secretion of erythropoietin by juxtaglomerular complex.

Match the Column - I with Column - II:

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) P-wave.</td>
<td>(i) Depolarization of ventricles</td>
</tr>
<tr>
<td>(b) QRS complex</td>
<td>(ii) Repolarization of ventricles</td>
</tr>
<tr>
<td>(c) T-wave</td>
<td>(iii) Coronary ischemia</td>
</tr>
<tr>
<td>(d) Reduction in the size of T-wave</td>
<td>(iv) Depolarization of atria</td>
</tr>
<tr>
<td>(v)</td>
<td>Repolarization of atria</td>
</tr>
</tbody>
</table>

Select the correct option:
(1) (ii) (i) (iii) (v) (iv) (iii)
92. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance \( x_1 \) along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel \( x_2 \) distance. Then \( x_1 : x_2 \) will be:

(1) \( 1 : 2\sqrt{3} \)
(2) \( 1 : \sqrt{2} \)
(3) \( \sqrt{2} : 1 \)
(4) \( 1 : \sqrt{3} \)

93. A soap bubble, having radius of 1 mm, is blown from a detergent solution having a surface tension of \( 2.5 \times 10^{-2} \) N/m. The pressure inside the bubble equals at a point \( Z_0 \) below the free surface of water in a container. Taking \( g = 10 \) m/s², density of water = \( 10^3 \) kg/m³, the value of \( Z_0 \) is:

(1) 0.5 cm
(2) 100 cm
(3) 10 cm
(4) 1 cm

94. A parallel plate capacitor of capacitance 20 \( \mu F \) is being charged by a voltage source whose potential is changing at the rate of 3 V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively:

(1) zero, zero
(2) zero, 60 \( \mu A \)
(3) 60 \( \mu A \), 60 \( \mu A \)
(4) 60 \( \mu A \), zero

95. \( \alpha \)-particle consists of:

(1) 2 protons only
(2) 2 protons and 2 neutrons only
(3) 2 electrons, 2 protons and 2 neutrons
(4) 2 electrons and 4 protons only

96. Which of the following acts as a circuit protection device?

(1) fuse
(2) conductor
(3) inductor
(4) switch

97. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction?

(1) 90°
(2) 180°
(3) 0°
(4) equal to angle of incidence

98. The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by:

(1) 45° west
(2) 30° west
(3) 0°
(4) 60° west

99. The total energy of an electron in an atom in an orbit is \(-3.4\) eV. Its kinetic and potential energies are, respectively:

(1) \(3.4\) eV, \(-3.4\) eV
(2) \(-3.4\) eV, \(-3.4\) eV
(3) \(-3.4\) eV, \(6.8\) eV
(4) \(3.4\) eV, \(-6.8\) eV

100. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 7%, 3% and 4% respectively. Then the maximum percentage of error in the measurement \( X \) where \( X = A^2 B^\% C^\% D^{\%} \) will be:

(1) 10%
(2) \(\frac{3}{13}\)%
(3) 16%
(4) \(-10\)%
102. Two parallel infinite line charges with linear charge densities \( \lambda \) C/m and \( -\lambda \) C/m are placed at a distance of 2R in free space. What is the electric field midway between the two line charges?

\[
\begin{align*}
(1) & \quad \frac{\lambda}{2\pi \varepsilon_0 R} \text{ N/C} \\
(2) & \quad 0 \\
(3) & \quad \frac{2\lambda}{\varepsilon_0 R} \text{ N/C} \\
(4) & \quad \frac{\lambda}{\varepsilon_0 R} \text{ N/C}
\end{align*}
\]

103. The unit of thermal conductivity is:

\[
\begin{align*}
(1) & \quad \text{W m}^{-1} \text{K}^{-1} \\
(2) & \quad \text{J m}^{-1} \text{K}^{-1} \\
(3) & \quad \text{J m}^{-1} \text{K}^{-1} \\
(4) & \quad \text{W m}^{-1} \text{K}^{-1}
\end{align*}
\]

104. The displacement of a particle executing simple harmonic motion is given by

\[ y = A_0 + A \sin \omega t + B \cos \omega t. \]

Then the amplitude of its oscillation is given by:

\[
\begin{align*}
(1) & \quad A + B \\
(2) & \quad A_0 + \sqrt{A^2 + B^2}
\end{align*}
\]

105. In a double-slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 40 cm away, was found to be 0.2°. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water (\( \mu_{\text{water}} = 4/3 \))

\[
\begin{align*}
(1) & \quad 0.1° \\
(2) & \quad 0.266° \\
(3) & \quad 0.15° \\
(4) & \quad 0.05°
\end{align*}
\]

106. A body weighs 200 N on the surface of the earth. How much will it weigh halfway down to the center of the earth?

\[
\begin{align*}
(1) & \quad 100 \text{ N} \\
(2) & \quad 150 \text{ N} \\
(3) & \quad 200 \text{ N} \\
(4) & \quad 250 \text{ N}
\end{align*}
\]

107. A particle moving with velocity \( \vec{V} \) is acted by the forces shown by the vector triangle PQR. The velocity of the particle will:

\[
\begin{align*}
(1) & \quad \text{change according to the smallest force} \\
(2) & \quad \text{increase} \\
(3) & \quad \text{decrease} \\
(4) & \quad \text{remain constant}
\end{align*}
\]

108. Two particles A and B are moving in unit circular motion in concentric circles of radii \( r_A \) and \( r_B \) with speed \( u_A \) and \( u_B \) respectively. The time period of rotation is the same. The ratio of the angular speed of A to that of B will be:

\[
\begin{align*}
(1) & \quad 1:1 \\
(2) & \quad r_A : r_B \\
(3) & \quad u_A : u_B \\
(4) & \quad r_A : u_B
\end{align*}
\]
10. A 800 turn coil of effective area 0.05 m² is kept perpendicular to a magnetic field $5 \times 10^{-3}$ T. When the plane of the coil is rotated by 90° around any of its coplanar axis in 0.1 s, the emf induced in the coil will be:

1. $0.02 \text{ V}$
2. $2 \text{ V}$
3. $0.2 \text{ V}$
4. $2 \times 10^{-3} \text{ V}$

11. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1 m. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be: ($g = 10 \text{ m/s}^2$)

1. $10 \pi \text{ rad/s}$
2. $\sqrt{10} \text{ rad/s}$
3. $\frac{10}{2\pi} \text{ rad/s}$
4. $10 \text{ rad/s}$

111. When a block of mass $M$ is suspended by a long wire of length $L$, the length of the wire becomes $(L + l)$. The elastic potential energy stored in the extended wire is:

1. $\frac{1}{2} M g L$
2. $M g l$
3. $M g L$
4. $\frac{1}{2} M g l$

112. Increase in temperature of a gas filled in a container would lead to:

1. decrease in intermolecular distance
2. increase in its mass
3. increase in its kinetic energy
4. decrease in its pressure

113. A cylindrical conductor of radius $R$ is carrying a constant current. The plot of the magnitude of the magnetic field, $B$ with the distance, $d$, from the centre of the conductor, is correctly represented by the figure:

1. (1)
2. (2)
3. (3)
4. (4)

114. Body A of mass 4m moving with speed $u$ collides with another body B of mass 2m, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is:

1. $\frac{5}{9}$
2. $\frac{1}{9}$
3. $\frac{8}{9}$
4. $\frac{4}{9}$

115. Which colour of the light has the longest wavelength?

1. violet
2. red
3. blue
4. green
116. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is: \( \alpha \text{Cu} = 1.7 \times 10^{-5} \text{K}^{-1} \) and \( \alpha \text{Al} = 2.2 \times 10^{-5} \text{K}^{-1} \)

\[ \begin{align*}
(1) & \quad 68 \text{ cm} \\
(2) & \quad 6.8 \text{ cm} \\
(3) & \quad 113.9 \text{ cm} \\
(4) & \quad 88 \text{ cm}
\end{align*} \]

117. For a p-type semiconductor, which of the following statements is true?

(1) Electrons are the majority carriers and pentavalent atoms are the dopants.

(2) Electrons are the majority carriers and trivalent atoms are the dopants.

(3) Holes are the majority carriers and trivalent atoms are the dopants.

(4) Holes are the majority carriers and pentavalent atoms are the dopants.

118. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.

\[ y \cdot \text{projection of the radius vector of rotating particle} \]

\[ P(t=0) \]

\[ T = 4 \text{ s} \]

\[ 3 \text{ m} \]

\[ y = 3 \cos \left( \frac{\pi t}{2} \right), \text{ where } y \text{ in m} \]

\[ y = -3 \cos 2\pi t, \text{ where } y \text{ in m} \]

\[ y = 4 \sin \left( \frac{\pi t}{2} \right), \text{ where } y \text{ in m} \]

119. A force \( F = 20 + 10y \) acts on a particle in y-direction, where \( F \) is in newton and \( y \) in meter. Work done by this force to move the particle by \( y = 0 \) to \( y = 1 \text{ m} \) is:

\[ \begin{align*}
(1) & \quad 20 \text{ J} \\
(2) & \quad 30 \text{ J} \\
(3) & \quad 5 \text{ J} \\
(4) & \quad 25 \text{ J}
\end{align*} \]

120. A mass \( m \) is attached to a thin wire and which is moved in a vertical circle. The wire is most likely to break when:

(1) inclined at an angle of 60° from vertical

(2) the mass is at the highest point

(3) the wire is horizontal

(4) the mass is at the lowest point

121. Average velocity of a particle executing SHM one complete vibration is:

\[ \begin{align*}
(1) & \quad \text{zero} \\
(2) & \quad \frac{A \omega}{2} \\
(3) & \quad A \omega \\
(4) & \quad \frac{A \omega^2}{2}
\end{align*} \]

122. Pick the wrong answer in the context with rainbow.

(1) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.

(2) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed.

(3) The order of colours is reversed in the secondary rainbow.

(4) An observer can see a rainbow when his face is towards the sun.

123. An electron is accelerated in a potential difference of 10 V. Answer:

\[ \text{(a) } 1 \times 10^{-6} \text{ m} \]

\[ \text{(b) } 1 \times 10^{-5} \text{ m} \]

\[ \text{(c) } 1 \times 10^{-4} \text{ m} \]

\[ \text{(d) } 1 \times 10^{-3} \text{ m} \]
A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it?

1. 1 J
2. 3 J
3. 30 kJ
4. 2 J

The correct Boolean operation represented by the circuit diagram drawn is:

1. NOR
2. AND
3. OR
4. NAND

Ionized hydrogen atoms and α-particles with same momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths \( r_B : r_H \) will be:

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

Two point charges A and B, having charges +Q and −Q respectively, are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B, then force between the charges becomes:

1. \( \frac{4F}{3} \)
2. F
3. \( \frac{9F}{16} \)
4. \( \frac{16F}{9} \)

In which of the following devices, the eddy current effect is not used?

1. electric heater
2. induction furnace
3. magnetic braking in train
4. electromagnet

At a point A on the earth's surface the angle of dip, \( \delta = +25^\circ \). At a point B on the earth's surface the angle of dip, \( \delta = -25^\circ \). We can interpret that:

1. A and B are both located in the southern hemisphere.
2. A and B are both located in the northern hemisphere.
3. A is located in the southern hemisphere and B is located in the northern hemisphere.
4. A is located in the northern hemisphere and B is located in the southern hemisphere.

Six similar bulbs are connected as shown in the figure with a DC source of emf E, and zero internal resistance. The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be:

1. 2 : 1
2. 4 : 9
3. 9 : 4
4. 1 : 2

A small hole of area of cross-section 2 mm² is present near the bottom of a fully filled open tank of height 2 m. Taking \( g = 10 \text{ m/s}^2 \), the rate of flow of water through the open hole would be nearly:

\( \sqrt{\frac{2g}{f}} \)

1. \( 6.4 \times 10^{-6} \text{ m}^3/\text{s} \)
2. \( 12.6 \times 10^{-6} \text{ m}^3/\text{s} \)
3. \( 8.9 \times 10^{-6} \text{ m}^3/\text{s} \)
4. \( 2.23 \times 10^{-6} \text{ m}^3/\text{s} \)
133. The work done to raise a mass \( m \) from the surface of the earth to a height \( h \), which is equal to the radius of the earth, is:

\[ \frac{3}{2} mgR \]

134. In which of the following processes, heat is neither absorbed nor released by a system?

(1) isochoric
(2) isothermal
(3) adiabatic
(4) isobaric

135. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2\( \pi \) revolutions is:

(1) \( 2 \times 10^6 \) N m
(2) \( 2 \times 10^{-6} \) N m

136. Which one is malachite from the following?

(1) \( \text{CuCO}_3 \cdot \text{Cu(OH)}_2 \)
(2) \( \text{CuFeS}_2 \)
(3) \( \text{Cu(OH)}_2 \)
(4) \( \text{Fe}_3\text{O}_4 \)

137. Enzymes that utilize ATP in phosphate transfer require an alkaline earth metal (M) as the cofactor. M is:

(1) Sr
(2) Be
(3) Mg
(4) Ca

138. For an ideal solution, the correct option is:

(1) \( \Delta_{\text{mix}} G = 0 \) at constant \( T \) and \( P \)
(2) \( \Delta_{\text{mix}} S = 0 \) at constant \( T \) and \( P \)
(3) \( \Delta_{\text{mix}} V \neq 0 \) at constant \( T \) and \( P \)
(4) \( \Delta_{\text{mix}} H = 0 \) at constant \( T \) and \( P \)

139. What is the correct electronic configuration for the central atom in \( \text{K}_4[\text{Fe(CN)}_6] \) based on cryo-field theory?

(1) \( \text{e}^4 \cdot \text{t}_2^2 \)
(2) \( \text{t}_2^4 \cdot \text{e}_g^2 \)
(3) \( \text{t}_2^6 \cdot \text{e}_g^0 \)
(4) \( \text{e}^3 \cdot \text{t}_2^3 \)

140. The number of sigma (\( \sigma \)) and pi (\( \pi \)) bonds in the pent-2-en-4-yne is:

(1) 13 \( \sigma \) bonds and no \( \pi \) bond
(2) 10 \( \sigma \) bonds and 3 \( \pi \) bonds
(3) 8 \( \sigma \) bonds and 5 \( \pi \) bonds
(4) 11 \( \sigma \) bonds and 2 \( \pi \) bonds

141. A compound is formed by cation C and anion A. The anions form hexagonal close packed lattice and the cations occupy 75% of octahedral voids. The formula of the compound is:

(1) \( \text{C}_4\text{A}_3 \)
(2) \( \text{C}_2\text{A}_3 \)
(3) \( \text{C}_3\text{A}_2 \)
(4) \( \text{C}_6\text{A}_4 \)
143. Which of the following is incorrect statement?

(1) SnF_4 is ionic in nature
(2) PbF_4 is covalent in nature
(3) SiCl_4 is easily hydrolysed
(4) GeX_4 (X = F, Cl, Br, I) is more stable than GeX_2

144. Which of the following is an amphoteric hydroxide?

(1) Be(OH)_2
(2) Sr(OH)_2
(3) Ca(OH)_2
(4) Mg(OH)_2

145. The manganate and permanganate ions are tetrahedral, due to:

(1) The π-bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese
(2) The π-bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese
(3) There is no π-bonding
(4) The π-bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese

146. pH of a saturated solution of Ca(OH)_2 is 9. The solubility product (K_sp) of Ca(OH)_2 is:

(1) 0.5 \times 10^{-10}
(2) 0.5 \times 10^{-15}
(3) 0.25 \times 10^{-10}
(4) 0.125 \times 10^{-15}

147. The mixture that forms maximum boiling azeotrope is:

(1) Heptane + Octane
(2) Water + Nitric acid
(3) Ethanol + Water
(4) Acetone + Carbon disulphide

148. Match the Xenon compounds in Column - I with its structure in Column - II and assign the correct code:

<table>
<thead>
<tr>
<th>Column - I</th>
<th>Column - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) XeF_4</td>
<td>(i) pyramidal</td>
</tr>
<tr>
<td>(b) XeF_6</td>
<td>(ii) square planar</td>
</tr>
<tr>
<td>(c) XeOF_4</td>
<td>(iii) distorted octahedral</td>
</tr>
<tr>
<td>(d) XeO_3</td>
<td>(iv) square pyramidal</td>
</tr>
</tbody>
</table>

Code:

(1) (i) (ii) (iii) (iv)
(2) (ii) (i) (iii) (iv)
(3) (ii) (i) (iii) (iv)
(4) (ii) (i) (iii) (iv)

149. Which of the following reactions are disproportionation reaction?

(a) 2Cu^+ \rightarrow Cu^{2+} + Cu^0
(b) 3MnO_4^- + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O
(c) 2KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2
(d) 2MnO_4^- + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^+

Select the correct option from the following:

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

150. Conjugate base for Brönsted acids H_2O and HF are:

(1) H_3O^+ and H_2F^+ , respectively
(2) OH^- and H_2F^+ , respectively
(3) H_2O^+ and F^- , respectively
(4) OH^- and F^- , respectively
151. Among the following, the reaction that proceeds through an electrophilic substitution, is:

(1) \[
\begin{align*}
\text{CH}_3\text{Cl} + \text{H}^+ + \text{Cl}^- &\rightarrow \text{CH}_3\text{Cl} + \text{H}_2\text{O} \\
\end{align*}
\]

(2) \[
\begin{align*}
\text{C}_6\text{H}_5\text{Cl} + \text{Cu}_2\text{Cl}_2 &\rightarrow \text{C}_6\text{H}_5\text{Cl} + \text{Cl}_2 \\
\text{C}_6\text{H}_5\text{Cl} + \text{H}_2\text{O} &\rightarrow \text{C}_6\text{H}_5\text{OH} + \text{HCl} \\
\end{align*}
\]

(3) \[
\begin{align*}
\text{C}_6\text{H}_6 + \text{HCl} &\rightarrow \text{C}_6\text{H}_5\text{Cl} + \text{H}_2\text{O} \\
\end{align*}
\]

(4) \[
\begin{align*}
\text{C}_6\text{H}_5\text{Cl} + \text{H}_2\text{O} &\rightarrow \text{C}_6\text{H}_5\text{OH} + \text{HCl} \\
\end{align*}
\]

An alkene "A" on reaction with \( \text{O}_2 \) and \( \text{Zn} - \text{H}_2\text{O} \) gives propane and ethanal in equimolar ratio. Addition of \( \text{HCl} \) to alkene "A" gives "B" as the major product. The structure of product "B" is:

\[
\begin{align*}
\text{CH}_3\text{C} - \text{CH} - \text{CH}_3 \\
\text{Cl} \\
\end{align*}
\]

155. In which case change in entropy is negative:

(1) \( 2\text{H}_2(g) \rightarrow \text{H}_2(g) \)

(2) Evaporation of water

(3) Expansion of a gas at constant temperature

(4) Sublimation of solid gas

156. Under isothermal condition, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is:

\[
\begin{align*}
W &= -\Delta{U} \\
\Delta{H} &= 0 \\
\end{align*}
\]

\[
\begin{align*}
\text{[Given that 1 L bar} &= 100 \text{ J]} \\
(1) &\quad 30 \text{ J} \\
(2) &\quad -30 \text{ J} \\
(3) &\quad 5 \text{ kJ} \\
(4) &\quad 25 \text{ J}
\end{align*}
\]

157. Which of the following species is not stable:

(1) \( [\text{SnCl}_4]^2- \)

(2) \( [\text{SiF}_4]^2- \)

(3) \( [\text{GeCl}_4]^2- \)

(4) \( [\text{Sn(OH)}_6]^2- \)

158. For a cell involving one electron \( E_{\text{cell}}^{\circ} = 0.59 \text{ V} \) at 298 K, the equilibrium constant for the cell reaction is:

\[
\begin{align*}
\frac{\text{F}}{\text{Cl}_2} &= 0.098 \text{ atm} \\
\text{[Given that 2.303 RT]} &= \frac{1}{10} \times \frac{1}{10} \\
\end{align*}
\]

\[
\begin{align*}
\text{(1)} &\quad 1.0 \times 10^{30} \\
\text{(2)} &\quad 1.0 \times 10^{20} \\
\text{(3)} &\quad 1.0 \times 10^{10} \\
\text{(4)} &\quad 1.0 \times 10^{0}
\end{align*}
\]

159. The method used to remove temporary hardness of water is:

(1) Synthetic resins method

(2) Calgon's method

(3) Clark's method

(4) Ion-exchange method

max. A gas at 350 K and 15 bar has molar volume 20 percent smaller than that for an ideal gas under the same conditions. The correct option about the gas and its compressibility factor (Z) is:

(1) \( Z < 1 \) and repulsive forces are dominant

(2) \( Z = 1 \) and attractive forces are dominant

(3) \( Z > 1 \) and repulsive forces are dominant

(4) \( Z < 1 \) and attractive forces are dominant

Among the following, the one that is a greenhouse gas is:

(1) Sulphur dioxide

(2) Nitrous oxide

(3) Methane

(4) Ozone

The method used to remove temporary hardness of water is:

(1) Synthetic resins method

(2) Calgon's method

(3) Clark's method

(4) Ion-exchange method
160. Which will make basic buffer?

1. 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH
2. 50 mL of 0.1 M NaOH + 25 mL of 0.1 M CH₃COOH
3. 100 mL of 0.1 M CH₃COOH + 100 mL of 0.1 M NaOH
4. 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH₄OH

161. The most suitable reagent for the following conversion is:

\[ \text{H}_2\text{C} = \text{C} \equiv \text{C} - \text{CH}_3 \xrightarrow{\text{H}_2\text{O}} \text{cis-2-butene} \]

1. H₂⁺ / H⁺, H₂O
2. Na/liquid NH₃
3. H₂, Pt/C, quinoline
4. Zn/HCl

162. The compound that is most difficult to protonate is:

1. \( \text{H}_3\text{C} \equiv \text{C} \equiv \text{O} \)
2. \( \text{H}_2\text{C} = \text{C} \equiv \text{O} \)
3. \( \text{H}_2\text{C} = \text{C} \equiv \text{O} \)
4. \( \text{H}_2\text{C} = \text{C} \equiv \text{O} - \text{CH}_3 \)

164. The correct structure of tribromooctaoxide is:

(1) \( \text{O} = \text{Br} - \text{Br} - \text{Br} = \text{O} \)
(2) \( \text{O} = \text{Br} - \text{Br} = \text{O} \)
(3) \( \text{O} = \text{Br} - \text{Br} - \text{Br} = \text{O} \)
(4) \( \text{O} = \text{Br} - \text{Br} = \text{O} \)

165. The major product of the following reaction is:

\[ \text{C}_{6}\text{H}_5\text{COOH} + \text{NH}_3 \xrightarrow{\text{strong heating}} \]

1. \( \text{C}_{6}\text{H}_5\text{NH}_2\text{COOH} \)
2. \( \text{C}_{6}\text{H}_5\text{NH}_2\text{CONH}_2 \)
3. \( \text{C}_{6}\text{H}_5\text{NH}_2\text{COOH} \)
4. \( \text{C}_{6}\text{H}_5\text{NH}_2 \)
166. Match the following:

(a) Pure nitrogen  (b) Haber process  (c) Contact process  (d) Deacon's process

9. Chlorine  0. Sulphuric acid  0. Ammonia  0. Sodium azide or Barium azide

Which of the following is the correct option?

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

(1) 0 0 0 0

167. For the chemical reaction

\[ \text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g) \]

the correct option is:

(1) \( \frac{d[H_2]}{dt} = 2 \frac{d[NH_3]}{dt} \)

(2) \( \frac{1}{3} \frac{d[H_2]}{dt} = \frac{1}{2} \frac{d[NH_3]}{dt} \)

(3) \( \frac{d[N_2]}{dt} = 2 \frac{d[NH_3]}{dt} \)

(4) \( \frac{d[N_2]}{dt} = \frac{1}{2} \frac{d[NH_3]}{dt} \)

169. The non-essential amino acid among the following is:

(1) lysine

(2) valine

(3) leucine

(4) alanine
170. Which of the following diatomic molecular species has only σ bonds according to Molecular Orbital Theory? 

(1) Be₂  
(2) O₂  
(3) N₂  
(4) C₂

171. The correct order of the basic strength of methyl substituted amines in aqueous solution is:

(1) CH₃NH₂ > (CH₃)₂NH > (CH₃)₂N 
(2) (CH₃)₂NH > CH₃NH₂ > (CH₃)₂N 
(3) CH₃NH₂ > CH₃NH₂ > (CH₃)₂NH 
(4) (CH₃)₂N > (CH₃)₂NH > CH₃NH₂

172. Which mixture of the solutions will lead to the formation of negatively charged colloidal [AgI]⁻ soln? 

(1) 50 mL of 0.1 M AgNO₃ + 50 mL of 0.1 M KI 
(2) 50 mL of 1 M AgNO₃ + 50 mL of 1.5 M KI 
(3) 50 mL of 1 M AgNO₃ + 50 mL of 2 M KI 
(4) 50 mL of 2 M AgNO₃ + 50 mL of 1.5 M KI

173. Identify the incorrect statement related to Cl₂ from the following:

(1) PCl₃ molecule is non-reactive 
(2) Three equatorial P–Cl bonds make an angle of 120° with each other 
(3) Two axial P–Cl bonds make an angle of 180° with each other 
(4) Axial P–Cl bonds are longer than equatorial P–Cl bonds

174. Among the following, the narrow spectrum antibiotic is:

(1) chloramphenicol 
(2) penicillin G 
(3) amoxicillin 
(4) ampicillin

175. If the rate constant for a first order reaction is k, the time (t) required for the completion of 99% of the reaction is given by:

(1) t = 2.303/k  
(2) t = 0.693/k  
(3) t = 6.909/k  
(4) t = 4.606/k

176. For the second period elements the correct increasing order of first ionisation enthalpy is:

(1) Li < Be < B < C < O < N < F < Ne 
(2) Li < Be < B < C < O < F < N < Ne 
(3) Li < B < Be < C < O < N < F < Ne 
(4) Li < B < Be < C < N < O < P < Ne

177. 4d, 5p, 6f and 6p orbitals are arranged in the order of decreasing energy. The correct option is:

(1) 5f > 6p > 4d > 5p 
(2) 5f > 6p > 5p > 4d 
(3) 6p > 5f > 5p > 4d 
(4) 6p > 5f > 4d > 5p

178. For the cell reaction:

2Fe³⁺(aq) + 2I⁻(aq) → 2Fe²⁺(aq) + I₂(aq)

E° = 0.24 V at 298 K. The standard Gibbs energy (ΔG°) of the cell reaction is:

[Given that Faraday constant F = 96500 C mol⁻¹]

(1) 23.16 kJ mol⁻¹ 
(2) -46.32 kJ mol⁻¹ 
(3) -23.16 kJ mol⁻¹ 
(4) 46.32 kJ mol⁻¹

179. Which of the following series of transitions in the spectrum of hydrogen atom falls in visible region?

(1) Brackett series 
(2) Lyman series 
(3) Balmer series 
(4) Paschen series

180. The biodegradable polymer is:

(1) Runa-3 
(2) nylon-6, 6 
(3) nylon-3, nylon 6 
(4) nylon-6