30/04/2024

CODE-A

Aakash
Medical | IIT-JEE | Foundations

Corporate Office: Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456

AIM – 720

(*Advanced* INTENSIVE *Mastery for* 720)

MM : 720 **CST-17** **Time : 3 Hrs. 20 Min.**

Answers

1. (2)	41. (4)	81. (4)	121. (2)	161. (1)
2. (2)	42. (3)	82. (2)	122. (4)	162. (4)
3. (3)	43. (1)	83. (1)	123. (4)	163. (2)
4. (3)	44. (4)	84. (2)	124. (3)	164. (2)
5. (3)	45. (2)	85. (4)	125. (3)	165. (3)
6. (3)	46. (3)	86. (4)	126. (3)	166. (2)
7. (1)	47. (1)	87. (1)	127. (4)	167. (3)
8. (4)	48. (3)	88. (2)	128. (3)	168. (2)
9. (4)	49. (1)	89. (2)	129. (2)	169. (2)
10. (2)	50. (1)	90. (1)	130. (3)	170. (3)
11. (2)	51. (3)	91. (4)	131. (1)	171. (1)
12. (4)	52. (1)	92. (2)	132. (4)	172. (3)
13. (3)	53. (4)	93. (3)	133. (2)	173. (3)
14. (4)	54. (3)	94. (4)	134. (2)	174. (4)
15. (1)	55. (3)	95. (2)	135. (1)	175. (4)
16. (1)	56. (2)	96. (3)	136. (3)	176. (3)
17. (4)	57. (3)	97. (3)	137. (2)	177. (4)
18. (1)	58. (3)	98. (4)	138. (4)	178. (2)
19. (3)	59. (2)	99. (1)	139. (3)	179. (4)
20. (3)	60. (4)	100. (4)	140. (3)	180. (3)
21. (3)	61. (1)	101. (3)	141. (3)	181. (2)
22. (3)	62. (4)	102. (2)	142. (2)	182. (1)
23. (1)	63. (3)	103. (4)	143. (4)	183. (2)
24. (4)	64. (3)	104. (3)	144. (2)	184. (1)
25. (4)	65. (3)	105. (1)	145. (2)	185. (3)
26. (1)	66. (4)	106. (3)	146. (2)	186. (4)
27. (1)	67. (3)	107. (3)	147. (3)	187. (4)
28. (4)	68. (2)	108. (1)	148. (2)	188. (2)
29. (2)	69. (4)	109. (2)	149. (1)	189. (1)
30. (2)	70. (4)	110. (4)	150. (3)	190. (2)
31. (4)	71. (2)	111. (2)	151. (3)	191. (1)
32. (2)	72. (1)	112. (1)	152. (4)	192. (2)
33. (2)	73. (4)	113. (2)	153. (1)	193. (3)
34. (1)	74. (2)	114. (1)	154. (2)	194. (3)
35. (3)	75. (1)	115. (2)	155. (3)	195. (3)
36. (1)	76. (1)	116. (3)	156. (2)	196. (3)
37. (4)	77. (3)	117. (4)	157. (3)	197. (4)
38. (2)	78. (3)	118. (3)	158. (4)	198. (3)
39. (3)	79. (2)	119. (2)	159. (2)	199. (2)
40. (2)	80. (2)	120. (2)	160. (3)	200. (2)

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Answers & Solutions

CHEMISTRY

SECTION-A

1. Answer (2)

n determines the size and energy of orbital.

ℓ determines the shape of orbital.

m_ℓ designates the orientation of the orbital.

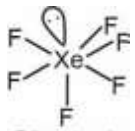
m_s refers to orientation of electron spin.

2. Answer (2)

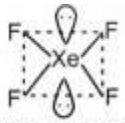
Zinc reacts with concentrated HNO_3 acid to give NO_2

$$Zn + 4HNO_3(conc) \longrightarrow Zn(NO_3)_2 + 2NO_2 + 2H_2O$$

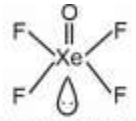
3. Answer (3)



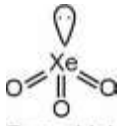
Distorted octahedral



Square planar



Square pyramidal



Pyramidal

4. Answer (3)

AgCl is more soluble in NH_3 than water as it forms a complex $[Ag(NH_3)_2]^+$ and shifts the equilibrium to forward direction.

5. Answer (3)

- Z = 39 (Y) is a *d*-block element known as transition element.
- Elements after uranium [Z = 92] are called transuranium elements.

6. Answer (3)

P has maximum ionization energy among the following as moving from top to bottom in a group IE decreases.

7. Answer (1)

Correct expression is $\Delta G = \Delta G^\circ + RT\ell n\, Q$

At equilibrium, $\Delta G = 0$, $Q = K$

$\Delta G^\circ = -RT\ell n\, K$

8. Answer (4)

$Ag^+ + e^- \rightarrow Ag$

3F of electricity produces 3 moles of Ag(s)

$Cu^{2+} + 2e^- \rightarrow Cu$

2F of electricity produces 1 mole of Cu(s)

$\therefore$ 3F of electricity produces $\frac{3}{2}$ moles of Cu(s)

$Al^{3+} + 3e^- \rightarrow Al$

3F of electricity produces 1 mole of Al(s)

Ratio of number of moles of Cu, Al and Ag = $\frac{3}{2} : 1 : 3 = 3 : 2 : 6$

9. Answer (4)

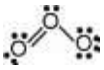
Intermolecular attractive force between solute and solvent are weaker for positive deviation.

10. Answer (2)

$$\pi = \frac{i \times w\, RT}{MV}$$

$$w = \frac{\pi MV}{iRT} = \frac{0.75 \times 111 \times 3}{2.47 \times 0.082 \times 300} = 4.11\,g$$

11. Answer (2)



Formal charge = $6 - 2 - \frac{6}{2} = +1$

12. Answer (4)

PCl_5 exist as $[PCl_4]^+ [PCl_6]^-$ in solid state

So, $PCl_4^+ \rightarrow sp^3$ hybridised

$PCl_6^- \rightarrow sp^3d^2$ hybridised

13. Answer (3)

$S_2O_3^{2-} + 4Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 8Br^- + 10H^+$

So, y = 4

z = 5

Ratio y : z = 4 : 5

14. Answer (4)

The compound in which an element present in its intermediate oxidation state can act both as oxidising as well as reducing agent.

$\underline{C}O_2 \Rightarrow +4 \Rightarrow$ Highest oxidation state

$\underline{S}O_2 \Rightarrow +4 \Rightarrow$ Intermediate oxidation state

$H_2\underline{O}_2 \Rightarrow -1 \Rightarrow$ Intermediate oxidation state

$H\underline{N}O_3 \Rightarrow +5 \Rightarrow$ Highest oxidation state

15. Answer (1)

Though SiO_2 resists the attack of various chemicals even at elevated temperatures but it can be attacked by HF and NaOH.

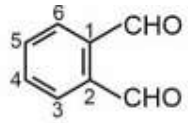
$SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$

$SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

16. Answer (1)

Nitrogen atom of nitro, azo or a ring is not free to get changed into ammonium sulphate.

17. Answer (4)



Benzene-1, 2-dicarbaldehyde

18. Answer (1)

Large number of unpaired electrons in transition metal atoms lead to stronger interatomic interactions and hence stronger bonding between atoms resulting in higher enthalpy of atomisation.

19. Answer (3)

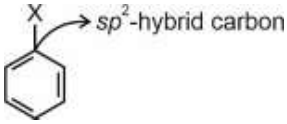
- Solubility of salts in water increases with rise of temperature as $\Delta_{sol}H°$ is positive and dissociation process is endothermic for most ionic compounds.
- $\Delta_{sol}H° = \Delta_{lattic}H° + \Delta_{hyd}H°$

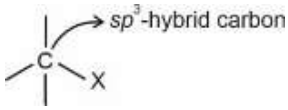
20. Answer (3)

S_N1 reaction proceeds via carbocation intermediate. Hence, 

is most reactive towards S_N1 reaction due to most stable 3° carbocation.

21. Answer (3)





where (X = halogen)

- Haloarenes are less reactive than haloalkanes towards nucleophilic substitution reaction as it is difficult to break a shorter bond than a longer bond.

22. Answer (3)

Moles of H_2SO_4 present = M × V

$= 0.5 \times \frac{500}{1000}$

= 0.25 mole

23. Answer (1)

Acidity of $Mg(OH)_2$ is 2.

Equivalent weight = $\frac{\text{Molecular weight}}{\text{Acidity}}$

M·W of $Mg(OH)_2$ = 24 + 34 = 58 g mol^{-1}

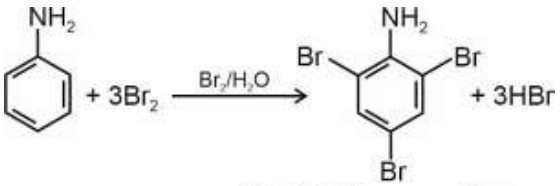
Equivalent weight = $\frac{58}{2}$ = 29

24. Answer (4)

Complexes in which a metal is bound to more than one kind of donor groups are known as heteroleptic complex.

$\therefore$ $K[Co(NH_3)_4Cl_2]$ is a heteroleptic complex in which Co^{3+} is bound to NH_3 and Cl^- ligands.

25. Answer (4)



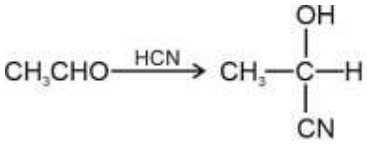
2, 4, 6-Tribromoaniline

26. Answer (1)

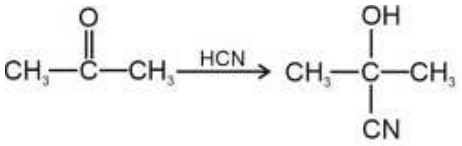
Valeraldehyde is $CH_3–CH_2–CH_2–CH_2–CHO$

IUPAC name: Pentanal

27. Answer (1)



Optically active



Optically inactive

28. Answer (4)

$2NO_2 \rightarrow N_2O_4$

$$\frac{-1}{2}\frac{d[NO_2]}{dt} = \frac{d[N_2O_4]}{dt}$$

$$\frac{-d[NO_2]}{dt} = 2\frac{d[N_2O_4]}{dt}$$

$= 2 \times 0.1 = 0.2$ mol L^{-1} s^{-1}

29. Answer (2)

Cu^{2+} gives $Cu(BO_2)_2$ during borax bead test.

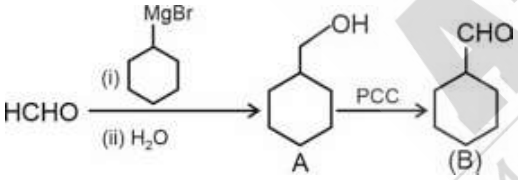
30. Answer (2)

Ba^{2+} belongs to group V cation and group reagent is $(NH_4)_2CO_3 + NH_4OH$.

31. Answer (4)

Glucocorticoids control the carbohydrate metabolism, modulate inflammatory reactions and are involved in reactions to stress.

32. Answer (2)

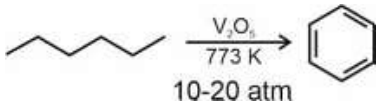


(B) contains one α, hydrogen hence it does not undergo aldol condensation reaction.

33. Answer (2)

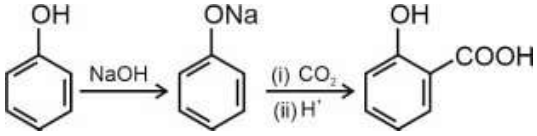
More is the electron releasing nature of the group, faster is the electrophilic substitution reaction.

34. Answer (1)



35. Answer (3)

Kolbe's reaction.



SECTION-B

36. Answer (1)

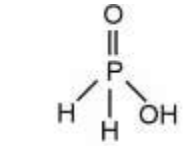
n = 4 has (4*s*, 4*p*, 4*d* and 4*f*) subshells.

Total number of orbitals = 16

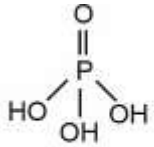
Each orbital can occupy two electrons

Total number of electrons = 32

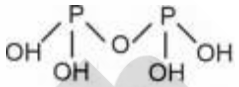
37. Answer (4)



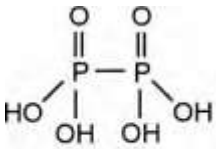
Hypophosphorous acid (+1)



Orthophosphoric acid (+5)



Pyrophosphorous acid (+3)



Hypophosphoric acid (+4)

38. Answer (2)

$$\lambda_{eq} = \frac{\lambda_m}{n-\text{factor}}$$

$$\lambda_m = (n\text{ factor}) \times \lambda_{eq}$$

So, n = 2 for $BaSO_4$

39. Answer (3)

Equilibrium in a system having more than one phase is called heterogenous equilibrium.

40. Answer (2)

$NH_4^+ \rightarrow sp^3$

$[Ni(CN)_4]^{2-} \rightarrow sp^3d$

$SF_6 \rightarrow sp^3d^2$

41. Answer (4)

$BH_4^{\ominus}$ being a electron rich acts as nucleophile.

42. Answer (3)

Lanthanoids upon heating with nitrogen form nitrides LnN.

The carbides, Ln_3C, Ln_2C_3 and LnC_2 are formed when Lanthanoids are heated with carbon.

43. Answer (1)

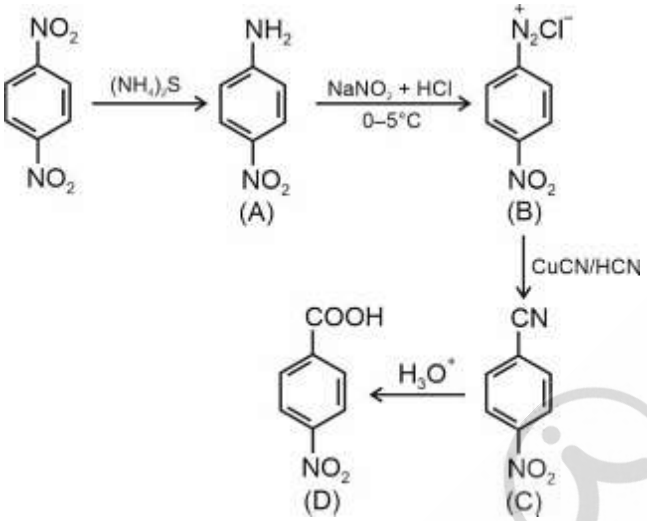
For isothermal reversible change

$$q = -w = nRT\ell n\frac{V_f}{V_i}$$

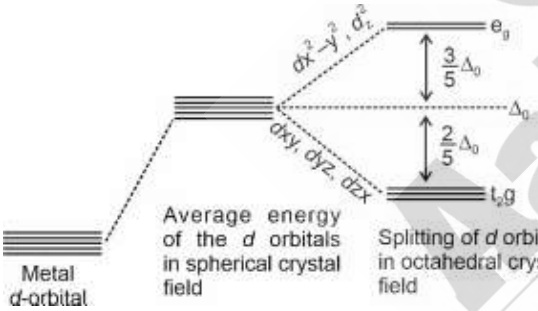
$$q = nRT\ell n\frac{10}{2}$$

$$\boxed{q = nRT\ell n5}$$

44. Answer (4)

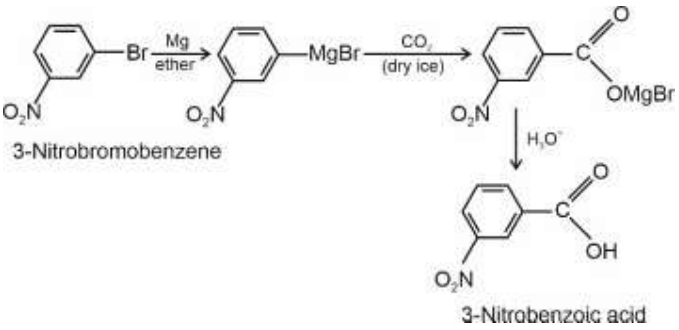


45. Answer (2)



The energy of two e_g orbitals will increase by $\left(\frac{3}{5}\right)$ Δ_0 and that of three t_{2g} will decrease by $\left(\frac{2}{5}\right)\Delta_0$.

46. Answer (3)



47. Answer (1)

$$t = \frac{2.303}{k}\log\frac{a_0}{a_0 - x}$$

$$t_{99\%} = \frac{2.303}{k}\log\frac{100}{100-99}$$

$$= \frac{2.303}{k}\times 2$$

$$t_{99.9\%} = \frac{2.303}{k}\log\frac{100}{100-99.9}$$

$$= \frac{2.303}{k}\times 3$$

$t_{99\%} : t_{99.9\%} = 2 : 3$

48. Answer (3)

α-D-(+)-Glucopyranose and

β-D-(+)-Glucopyranose are anomers.

49. Answer (1)

 and are anti-aromatic species.

50. Answer (1)

Molecule	Boiling point (K)
$C_2H_5–O–C_2H_5$	307.6
$CH_3(CH_2)_3–OH$	390

BOTANY

SECTION-A

51. Answer (3)

Carrageen is a hydrocolloid obtained from red algae.

52. Answer (1)

Haplo-diplontic is an intermediate type of life cycle where both the sporophyte and gametophyte are multicellular, equally dominant and often free-living.

Polysiphonia exhibits haplo-diplontic life cycle.

Spirogyra and *Volvox* shows haplontic life cycle.

Fucus shows diplontic life cycle.

53. Answer (4)

Ladybird beetle is useful in the control of aphids and dragonflies are useful to get rid of mosquitoes.

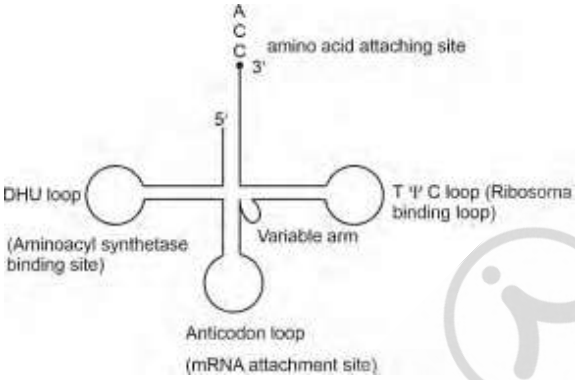
54. Answer (3)

In nature a given habitat has enough resources to support a maximum possible number beyond which no further growth is possible. This natural limit for that species in that habitat is called carrying capacity. The value of r (biotic potential) is an important parameter to assess impact of environmental factors on population growth.

55. Answer (3)

Anthropogenic ecosystem is created and maintained by human beings. It generally has high productivity.

56. Answer (2)



57. Answer (3)

Except H-bond all other bonds are found in a dinucleotide.

58. Answer (3)

The tension created by supercoiling in DNA double helix is relieved by DNA gyrase.

59. Answer (2)

Introns are intervening sequences that do not appear in mature mRNA. The presence of introns is reminiscent of antiquity.

60. Answer (4)

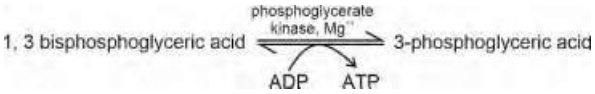
Action spectrum of photosynthesis corresponds closely to absorption spectra of chlorophyll *a* showing that chlorophyll *a* is the chief pigment associated with photosynthesis.

61. Answer (1)

PEP synthetase is a cold sensitive enzyme.

62. Answer (4)

The conversion of BPGA to phosphoglyceric acid is an energy yielding step.



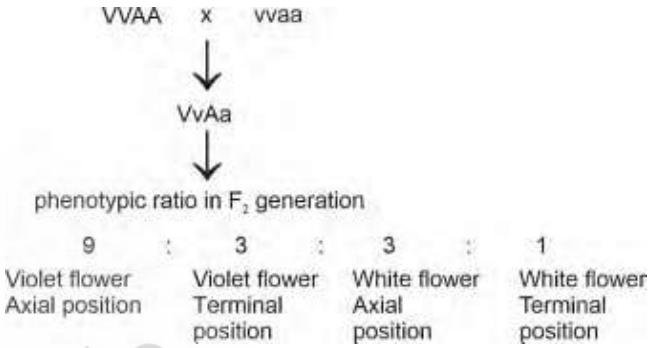
63. Answer (3)

The recent illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

64. Answer (3)

The number of fungi species in the world is more than the combined total of the species of fishes, amphibians, reptiles and mammals.

65. Answer (3)



There are 3 individuals out of 16 with terminal-violet flower.

$$\therefore \quad \frac{3}{16} \times 100 = 3 \times 6.25 = 18.75\%$$

66. Answer (4)

Mendel selected 14 true breeding pea plant varieties, for his experiments.

67. Answer (3)

Linkage term is used to describe the physical association of genes on a chromosome and the term recombination is used to describe the generation of non- parental gene combinations.

68. Answer (2)

Grasshopper is an example of XO type of sex determination in which the males have only one X chromosome besides autosomes, whereas females have a pair of X chromosomes.

69. Answer (4)

Poales and Sapindales are orders.

70. Answer (4)

Molecular weight of a viroid is lower than that of viruses.

71. Answer (2)

Dinoflagellates are mostly marine and photosynthetic.

72. Answer (1)

Underground stems of ginger, turmeric and *Colocasia* are modified to store food in them and also act as organs of perennation to tide over conditions that are unfavourable for growth.

73. Answer (4)

Petiole helps hold the leaf blade to light and allow them to flutter in wind.

Lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets.

74. Answer (2)

Sunflower plant shows alternate phyllotaxy.

Argemone show parietal placentation having false septum.

75. Answer (1)

Meristematic tissues have cells with active cell division capacity.

76. Answer (1)

Cork is impervious to water due to suberin deposition.

In dicot stem, the cells of endodermis are rich in starch grains and the layer is referred to as starch sheath.

In grasses, certain adaxial epidermal cells along the veins modify themselves into large, empty, colourless cells called bulliform cells.

Xylem parenchyma cells are living and thin walled.

77. Answer (3)

Naphthalene acetic acid (NAA) and 2, 4-D are synthetic auxins.

78. Answer (3)

Water hyacinth and water lily are pollinated by insects or wind.

79. Answer (2)

The proximal end of the filament is attached to the thalamus or the petal of the flower.

The number and length of stamens are variable in flowers of different species.

80. Answer (2)

A special membranous structure in bacteria is the mesosome which is formed by the extensions of plasma membrane into the cell. They help in respiration, secretion process, etc.

81. Answer (4)

The cell envelope consist of a tightly bound three layered structure, *i.e.,* the outermost glycocalyx followed by the cell wall and then the plasma membrane.

82. Answer (2)

The plasma membrane is selectively permeable in nature and interacts with the outside world. This membrane in prokaryotes is similar structurally to that of eukaryotes.

83. Answer (1)

Diplotene is recognised by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers.

84. Answer (2)

Diakinesis represents transition to metaphase I.

85. Answer (4)

A bivalent or a tetrad contains four chromatids hence 12 tetrads contain 48 chromatids.

SECTION-B

86. Answer (4)

Dryopteris, Pteris, Adiantum belong to class Pteropsida.

87. Answer (1)

Acetic acid is obtained from bacteria *Acetobacter aceti* and used in the preparation of vinegar.

88. Answer (2)

Parasites also reduce host population density.

89. Answer (2)

Phytoplanktons are pioneer species in pond.

The organic matter formed by death and decay of planktons, mixes with clay and silt at the bottom of pond to form soft mud. The habitat becomes suitable for the growth of next stage.

90. Answer (1)

Lactose is an inducer of *lac* operon.

91. Answer (4)

Frederick Sanger is credited for developing method for determination of amino acid sequence in proteins.

92. Answer (2)

The complete oxidation of pyruvate by the stepwise removal of all the hydrogen atoms leaves three molecules of CO_2.

93. Answer (3)

In sickle cell anaemia, the mutant haemoglobin molecules undergoes polymerisation under low oxygen tension causing the change in the shape of the RBC from biconcave disc to elongated sickle cell structure.

94. Answer (4)

Yeast is a unicellular fungi.

95. Answer (2)

In Asteraceae family, the inflorescence is head or capitulum. The disc florets are present in the centre of head, having floral formula, Br % or $\oplus \, \delta \, \underset{\text{Pappus or 0}}{K} \, \overset{\frown}{C_{(5)}} \, A_{(5)} \, \bar{G}_{(2}$.

96. Answer (3)

This section is more likely to be a dicot root. Cells of epiblema protrude in the form of unicellular root hairs. Vascular bundles are of radial type and pith is small or inconspicuous. Presence of conjunctive tissue in dicot root.

97. Answer (3)

Cytokinins have specific effects on cytokinesis and were discovered as kinetin from the autoclaved herring sperm DNA (a modified form of adenine). It does not occur naturally in plants and known to overcome the apical dominance.

98. Answer (4)

In watermelon, many ovules are found in an ovary. Pollen grains of wheat lose viability within 30 minutes of their release.

99. Answer (1)

In eukaryotic cells there is an extensive compartmentalisation of cytoplasm. Bacteria is a prokaryotic cell.

100. Answer (4)

Cells at the end of prophase, when viewed under the microscope, do not show golgi complexes, endoplasmic reticulum, nucleolus and the nuclear envelope.

ZOOLOGY

SECTION-A

101. Answer (3)

Gene therapy is collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo.

102. Answer (2)

Each lobule of testis contains one to three highly coiled seminiferous tubules in which sperms are produced. Each testis has about 250 compartments called testicular lobules.

103. Answer (4)

Impulse transmission across an electrical synapse is independent of neurotransmitters and is always faster than that across a chemical synapse.

104. Answer (3)

Each ovary is about 2-4 cm in length and is connected to the pelvic wall and uterus by ligaments. Testes are present in scrotum supported by gubernaculum. Kidneys are present in the abdominal cavity.

105. Answer (1)

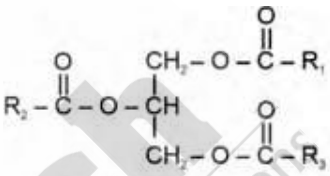
Ovaries are considered as the primary sex organs in human females. The oviduct, uterus and vagina constitute the female accessory ducts.

106. Answer (3)

Each cerebral hemisphere consists of two parts *i.e.,* outer cortex and inner medulla. Cortex is grey in colour due to the presence of cell bodies of neurons. Medulla is formed by the tracts of myelinated nerve fibres.

107. Answer (3)

Each triglyceride contains three fatty acids.



Triglyceride (R_1, R_2 and R_3 are fatty acids)

108. Answer (1)

PTH stimulates reabsorption of Ca^{2+} by the renal tubules and increases Ca^{2+} absorption from the digested food.

109. Answer (2)

Based on the number of amino and carboxyl groups, there are acidic (glutamic acid), basic (lysine) and neutral (valine) amino acids.

110. Answer (4)

There are two hydrogen bonds between A and T and three hydrogen bonds between G and C in a dsDNA molecule.

111. Answer (2)

Many bony fishes, aquatic amphibians and aquatic insects are ammonotelic. *Clarias* is a bony fish which belongs to the class Osteichthyes. Mammals and many terrestrial amphibians excrete urea and are called ureotelic animals. Reptiles, birds and land snails excrete uric acid and are called uricotelic animals.

112. Answer (1)

pO_2 is 95 mm Hg in oxygenated blood. Pulmonary artery and vena cava carry deoxygenated blood (pO_2 = 40 mm Hg). Systemic arteries carry oxygenated blood.

113. Answer (2)

Pivot joint – Between atlas and axis

Gliding joint – Between the carpals

Ball and socket joint – Hip joint and shoulder joint

114. Answer (1)

The role of calcium in muscle contraction is to bind with troponin, which leads to the exposure of the myosin-binding sites on actin.

Neuromuscular junction has no role in muscle relaxation.

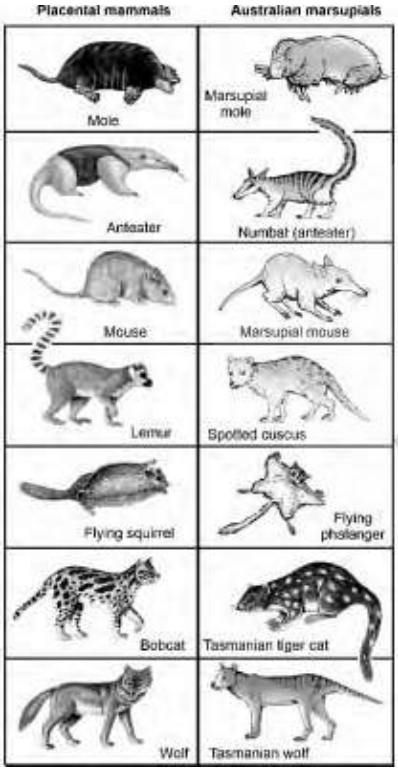
115. Answer (2)

Some mammals are aquatic. Whales, dolphins, seals and sea cows are some of the examples.

116. Answer (3)

The Neanderthal man with a brain size of 1400cc lived in near east and central Asia between 1,00,000 – 40,000 years back. They used hides to protect their body and buried their dead.

117. Answer (4)



118. Answer (3)

Scientists at CDRI, Lucknow, developed a non-steroidal preparation 'Saheli', which is an oral contraceptive pill. It is "once a week" pill with very few side effects and high contraceptive value.

119. Answer (2)

Human kidneys can produce urine nearly four times concentrated than the initial filtrate. The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms.

120. Answer (2)

A wide range of contraceptive methods are presently available which could be broadly grouped into the categories, namely natural barriers, IUDs, oral contraceptives, injectables, implants and surgical methods. IUT (Intra Uterine Transfer) is one of the methods of ART (Assisted Reproductive Technologies).

121. Answer (2)

The machine used to obtain electrocardiogram (ECG) is known as electrocardiograph.

ECG is a graphical representation of the electrical activity of the heart during a cardiac cycle.

122. Answer (4)

Blood of humans are grouped into 'A', 'B', 'AB' and 'O' based on the presence or absence of two surface antigens, 'A' and 'B' on the surface of the RBCs.

123. Answer (4)

Fore wings (mesothoracic) called tegmina are opaque, dark and leathery and cover the hind wings when at rest. These wings are not used for flight, instead they cover and protect the metathoracic wings. Hence, they are also called wing covers, tegmina or elytra.

124. Answer (3)

MRI uses strong magnetic fields to accurately detect cancer and other pathological and physiological changes in the living tissue.

Computed tomography uses X-rays to create a three-dimensional image of the internals of an object.

125. Answer (3)

Coca alkaloid is obtained from *Erythroxylum coca*. It interferes with the transport of the neuro-transmitter, dopamine.

126. Answer (3)

An American company prepared two DNA sequences corresponding to 'A' and 'B' chains of human insulin and introduced them in plasmids of *E.coli* to produce insulin chains.

127. Answer (4)

Microvilli are microscopic finger like minute projections present in intestine and help in absorption of food.

128. Answer (3)

Natural selection can lead to directional change in which more individuals acquire value other than the mean character value.

129. Answer (2)

Pinnae are present in the members of the class Mammalia.

Subphylum	Urochordata	*Ascidia*
	Cephalochordata	*Branchiostoma* (Lancelet)
Class	Amphibia	*Ichthyophis, Bufo*
	Reptilia	*Calotes*
	Aves	*Struthio*, *Pavo*
	Mammalia	*Platypus*, *Equus*, *Delphinus*
	Cyclostomata	*Petromyzon* (Lamprey)
	Osteichthyes	*Exocoetus*

130. Answer (3)

Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues under normal physiological conditions.

$100\ mL \longrightarrow 5\ mL\ O_2$

$1\ mL \longrightarrow \frac{5}{100} mL$

$500\ mL \longrightarrow \frac{5}{100} \times 500\ mL = 25\ mL$

131. Answer (1)

Gel electrophoresis is employed to check the restriction enzyme digestion.

132. Answer (4)

Pseudometamerism is characteristic of *Taenia* (Tapeworm).

Planaria is a free-living flatworm.

Hirudinaria is an ectoparasite.

Sexes are separate in *Ascaris.*

133. Answer (2)

More than one cloning site for a single restriction enzyme can complicate the process of gene cloning.

Origin of replication intiates the replication of DNA.

134. Answer (2)

Echinoderms are spiny bodied animals.

Ctenophores are radially symmetrical.

135. Answer (1)

When migration of a section of population to another place and population occurs, gene frequencies change in the original as well as in the new population. New genes/alleles are added to the new population and these are lost from the old population. There would be a gene flow if gene migration, happens multiple times. If the same change occurs by chance, it is called genetic drift.

SECTION-B

136. Answer (3)

The recombinants will have *lac*-Z gene along with the gene of interest. Therefore, they will produce blue coloured colonies in the presence of a chromogenic substrate.

137. Answer (2)

*Bam*H I, *Sal* I and *Eco*R I produce sticky ends.

138. Answer (4)

The sample is heated usually at 94°C in the denaturation step of PCR.

139. Answer (3)

An ideal contraceptive should be reversible with no or least side-effects.

According to 2011 census report, the population growth rate was less than 2% *i.e.,* 20/1000/year.

Induced abortion or MTP was legalised in 1971 in India.

140. Answer (3)

A healthy individual has 12-16 gms of haemoglobin in every 100 mL of blood.

Therefore, 400 mL blood contains 48-64 gms of haemoglobin.

141. Answer (3)

There is always a time-lag between the infection and appearance of AIDS symptoms. This period may vary from a few months to many years (usually 5-10 years).

After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.

142. Answer (2)

Hind-brain consists of cerebellum and medulla oblongata in frogs.

RBCs are nucleated in frogs.

The lymph is different from blood. It lacks few proteins and RBCs.

143. Answer (4)

The technique used to detect the DNA in a clone of cells is autoradiography.

144. Answer (2)

Axons contain axoplasm but lack Nissl's granules. Nissl's granules are present in cyton and dendrites. Dendrites are afferent and axons are efferent processes of neurons.

145. Answer (2)

Testes are the primary sex organs in human males and ovaries are the primary sex organs in human females. Vagina is the female copulatory organ. The female external genitalia includes mons pubis, labia majora, labia minora, hymen and clitoris. Presence of the functional mammary glands is characteristic of female mammals.

146. Answer (2)

Lipids whose molecular weights do not exceed 800 Da come under the acid insoluble fraction as during cell disruption, they form vesicles that are not water soluble. Therefore, vesicles get separated along with the acid-insoluble pool.

147. Answer (3)

T-lymphocytes provide cell-mediated immunity.

B-lymphocytes provide humoral immune response.

148. Answer (2)

Amniocentesis is used to test for the presence of certain genetic disorders such as haemophilia, down syndrome, *etc*.

149. Answer (1)

RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantites of the same is present in the plasma too.

$$CO_2 + H_2O \underset{\text{anhydrase}}{\overset{\text{carbonic}}{\rightleftharpoons}} H_2CO_3 \underset{\text{anhydrase}}{\overset{\text{carbonic}}{\rightleftharpoons}} HCO_3^- + H^+$$

150. Answer (3)

Neurons are only excitable cells whereas muscle cells show the property of both excitability and contractility.

PHYSICS

SECTION-A

151. Answer (3)

$\text{K.E} = \frac{1}{2} I\omega_i^2$

$200 = \frac{1}{2}(4)\omega_i^2 \Rightarrow \omega_i = 10$ rad/s

Also, $(\omega_f)^2 - (\omega_i)^2 = 2\alpha\theta$

$0 - (10)^2 = 2\left(-\frac{5}{4}\right)\theta \qquad \left[\begin{matrix}\tau = I\alpha \\ \alpha = \frac{-5}{4}\end{matrix}\right]$

$\theta = 40$ radian

or no. of revolution $= \frac{\theta}{2\pi} = \frac{40}{2\pi} = 6.4$

152. Answer (4)

When $\sum \tau_{net} = 0$ about any point in universe (for a system)

Then, the system is said to be in rotational equilibrium.

153. Answer (1)

We know,

$Y = \frac{Fl}{Ax} \Rightarrow x = \frac{Fl}{AY}$

$x = \frac{(10)(9.8)\times 1.5}{\frac{\pi}{4}[(0.25)\times 10^{-2}]^2 \times 2\times 10^{11}}$

$x = 1.497 \times 10^{-4} \approx 0.15 \times 10^{-3}$ m

$x = 0.15$ mm

154. Answer (2)

Here gravitational force provide centripetal force and Centripetal force makes the satellite go in circular orbit where velocity is always tangential.

In the sudden absence of gravitational force the satellite will keep moving tangentially with same velocity.

155. Answer (3)

$\Delta R = R_0\ \alpha\Delta T$

$\frac{\Delta R}{R_0 \Delta T} = \alpha \leftarrow$ Thermal coefficient of resistivity

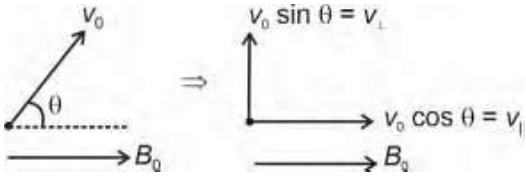
156. Answer (2)

According to balanced Wheatstone bridge:

$60\ \Omega \times 70$ cm $= R \times 30$ cm

$R = 140\ \Omega$

157. Answer (3)



The path of the charged particle is helical for the above condition.

158. Answer (4)

The resistance of an ideal voltmeter is infinite.

159. Answer (2)

North-south poles of a bar magnet cannot be separated. Other three options are wrong.

160. Answer (3)

Since the net force acting on the particle is zero hence the velocity of particle will remain constant.

161. Answer (1)

For the motion along the vertical direction.

$$H = ut + \frac{1}{2}gt^2$$

$H = -5 \times 4 + 5 \times (16)$ [Taking downward direction as positive]

$H = 80 - 20 = 60$ m

162. Answer (4)

For $t = 0$ to $t = t_1$ slope is positive and constant

For $t = t_1$ to $t = t_3 \Rightarrow$ slope is zero

For $t = t_3$ to $t = t_4 \Rightarrow$ slope is negative and constant

163. Answer (2)

$$\vec{r} = A\cos(\omega t)\hat{i} + A\sin(\omega t)\hat{j}$$

$$\Rightarrow \vec{v} = \frac{d\vec{r}}{dt} = -A\omega\sin(\omega t)\hat{i} + A\omega\cos(\omega t)\hat{j}$$

$$\Rightarrow |\vec{v}|_{\text{at } t=0} = A\omega$$

164. Answer (2)

$E_0 = cB_0$

$E_0 = 3 \times 10^8 \times 420 \times 10^{-9}$

$= 126$ N/C

165. Answer (3)

For first minima $y_1 = \frac{\lambda D}{d}$

And for fifth minima $y_5 = \frac{5\lambda D}{d}$

$$\Delta x = y_5 - y_1 = \frac{4\lambda D}{d} = 0.4 \times 10^{-3}$$

$$\Rightarrow d = \frac{4 \times 5000 \times 10^{-10} \times 1}{4 \times 10^{-4}}$$

$d = 5$ mm

166. Answer (2)

For TIR, ray goes from denser medium to rarer medium and $i > i_c$

167. Answer (3)

Dispersive power = $\frac{\mu_V - \mu_R}{\mu_Y - 1}$

Since both prism are of same material, Therefore both have same dispersive power.

168. Answer (2)

$$\phi_{net} = \frac{q_{enc}}{\varepsilon_0}$$

$$(\phi_2 - \phi_1) = \frac{q_{enc}}{\varepsilon_0}$$

$$q_{enc} = (\phi_2 - \phi_1)\varepsilon_0$$

169. Answer (2)

$$U = \frac{-ke^2}{r}$$

On decreasing r, U decreases.

170. Answer (3)

$$X = 4[\cos\pi t + \sin\pi t]$$

$$X = 4\sqrt{2}\sin\left(\pi t + \frac{\pi}{4}\right)$$

$v_{max} = A\omega$

$= 4\sqrt{2}\pi$

171. Answer (1)

$v = 2f(l_2 - l_1)$

$= 2 \times 256 (105 - 35) \times 10^{-2}$

$= 359$ m/s

172. Answer (3)

Dimension formula of $\frac{v}{\lambda}$ and $\frac{x}{\lambda}$ are not same.

$$\left[\frac{v}{\lambda}\right] = [T^{-1}]$$

$$\left[\frac{x}{\lambda}\right] = [M^0L^0T^0]$$

173. Answer (3)

$$\alpha = \frac{\Delta\ell}{\ell_0\Delta\theta}$$

Slope $\propto \alpha$

174. Answer (4)

At the feet, height of the blood column is more as compared to that at brain. Hence, blood pressure in humans is greater at the feet than at brain.

Angle of contact of mercury with glass is obtuse while that of water with glass is acute.

Spinning of cricket ball does not follow a straight trajectory.

175. Answer (4)

Internal energy change in a cyclic process is zero.

176. Answer (3)

$m = 5.6 \times 10^{-2}$ kg

$= 56$ g

$\Delta T = 45°C$

Molecular mass, $M = 28$

$R = 8.31$ J/mol K.

No. of moles $n = \frac{m}{M}$

$= \frac{56}{28} = 2$

Molar specific heat at constant pressure for nitrogen, $C_p = \frac{7}{2}R$

$Q = nC_p\Delta T$

$= 2 \times \frac{7}{2} \times 8.3 \times 45 = 2614.5$ J

177. Answer (4)

$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mE}}$

$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{E_2}{E_1}} \Rightarrow \frac{\lambda_2}{\lambda_1} = \sqrt{\frac{E_1}{E_2}} = \frac{60}{100}$

$\sqrt{\frac{E_1}{E_2}} = \frac{3}{5} \Rightarrow \frac{E_1}{E_2} = \frac{9}{25}$

$E_2 = \frac{25}{9}E$

Extra energy given $= \frac{25}{9}E - E = \frac{16E}{9}$

178. Answer (2)

In nucleus ${}_zX^A$

Number of proton = Z

Number of neutron = A-Z

179. Answer (4)

$i = \frac{60}{6 \times 10^3} = 10 \times 10^{-3} = 10$ mA

$i_L = \frac{50}{8 \times 10^3} = 6.25 \times 10^{-3} = 6.25$ mA

$i_z = i - i_L$

$= 10 - 6.25$

$i_z = 3.75$ mA

180. Answer (3)

$\Delta E = \frac{12400}{4960} = 2.5$ eV

181. Answer (2)

$F_x = -\frac{dv}{dx} = +3$ N

$F_y = -\frac{dv}{dy} = -4$ N

$a = 5$ m s^{-2}

$s = \frac{1}{2} \times 5 \times (2)^2$

$s = 10$ m

182. Answer (1)

KE $= \frac{p^2}{2m_2}$

$= \frac{1}{2 \times 4}(6 \times 4)^2$

$= \frac{24 \times 24}{8}$ J

$= 24 \times 3$ J

$= 72$ J

183. Answer (2)

$Q = \frac{\omega L}{R} = \frac{I_0 \omega L}{I_0 R} = \frac{(I_0)}{(I_0 R)}\frac{1}{\omega C}$

$= \frac{V_C}{V_R} = \frac{150V}{200V} = \frac{3}{4}$

184. Answer (1)

$\frac{\Delta\phi}{R} = \Delta Q$

$\Delta\phi = R\Delta Q$

ΔQ = area under current time graph

$= \frac{1}{2} \times 1 \times 4 - 2 \times 1$

$= 2 - 2$

$\Delta Q = 0$

$\Delta\phi = 0$

185. Answer (3)

$\ell = \frac{1}{\sqrt{2}\pi n d^2} \Rightarrow \ell \propto d^{-2} \Rightarrow n = -2$

SECTION-B

186. Answer (4)

We know,

$\frac{I_2}{I_1} = \frac{1}{4}$

$\frac{m_1 r_1^2}{m_2 r_2^2} = \frac{\sigma(2\pi r_1) r_1^2}{\sigma(2\pi r_2) r_2^2} = 4$

$\left(\frac{r_1}{r_2}\right)^3 = 4 \Rightarrow \frac{r_2}{r_1} = 4^{-1/3}$

187. Answer (4)

Acceleration due to gravity on the surface of earth of $g = \frac{GM}{R^2}$

& At height $2R$ above earth surface

$$g' = \frac{GM}{R^2\left(1+\frac{h}{R}\right)^2} = \frac{GM}{R^2\left(1+\frac{2R}{R}\right)^2}$$

$$g' = \frac{GM}{R^2 9}$$

$$\Rightarrow \frac{g'}{g} = \frac{GM}{9R^2} \times \frac{R^2}{GM} = \frac{1}{9}$$

188. Answer (2)

Final velocity = Zero

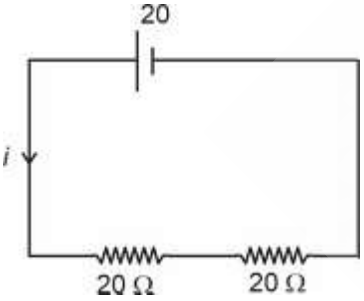
$\Rightarrow 2as = v^2 - u^2 \Rightarrow S = \frac{u^2}{2a}$

$\Rightarrow S = \frac{10^2}{2 \times a}$ and $a = g \sin 30° + \mu_k g \cos 30°$

$\Rightarrow a = 6.7 \text{ m s}^{-2} \Rightarrow s = 7.46 \text{ m}$

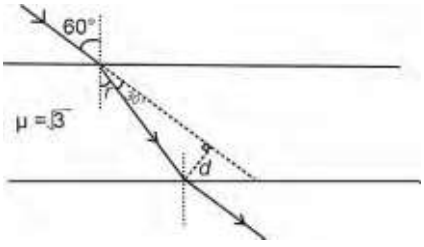
189. Answer (1)

Equivalent circuit



Reading of voltmeter v = 10 volt

190. Answer (2)



$1.\sin 60 = \sqrt{3} \sin r$

$\Rightarrow \frac{\sqrt{3}}{2} = \sqrt{3} \sin r$

$\Rightarrow r = 30°$

$d = t \sin 30°$

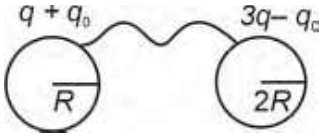
$= \frac{t}{2} = \frac{4}{2} = 2 \text{ cm}$

191. Answer (1)

In equal width, intensity of both the slit are equal.

Now, width of one of the slits doubled, intensity becomes double. Hence, intensities of both maxima and minima increases.

192. Answer (2)



$$\frac{K(q+q_0)}{R} = \frac{K(3q-q_0)}{2R}$$

$2q + 2q_0 = 3q - q_0$

$3q_0 = q$

$\Rightarrow q_0 = \frac{q}{3}$

193. Answer (3)

$P_{net} = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos 60}$

$P_1 = P_2 = qd$

$P_{net} = \sqrt{3}\, qd$

$= \sqrt{3} \times \sqrt{3} \times 10^{-6} \times 2 \times 10^{-3}$

$= 6 \ \mu\text{C m}$

194. Answer (3)

- Rate of change in linear momentum = force and has unit kg m s^{-2}.
- Velocity gradient has unit s^{-1}.
- Electromotive force is voltage or potential difference and has unit N m C^{-1}.
- Electric field intensity has unit N C^{-1}.

195. Answer (3)

All the statements are correct

196. Answer (3)

Pressure outside the submarine is $P = P_a + \rho gh$ and pressure inside is P_a.

$A = (0.1 \times 0.1) \text{ m}^2$

$= 1 \times 10^{-2} \text{ m}^2$

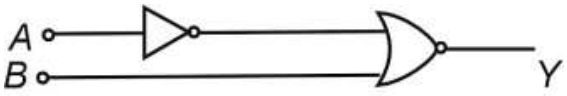
Force acting on it is

$F = \Delta P \times A$

$= 1.03 \times 10^3 \times 10 \times 1000 \times 1 \times 10^{-2}$

$F = 1.03 \times 10^5$ N

197. Answer (4)



$Y = \overline{\overline{A} + B} = A.\overline{B}$

198. Answer (3)

$$T \propto \frac{n^3}{z^2}$$

$$\frac{T_2}{T_3} = \left(\frac{n_2}{n_3}\right)^3$$

$$\frac{12.8\times10^{-16}}{T_3} = \left(\frac{2}{3}\right)^3$$

$$T_3 = \frac{27\times12.8\times10^{-16}}{8}$$

$$f_3 = \frac{8}{27\times12.8\times10^{-16}}$$

$$= \frac{8}{345.6}\times10^{16}\,s^{-1} = 2.3 \times 10^{14}\,s^{-1}$$

199. Answer (2)

$$\cos\phi = \frac{R}{Z}$$

$$4R = \sqrt{R^2 + X_c^2}$$

$$16R^2 - R^2 = X_c^2$$

$$R\sqrt{15} = X_c$$

$$100\sqrt{15}\,\Omega = X_c$$

200. Answer (2)

$$L = \frac{\mu_0 N^2 A}{\ell}$$

$N.\ 2\pi r = k$ (length of wire)

$$N = \frac{k}{2\pi r}$$

$$L = \mu_0 \cdot \frac{k^2}{4\pi^2 r^2} \cdot \frac{\pi r^2}{\ell} = \frac{\mu_0 k^2}{4\pi^2 \ell}$$

$$L' = \frac{\mu_0 k^2}{4\pi^2\,(2\ell)}$$

$$L' = \frac{L}{2}$$

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