

JNU Biotechnology

Model Paper

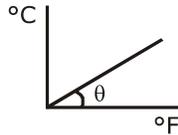
PART - A

All questions are to be answered.

- If the absolute temperature of a gas is doubled and the pressure is reduced to one-half, the volume of the gas will
 - remain unchanged
 - be doubled
 - increase four-fold
 - be reduced to $1/4^{\text{th}}$
- If in the fermentation of sugar in an enzymic solution that is 0.12M, the concentration of the sugar is reduced to 0.06M in 10 hour and to 0.03M in 20 hour what is the order of the reaction?
 - 1
 - 2
 - 3
 - 0
- For the gaseous equilibrium $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$, the degree of dissociation of PCl_5 is 0.80 at 1 atm. The degree of dissociation at 2 atm is
 - 0.69
 - 0.80
 - 0.85
 - 0.90
- The values of standard reduction potential E° for the half reaction are
$$\text{Zn} = \text{Zn}^{2+} + 2e^- ; E^\circ = + 0.76 \text{ V}$$
$$\text{Fe} = \text{Fe}^{+2} + 2e^- ; E^\circ = + 0.41 \text{ V}$$
The emf of the cell reaction $\text{Fe}^{+2} + \text{Zn} \rightarrow \text{Zn}^{+2} + \text{Fe}$ will be
 - 0.35 V
 - +0.35 V
 - +1.17 V
 - 1.17 V
- The reaction, $3\text{ClO}^-_{(\text{aq})} \rightarrow \text{ClO}^-_{3(\text{aq})} + 2\text{Cl}^-_{(\text{aq})}$, is an example of
 - oxidation reaction
 - reduction reaction
 - disproportionation reaction
 - decomposition reaction
- The hybridisation of atomic orbitals of N in NO_2^+ , NO_3^- and NH_4^+ are respectively
 - sp, sp^2 , sp^3
 - sp, sp^3 , sp^2
 - sp^2 , sp, sp^3
 - sp^2 , sp^3 , sp
- The conjugate base of HCO_3^- is
 - H_2CO_3
 - CO_2
 - H_2O
 - CO_3^{2-}
- Which of the following complex cannot show geometrical isomerism?
 - $[\text{Co}(\text{NH}_3)_2\text{Cl}_4]^-$
 - $[\text{AuCl}_2\text{Br}_2]^-$
 - $[\text{CoCl}_2\text{Br}_2]^{2-}$
 - $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
- Consider the isoelectrons series : K^+ , S^{2-} , Cl^- and Ca^{2+} , the radii of the ions decrease as
 - $\text{Ca}^{2+} > \text{K}^+ > \text{Cl}^- > \text{S}^{2-}$
 - $\text{Cl}^- > \text{S}^{2-} > \text{K}^+ > \text{Ca}^{2+}$
 - $\text{S}^{2-} > \text{Cl}^- > \text{K}^+ > \text{Ca}^{2+}$
 - $\text{K}^+ > \text{Ca}^{2+} > \text{S}^{2-} > \text{Cl}^-$

19. The ratio of the velocity of sound in hydrogen gas $\left(\gamma = \frac{7}{5}\right)$ to that in helium gas at the same temperature is
- $\sqrt{21}/5$
 - $\sqrt{42}/5$
 - $5/42$
 - $5/\sqrt{21}$

20. The graph shown in the figure is a plot of the temperature of a body in °C and °F. The value of $\sin \theta$ is
- $5/9$
 - $5/\sqrt{86}$
 - $9/\sqrt{86}$
 - $5/\sqrt{106}$



21. Which molecules does not appear in glycolysis and Krebs cycle (citric acid cycle)?
- | | |
|---------------|----------|
| a. GTP | b. NADPH |
| c. acetyl-CoA | d. ADP |

22. Which of the followings is *not* an aromatic amino acid?

- tyrosine
- serine
- cytosine
- phenylalanine

- | | |
|------------|------------|
| a. P and Q | b. Q and R |
| c. R and S | d. P and S |

23. What is purpose of repressing an operon?
- prevention of enzymes from being active
 - prevention of unnecessary waste of energy and resource
 - prevention of denaturation of enzymes
 - prevention of DNA damage

24. What would stop DNA replication in bacteria?

- addition of a DNA polymerase inhibitor
- addition of dideoxynucleotides (ddNTP)
- addition of lamin inhibitor
- addition of actin inhibitor

- | | |
|------------|------------|
| a. P and Q | b. Q and R |
| c. R and S | d. P and S |

25. If the extinction coefficient of RNA in aqueous solution is $66 \mu\text{g/ml}$ and the absorbance of a solution is 0.66 in a 1 cm cuvette, what is the concentration of the RNA in that solution in $\mu\text{g/ml}$?

- | | |
|-------------------------|--------------------------|
| a. $10 \mu\text{g/ml}$ | b. $1 \mu\text{g/ml}$ |
| c. $0.1 \mu\text{g/ml}$ | d. $0.01 \mu\text{g/ml}$ |

26. Which of the following would not need a channel or a carrier protein to cross the plasma membrane?

- | | |
|-------------------|----------------|
| P. aspartate ions | Q. sodium ions |
| R. cholesterol | S. DNA |
| a. P and Q | b. Q and R |
| c. R and S | d. P and S |

27. Why do eukaryotic cells need to package their genomes?
- to fit into the nucleus
 - to control the gene expression
 - to protect from mutagenesis
 - all of the above
28. What part of the *lac* operon serves a function similar to the function of attenuation mechanism in *trp* operon?
- lac Z*
 - lac Y*
 - lac A*
 - lac I*
29. Which of the following organelles does not have functional nucleic acids?
- P. Nucleus
Q. Mitochondria
R. Lysosomes
S. Peroxisomes
- P and Q
 - Q and R
 - R and S
 - P and S
30. Which of the following molecules are *not* forming polymers?
- actin
 - myosin
 - ribonucleotides
 - nucleotides
31. Which of the following serves as a storage molecule for high-energy phosphate groups in skeletal muscle?
- ADP
 - creatine phosphate
 - glucose-1-phosphate
 - pyrophosphate
32. If for the biochemical reaction $A \rightarrow B, \Delta H < 0$ and $\Delta S > 0$, then
- the reaction is spontaneous
 - the reaction is endothermic
 - $\Delta G = 0$
 - the disorder in the system will decrease if the reaction proceeds
33. Chylomicrons are which of the following types of molecules?
- carbohydrates
 - lipids
 - lipoproteins
 - proteins
34. Which of the following amino acids cannot participate in transamination?
- alanine
 - cysteine
 - glutamate
 - lysine
35. Which of the following is *not* used in the synthesis of fatty acids?
- ATP
 - cobalamin (vitamin B₁₂)
 - FADH₂
 - HCO₃⁻
36. Which of the following protein's mRNA lacks a poly-A tail?
- immunoglobulin
 - albumin
 - keratin
 - histone
37. Which of the following vitamins would most likely become deficient in a person who develops a completely carnivorous lifestyle?
- thiamine
 - niacin
 - cobalamin
 - vitamin C

49. Loss of function mutations (involving a single allele) that affect the production on an enzyme are usually autosomal, while loss of function mutations that affect structural proteins are usually autosomal.....
- recessive, recessive
 - recessive, dominant
 - dominant, dominant
 - dominant, recessive
50. Oxygenated blood from lungs enters heart through
- pulmonary vein
 - pulmonary artery
 - coronary system
 - coronary vein
51. The real number x when added to its inverse gives the minimum value of the sum at x equals to
- 2
 - 1
 - 1
 - 2
52. The function $f(x) = \log(x + \sqrt{x^2 + 1})$, is
- an even function
 - an odd function
 - a periodic function
 - neither an even nor an odd function
53. The degree and order of the differential equation of the family of all parabolas whose axis is x -axis, are respectively
- 2, 1
 - 1, 2
 - 3, 2
 - 2, 3
54. The value of $\lim_{x \rightarrow 0} \frac{\int_0^{x^2} \sec^2 t \, dt}{x \sin x}$ is
- 3
 - 2
 - 1
 - 1
55. If the two circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect in two distinct points, then
- $2 < r < 8$
 - $r < 2$
 - $r = 2$
 - $r > 2$
56. The lines $2x - 3y = 5$ and $3x - 4y = 7$ are diameters of a circle having area as 154 square unit. Then the equation of the circle is
- $x^2 + y^2 + 2x - 2y = 62$
 - $x^2 + y^2 + 2x - 2y = 47$
 - $x^2 + y^2 - 2x + 2y = 47$
 - $x^2 + y^2 - 2x + 2y = 62$
57. The shortest distance from the plane $12x + 4y + 3z = 327$ to the sphere $x^2 + y^2 + z^2 + 4x - 2y - 6z = 155$ is
- 26
 - $11\frac{4}{13}$
 - 13
 - 39
58. A particle acted on by constant forces $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ is displaced from the point $\hat{i} + 2\hat{j} + 3\hat{k}$ to the point $5\hat{i} + 4\hat{j} + \hat{k}$. The total work done by the force is
- 20 unit
 - 30 unit
 - 40 unit
 - 50 unit
59. The mean and variance of a random variable X having a binomial distribution are 4 and 2 respectively, then $P(X = 1)$ is
- 1/32
 - 1/16
 - 1/8
 - 1/4

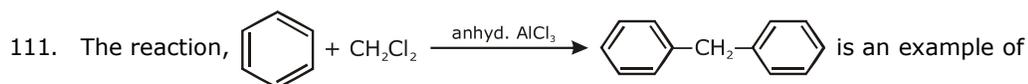
67. Which of the followings are *true* about the offsprings of a female carrier of an X-linked recessive disorder and a normal male?
- half of their children will be symptomatic
 - half of their daughters will be symptomatic
 - half of their daughters will be carriers
 - half of their sons will be asymptomatic carriers
68. Assuming the comparable chromosomes in different individuals are genetically dissimilar because of different alleles. How many unique zygotic combinations are possible in fertilization in an organism where $n = 3$ (Assuming that no crossing over occurs)?
- 8
 - 16
 - 64
 - 216
69. All of the following statements about Type I topoisomerase (Topo I) are true *except*
- Topo I removes DNA supercoils in an ATP-dependent reaction
 - Topo I from eukaryotic cells can remove both positive and negative supercoils
 - Topo I from *E. coli* can remove only negative supercoils
 - Topo I is essential for viability in *E. coli*
70. Which event does not occur within the nucleus?
- RNA editing in mammals
 - RNA capping
 - polyadenylation
 - scanning of initiation codon
71. In Scanning Electron Microscope (SEM), to form an image of the specimen
- electron should pass through the specimen
 - electrons are scattered from the surface of the specimen
 - a thin film of heavy metal is evaporated
 - specimens are stained
72. The high solubility of amino acids in water is due to
- presence of side chain
 - dipolar ion structure
 - unipolarity
 - hydrophilic nature of the amino group
73. If the carboxyl carbon of mevalonic acid is labeled with ^{14}C and then incubated with a liver preparation capable of synthesizing cholesterol, which of the cholesterol carbons will be labeled?
- all carbons
 - every third carbon, starting with C-1
 - only the side-chain carbons
 - none of the carbons
74. The mechanism of signal transduction by steroid hormones differs from amine and peptide hormones because
- steroids use small, water soluble second messengers
 - they bind with specific receptor proteins on target-cell plasma membranes
 - they bind to cytoplasmic or nuclear receptors and affect gene expression
 - they are secreted from exocrine glands
75. Which of the following statements correctly describes the nucleolus of a mammalian cell?
- it synthesizes 5S ribosomal RNA
 - it synthesizes 60S and 40S ribosomal subunits
 - it synthesizes all ribosomal RNA primary transcripts
 - it may contain hundreds of copies of genes for different types of ribosomal RNAs

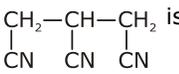
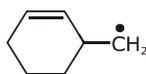
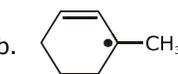
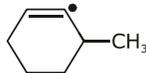
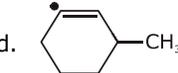
76. Which of the following regulators are said to act in "cis"?
- the *lac* repressor and the *lac* operator
 - the *lac* operator and mammalian transcription factors
 - the *lac* operator and mammalian enhancers
 - mammalian transcription factors and enhancers
77. Which of the following is *not* true about NO?
- acts as intracellular signalling molecule as well as neurotransmitter
 - regulates the vasodilation
 - synthesized from L-arginine
 - induces adenylate cyclase, which catalyzes cAMP formation
78. Which of the following coenzymes does *not* contain adenine?
- thiamine pyrophosphate
 - S-adenosylmethionine
 - coenzyme A
 - NADH
79. Which one of the following cofactors must be utilized during the conversion of acetyl-CoA to malonyl-CoA?
- thiamine pyrophosphate
 - acyl carrier protein (ACP)
 - NAD⁺
 - biotin
80. Cooperation of the two photosystems of the chloroplast is required for
- ATP synthesis
 - reduction of NADP⁺
 - oxidation of the reaction center of photosystem I
 - generation of a proton-motive force
81. An enhancer element shows all of the following properties *except*
- acts as a binding site for transcription factors
 - acts as a binding site for RNA polymerase
 - is functional when located upstream or downstream of the transcription initiation site
 - is functional when located in an intron
82. A linear DNA fragment is 100% labelled at one end and has 3 restriction sites for EcoRI. If it is partially digested by EcoRI so that all possible fragments are produced, how many of these fragments will be labelled and how many will not be labelled?
- | | |
|------------------------------|------------------------------|
| a. 4 labelled ; 6 unlabelled | b. 4 labelled ; 4 unlabelled |
| c. 3 labelled ; 5 unlabelled | d. 3 labelled ; 3 unlabelled |
83. What is the charge on the oligonucleotide 5' pGpGpApCpT 3' at neutral pH?
- | | |
|-------|-------|
| a. -5 | b. -6 |
| c. -7 | d. -8 |
84. Alkylating reagents, such as the mustard gases used during World War I, can damage DNA. Which of the following alkylated nucleosides is most likely to be mutagenic in the context of a DNA molecule; that is, to cause the insertion of the wrong base across from it during DNA replication?
- | | |
|-----------------------|------------------------|
| a. 7-methyl guanosine | b. 6-methoxy guanosine |
| c. 5-methyl cytosine | d. 1-methyl adenosine |

85. During peptide bond synthesis which of the following steps doesn't require an input of energy?
- an amino acid activation
 - the formation of the 70S initiation complex of prokaryotes
 - the binding of the aminoacyl-tRNA to the A site on the ribosome
 - the movement of the peptidyl-tRNA to the P site
86. A mechanism that can cause a gene to move from one linkage group to another is
- translocation
 - inversion
 - crossing over
 - duplication
87. How many ATP required for the conversion of one N_2 to $2NH_4^+$ during biological N_2 fixation?
- 8 ATP
 - 10 ATP
 - 12 ATP
 - 16 ATP
88. Which of the following is false about glyoxylate cycle?
- it is a variant of citric acid cycle
 - it results in the formation of succinate from acetyl-CoA
 - it occurs in glyoxisome
 - it occurs in all eukaryotic cells
89. Which of the following is *not* true about the human Y chromosome (in a male)?
- it is a single linear DNA molecule
 - its genes are known as holandric genes
 - it is packaged in nucleosomes
 - during mitosis, prior to metaphase, it contains only one chromatid
90. In an alpha helix, the amide carbonyl oxygen of an amino acid residue n is hydrogen-bonded to the amide hydrogen of residue $n + \underline{\hspace{1cm}}$?
- 2
 - 3
 - 4
 - 5
91. Antiparallel beta-sheets are often found at the surface of a protein, while parallel beta-sheet structures are found in the interior of proteins. From this information, one can infer that
- every third or fourth amino acid in an antiparallel beta sheet is charged
 - anti-parallel beta sheets are composed of hydrophilic amino acids only
 - parallel beta sheets are composed of hydrophilic amino acids
 - antiparallel beta sheets are composed of alternating hydrophobic and hydrophilic amino acids
92. Which process involves two transesterification reactions?
- splicing
 - RNA editing
 - capping
 - nuclear transport
93. Binding of antigen to IgG not involves
- electrostatic interactions
 - disulfide bonds
 - hydrogen bonds
 - van der Waals interactions
94. In *E. coli*, attenuation and antitermination utilize which structure?
- stem loop structures in RNA
 - stem loop structures in DNA
 - RNA/DNA hybrids
 - differential protein folding

95. Which of the following structural protein contains special aminoacid desmosine?
a. collagen
b. β -keratin
c. proteoglycan
d. elastin
96. The synthesis of ATP by chemiosmosis
a. is endergonic and is coupled to exergonic electron transport
b. is exergonic and is coupled to endergonic electron transport
c. is due to electrons shuttled down the ETC to the final electron acceptor, which is NAD^+
d. produces less ATP than the Krebs cycle and glycolysis combined
97. The enzyme alkaline phosphatase
a. joins double-stranded DNA fragments
b. adds a phosphate group to the 5'-end of DNA
c. cuts double-stranded DNA
d. removes a phosphate group from the 5'-end of DNA
98. If a chiasma forms between the loci of genes A and B in 20% of the tetrads of an individual of genotype AB/ab , the percentage of gametes expected to be Ab is
a. 40
b. 20
c. 10
d. 5
99. The chemical that causes an A-T base pair to replace a G-C base pair is
a. proflavin
b. acridine dye
c. ethylmethane sulfonate
d. ethidium bromide
100. According to classical genetics, which of the following statements is *true*?
a. recessive alleles are detected by the phenotype of the F_1 generation
b. the closer two genes are, the more frequently they recombine
c. genes on different autosomes segregate independently
d. genes on sex chromosomes segregate with the same pattern as autosomal genes
101. A plasmid that will express a eukaryotic protein X in *E. coli* it should contain:
P. origin of replication
Q. bacterial promoter
R. mammalian promoter
S. antibiotic-resistance gene
T. genomic sequence of gene X
U. cDNA sequence of gene X
a. P, Q, S and U
b. P, R, S and T
c. P, R, S and U
d. Q, R and T
102. Which phosphate of an ATP molecule is sufficient to be labeled if a kinase is used for labeling a double-stranded DNA molecule?
P. alpha-phosphate
Q. beta-phosphate
R. gamma-phosphate
a. P only
b. Q only
c. R only
d. P, Q and R

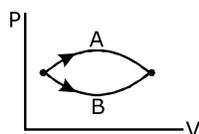
- c. protein X would localize to the mitochondria
d. protein Z would localize to the mitochondria
109. Gene X is known to be a cytosolic protein. A repressor of gene X expression is overexpressed in a cell line using recombinant DNA technology. After the overexpression, the cell line is observed to be susceptible to UV lights and higher mortality rates are observed upon even short exposures to the UV. What could be the function of the gene X related to?
- a. photosynthesis
b. DNA repair
c. DNA replication
d. X-chromosome assembly
110. Genetic mosaics have
- P. highly methylated chromosome
Q. an extra chromosome
R. an inactivated chromosome
S. nuclei containing Barr body
- a. Q only
b. R and S
c. Q and R
d. P, R and S



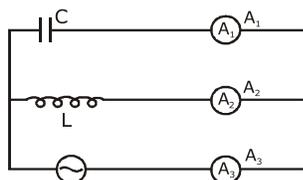
- a. Kolbe reaction
b. Wurtz reaction
c. Perkin reaction
d. Friedel Craft reaction
112. In which of the following species, all types of hybrid carbon atoms are present?
- a. CH₂-CH=CH-CH₂⁺
b. CH₂=C=CH₂
c. CH₃-C≡C-CH₂⁺
d. CH₃-CH=CH-CH₂⁻
113. The IUPAC name of compound  is
- a. 1,2,3-tricyanopropane
b. 3-cyanopentane-1,5-tricarbonitrile
c. propane-1,2,3-tricarbonitrile
d. 1,2,3-propanenitrile
114. Increasing pK_a values of o-, m- and p-nitro benzoic acid
- a. p < m < o
b. o < m < p
c. o < p < m
d. m < p < o
115. Which is most stable free radical
- a. 
b. 
c. 
d. 
116. Carbonation of alkyl magnesium halide followed by acidification gives
- a. a carboxylic acid
b. an alcohol
c. an anhydride
d. an aldehyde

117. Rate of the chemical reaction : $nA \longrightarrow$ products, is doubled when the concentration of A is increased four times. If the half time of the reaction at any temperature is 16 minute then time required for 75% of the reaction to complete is
- 24 minute
 - 27.3 minute
 - 48 minute
 - 49.4 minute
118. In which of the following resonance of $-NH_2$ is possible?
- p-toluidine
 - benzyl amine
 - 1-aminopropanone
 - ethyl amine
119. The phosphorus atom in the molecule PF_3 is in the state of hybridization
- sp^2
 - sp^3
 - p^3
 - dsp
120. The action of NH_3 on S_2Cl_2 produces a thermochromic crystalline compound, whose chemical formula is
- S_3N_3Cl
 - S_4N_3Cl
 - S_2N_2
 - S_4N_4
121. Find the emf of the following cell at $25^\circ C$? $H_2(1 \text{ atm}) | (0.5M) HCOOH || 1 M CH_3COOH | H_2(1 \text{ atm})$ the K_a for $HCOOH$ and CH_3COOH are 1.77×10^{-4} and 1.80×10^{-5} respectively.
- 0.0204 V
 - +0.0204 V
 - 0.09 V
 - +0.09 V
122. For the cell $Zn|Zn^{2+}(a_1) || Zn^{2+}(a_2)|Zn$, ΔG is negative if
- $a_1 = a_2$
 - $a_1 > a_2$
 - $a_2 > a_1$
 - $\frac{a_1}{a_2} = 1$
123. Match the compound of column X with oxidation state of column Y.
- | Column X | Column Y |
|-----------------------|-----------------------|
| P. $[Cr(H_2O)_6Cl_3]$ | 5 |
| Q. CrO_5 | 4 |
| R. K_3CrO_8 | 6 |
| S. $(NH_3)_3CrO_4$ | 3 |
| a. P-3, Q-6, R-5, S-4 | b. P-3, Q-4, R-5, S-6 |
| c. P-4, Q-5, R-6, S-3 | d. P-6, Q-5, R-4, S-3 |
124. An aqueous solution of 1M NaCl and 1M HCl is
- not a buffer but $pH < 7$
 - not a buffer but $pH > 7$
 - a buffer with $pH < 7$
 - a buffer with $pH > 7$
125. Geometrical isomerism is *not* shown by
- 1,1-dichloro-1-pentene
 - 1,2-dichloro-1-pentene
 - 1,3-dichloro-2-pentene
 - 1,4-dichloro-2-pentene
126. Number of atoms in the unit cell of Na (bcc type crystal) and Mg (fcc type crystal) are respectively
- 4, 4
 - 4, 2
 - 2, 4
 - 1, 1

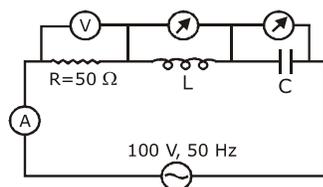
127. For the following reaction in gaseous phase $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2$; K_c/K_p is
- $(RT)^{1/2}$
 - $(RT)^{-1/2}$
 - RT
 - $(RT)^{-1}$
128. PCl_3 and PCl_5 both exist; NCl_3 exists but NCl_5 does not exist. It is due to
- lower electronegativity of P than N
 - lower tendency of N to form covalent bond
 - availability of vacant d-orbital in P but not in N
 - statement is itself incorrect
129. The orbital angular momentum of electron in 2s orbital is
- $h/2\pi$
 - 0
 - $2h/\pi$
 - $h/2\pi\sqrt{2}$
130. Which among the following is hydrolysed most easily?
- $\text{CH}_3\text{COOC}_2\text{H}_5$
 - CH_3CONH_2
 - CH_3COCl
 - $(\text{CH}_3\text{CO})_2\text{O}$
131. Figure shows two processes A and B on a system. Let ΔQ_1 and ΔQ_2 be the heat given to the system in processes A and B respectively. Then



- $\Delta Q_1 > \Delta Q_2$
 - $\Delta Q_1 = \Delta Q_2$
 - $\Delta Q_1 < \Delta Q_2$
 - $\Delta Q_1 \leq \Delta Q_2$
132. An inductor L, a capacitor C and ammeters A_1 , A_2 and A_3 are connected to an oscillator in the circuit as shown in the following figure. When the frequency of oscillator is increased, then at resonant frequency, the ammeter reading is zero in the case of

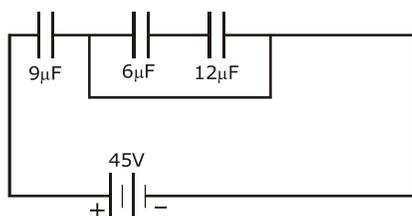


- ammeter A_1
 - ammeter A_2
 - ammeter A_3
 - all the three ammeters
133. In the R-L-C series circuit, the readings of voltmeter and ammeter are

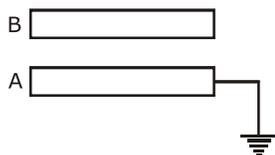


- $V = 100$ volt, $I = 2$ ampere
- $V = 100$ volt, $I = 5$ ampere
- $V = 1000$ volt, $I = 2$ ampere
- $V = 300$ volt, $I = 1$ ampere

134. The potential difference applied to an X-ray tube is 5kV and the current through it is 3.2 mA. Then the number of electrons striking the target per second is
- 2×10^{16}
 - 5×10^{16}
 - 1×10^{17}
 - 4×10^{15}
135. Two concave lenses L_1 and L_2 are kept in contact with each other. If the space between the two lenses is filled with a material of refractive index $\mu = 1$, the magnitude of the focal length of the combination
- becomes undefined
 - remains unchanged
 - increases
 - decreases
136. Three capacitors are connected across a 45 volt power supply as shown in the figure. What is the charge on the $6\mu\text{F}$ capacitor?



- $60 \mu\text{C}$
 - $90 \mu\text{C}$
 - $120 \mu\text{C}$
 - zero
137. In the following figure A and B are thin metallic sheets. A is earthed and B is given a +ve charge q . In equilibrium the outer surface of A will have a charge



- $q/2$
 - q
 - $-q/3$
 - zero
138. The work done by all the forces (external and internal) on a system equals the change in
- total energy
 - kinetic energy
 - potential energy
 - none of these
139. A capacitor is charged so as to have energy U . Then the capacitor is connected with an uncharged similar capacitor in parallel. The energy in each of the capacitors is
- $3U/2$
 - U
 - $U/4$
 - $U/2$
140. A charged particle moves with a speed v in a circular path of radius r around a long uniformly charged conductor. If the conductor has a charge per unit length λ , the particle has mass m and charge q ; then which one is *incorrect*?
- $v \propto \sqrt{q}$
 - $v \propto \sqrt{\lambda}$
 - $v \propto \sqrt{m}$
 - $v \propto \frac{1}{\sqrt{m}}$
141. When the current through a solenoid increases at a constant rate, the induced current
- is constant and in the direction of the inducing current
 - is constant and opposite to the direction of the inducing current

158. The value of $\frac{1 - \tan^2 15^\circ}{1 + \tan^2 15^\circ}$ is
- a. 1
b. $\sqrt{3}$
c. $\sqrt{3}/2$
d. 2
159. In a ΔABC , $\tan \frac{A}{2} = \frac{5}{6}$, $\tan \frac{C}{2} = \frac{2}{5}$, then
- a. a, c, b are in AP
b. a, b, c are in AP
c. b, a, c are in AP
d. a, b, c are in GP
160. The coefficient of x^5 in $(1 + 2x + 3x^2 + \dots)^{-3/2}$ is
- a. 21
b. 25
c. 26
d. none of these