

THE RANKERS ACADEMY

Sure shots Science Questions (Most Probable)

12th (STATE) session 2024-25

<u>Sure shots (1 Mark) Questions</u>	16. Choose the correct relation with reason.
1. A pair of adjacent coil has a mutual inductance of	(1) Isothermal curve slope = adiabatic curve slope
1.5 H. If the current at one coil changes from 0 to	(2) Isothermal curve slope = $\gamma \times$ adiabatic curve
20 A in 0.5 sec, what is the change of flux linked	slope
with the other coil?	(3) Adiabatic curve slope $- \chi \times isothermal curve$
with the other con :	slope
2. A particle executes S.H.M. of amplitude 3 cm. Its	(4) Adjabatic curve slope $-\frac{1}{2} \times isothermal curve$
acceleration at extreme position is 27 cm/s^2 .	(4) Adducte curve slope $=\frac{2}{2}$ × isothermal curve
Calculate its angular velocity	slope
Calculate its angular verserty.	
3 Draw the schematic symbol for NAND gate and	17. Why does a motorcyclist moving along a level
s. Draw the schematic symbol for training gate and	curve at high speed have to lean more than a cyclist
while its boolean expression.	moving along the same curve at low speed?
4. State dimensions of magnetic field.	18. In a common base connection, the emitter
	current is 6.28 mA and collector current is 6.20 mA
5. Define velocity gradient.	Determine the common base DC current gain
	Betermine the common base be current gam.
6. State Wien's displacement law.	10 A hadre of mass 0.5 ha nonformed SUM with
	19. A body of mass 0.5 kg performs SHM with
7 What is Isobaric process?	amplitude 3 cm and force constant 10 N/m. Find its
	total energy.
8 Define 'Radius of Gyration'	
o. Define Radius of Gyradion .	20. Define ionization energy of an electron in an
	atom.
9. A ray of light is incident on a water surface of	
refractive index $\frac{4}{2}$ making an angle of 40° with the	21. What is the relation between Tesla and Gauss?
surface. Find the angle of refraction	
surrace. I ma the angle of ferraction.	22. What is mean by Hydrostatic paradox?
10 What is the excess of pressure inside a soap	22. What is moun by Hydrostate paradox.
hubble of radius 2 am if the surface tension of the	23 Give an example of some familiar process in
bubble of fadius 5 cm if the sufface tension of the	23. One all example of some familiar process in
soap solution is 30 dyne/cm?	which heat is added to an object, without changing
	its temperature.
11. Which type of force is experienced by a moving	
charge in a magnetic field?	24. Where is the power dissipated in an alternating
	current circuit?
12. State the formula for magnetic potential energy.	
	25. An incompressible liquid is flowing through a
13. Write about the kinetic friction between the road	uniform cross-sectional tube with a velocity 12
and the tyres.	cm/s. If the thickness of liquid layer is 0.8 cm, what
	is the velocity gradient of that flow of liquid?
14. Spring constant is a dimensional constant	
Instify:	26 What is Brownian motion?
Jusury.	20. what is brownian motion?
15. What is absolute zono torrespondence?	27 Give the name of following symbol
15. what is absolute zero temperature?	27. Give the name of following symbol.
	Anode \sim \sim Cathode

28. What is the energy required to built up a current of 1A in an inductor of 20 mH?	45. Prove that for pipe closed at one end, the end correction is $e = \frac{n_2 l_2 - n_1 l_1}{n_1 - n_2}$.
29. A wave is represented by an equation $Y = A \sin (Bx + Ct)$. Given that the constants A, B and C are positive. Can you tell in which direction the wave is moving?	46. Calculate the de Broglie wavelength associated with an electron moving with a speed of 5×10^6 m/s. (m _e = 9.1×10^{-31} kg)
30. For a charged cylindrical conductor of cross- sectional radius R, what is the relation between the surface charge density and linear charge density?	47. Calculate the energy radiated in one minute by a black body of surface area 100 cm^2 when it is maintained at 227° C.
31. State the dimensions of magnetization.	48. A motor cyclist rides in a vertical hollow sphere of radius 5 m. Find minimum angular speed
32. State the formula for cyclotron frequency.	required so that it does not loose contact with the sphere at the highest point. $(g = 9.8 \text{ m/s}^2)$
33. State SI unit and dimensions of surface energy.	49. State Kirchhoff's current law in electric circuit.
34. A gas in a closed container is heated with 10 J	Also state their sign conventions.
of energy, causing the lid of the container to rise 2	
m with 3 N of force. What is the total change in	50. Obtain an expression for magnetic field at a
energy of the system?	distance r from straight conductor carrying current using Ampere's law.
35. What is Lorentz force?	
	51. Derive an expression for energy stored in a
36. State Curies law.	capacitor.
37. Two coils having self inductances $L_1 = 75$ mH and $L_2 = 55$ mH are coupled with each other. The	52. State zeroth law of thermodynamics. State its significance.
coefficient of coupling (K) is 0.75. Calculate the	53 Draw a neat labelled diagram of displacement
mutual inductance (M) of the two coils.	current in the space between the plates of the
38. Define peak value of alternating signal.	capacitor.
39. Define half life period.	54. Explain the term sphere of death.
40. What is a ripple ?	55. An infinite line charge produces a field of 9 \times 10 ⁴ N/C at a distance of 2 cm. Calculate the linear
Sure shots (2 Marks) Questions	charge density.
41. Draw a near labelled energy level diagram for	56 Compare rates of loss of heat by the body at
hydrogen atom.	temperature 527°C and 127°C. Temperature of
42. What are eddy currents? State any two	surrounding is 27°C.
applications of eddy currents.	57. Explain the process of corona discharge.
43 A drop of water of radius 8 mm breaks into	
number of droplets each of radius 1 mm. How many droplets will be formed?	58. Find the ratio of radius of 1 st Bohr orbit to that of 4 th Bohr orbit.
44. Find the reactance of a coil of inductance 100 mH at a frequency of 50 Hz.	59. A light bulb is rated 100 W for 220 V. If AC supply of 50 Hz, calculate the resistance of the bulb.

	72 Express the kinetic energy of a rotating body in
60. Two sound waves travel at a speed of 330 m/s.	terms of its angular momentum.
If their frequencies are also identical and are equal to 540 Hz, what will be the phase difference between the waves at points 3.5 m from one source and 3 m from the other if the sources are in phase?	73. Obtain an expression for orbital magnetic moment of an electron rotating about the nucleus in an atom.
61. Draw a neat labelled diagram of unpolarized light passing through two polarizers.	74. State the theories which were proposed to explain nature of light.
62. Prove that, equivalent S.I. unit of surface tension is J/m^2 .	75. Define the following terms:(i) Range of molecular attraction(ii) Sphere of influence
63. When an inflated ballon is suddenly burst, why is the emerging air slightly cooled?	76. Write a short note on isobar.
64. Why the ring jumps several metres in air in jumping ring experiment?	77. Define binding energy per nucleon. State its significance.
65. A pipe closed at one end can produce overtones at frequencies 640 Hz, 896 Hz and 1152 Hz.	78. What is the rotational analogue of Newton's second law of motion? Define angular momentum.
66. An alternating emf is applied to a series combination of an inductor and resistor ($\mathbf{R} = 100\Omega$).	79. What is a heat engine? Mention any two elements of heat engine.
If the impedance of the circuit is $100\sqrt{2}\Omega$; what is the phase difference between the emf and the current?	80. A current of 10 A passes through a coil having 5 turns and produces magnetic field at the centre of the coil having magnitude 0.5×10^{-4} T. Calculate diameter of the coil. ($\mu_0 = 4\pi \times 10^{-7}$ Wb/Am)
67. The velocities of five molecules are 2 m/s, 3 m/s, 4 m/s, 5 m/s and 6 m/s. Find the root mean square velocity of molecules.	81. A monoatomic gas at 27°C is adiabatically compressed to 80% of its initial volume. Find the final temperature of the gas.
68. Draw a neat labelled diagram of photo-current as a function of accelerating potential for fixed incident intensity but different incident frequencies	82. Draw a neat labelled schematic diagram of LED.
for the same emitter material.	83. A sonometer wire is subjected to a certain
69. State the factors on which magnetic coupling coefficient of two coils depends.	tension. If the tension is increased four times and the length of wire is reduced to half the original value, how is frequency of vibrations altered?
70. Four resistances 4Ω , 4Ω , 4Ω and 12Ω form a Wheatstone's network. Find the resistance which when connected across the 12Ω resistance will balance the network.	84. A capacitor of capacitance 0.5μ F is connected to a source of alternating emf of frequency 100 Hz. What is the capacitive reactance? ($\pi = 3.142$)
71. The wires which connect the battery of an automobile to its starting motor carry a current of 300 A (for a short time). What is the force per unit length between the wires if they are 70 cm long and 1.5 cm apart?	85. A steel blade floats on the surface of pure water, when detergent is added it sink, why? What is capillarity?

86. When two cells of emfs E_1 and E_2 are connected in series so as to assist each other, their balancing length on a potentiometer is found to be 2.7 m. When the cells are connected in series so as to oppose each other, the balancing length is found to be 0.3 m. Compare the emfs of the two cells.

87. State and define the SI unit of mutual inductance.

88. What is electric susceptibility of dielectric medium?

89. Distinguish between centripetal force and centrifugal force.

90. State and explain Newton's law of viscosity.

91. Explain, on the basis of kinetic theory, how the pressure of gas changes if its volume is reduced at constant temperature.

92. A steam engine delivers 4.8×10^5 J of work per minute and services 1.2×10^9 J of heat per minute from its boiler. What is the percentage efficiency of the engine ?

93. A proton is accelerated in a cyclotron in which the magnetic induction is 0.6 Wb/m². Find the cyclotron frequency. (Given: $m_p = 1.673 \times 10^{-27}$ kg, $e = 1.6 \times 10^{-19}$ C)

94. Two sound waves travel at a speed of 330 m/s. If their frequencies are also identical and are equal to 540 Hz, what will be the phase difference between the waves at points 3.5 m from one source and 3 m from other if the sources are in phase ?

95. 125 small liquid drops, each carrying a charge of 0.5 μ C and each of diameter 0.1 m form a bigger drop. Calculate the potential at the surface of the bigger drop.

96. Calculate the change in angular momentum of electron when it jumps from 3^{rd} orbit to 1^{st} orbit in hydrogen atom. (Take $h = 6.33 \times 10^{-34}$ Js)

97. Draw labelled circuit diagram of meter bridge to determine unknown resistance.

98. State Faraday's laws of electromagnetic induction.

99. Explain the theory of an AC circuit with resistor.

100. Define: (a) Threshold frequency(b) Work function

Sure shots (3 Marks) Questions

101. Derive an expression for the total emf induced in a conducting rotating rod.

102. Find the wavelength and wave number of the first member of the Balmer series in Hydrogen spectrum.

$$(\mathbf{R} = 1.097 \times 10^7 \text{ m}^{-1})$$

103. A rectangular coil of wire 50 turn each of area 6×10^{-4} m² is freely suspended in a field of 3×10^{-2} Wb/m². Calculate the current flowing through the coil when it deflects through 60°, when torsional constant is 3.82×10^{-6} SI unit.

104. Consider the cyclic process ABCA on a sample of 2.0 mol of an ideal gas as shown in following fig. The temperature of the gas at A and B are 300 K and 500 K respectively. A total of 1200 J heat is withdrawn from the sample in this process. Find the work done by the gas in part BC. (R = 8.3 J / mol K)



105. Define surface tension. Obtain the relation between surface tension and surface energy.

106. In a biprism experiment, the slit is illuminated by red light of wavelength 6400 A and the crosswire of eyepiece is adjusted to the centre of 3^{rd} bright band. By using blue light it is found that 4^{th} bright band is at the centre of the cross wire. Calculate the wavelength of blue light.

107. An electron in an atom is revolving around the nucleus in a circular orbit of radius 0.53 Å, with a speed of 2×10^6 m/s. Find the resultant orbital magnetic moment and angular momentum of electron.

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 $(e = 1.6 \times 10^{-19} \text{ C}, m = 9.1 \times 10^{-31} \text{ kg})$

108. With a neat circuit diagram, explain working of p-n junction diode as a half wave rectifier.	122. How is the magnetic field of a small current loop identical to that of a short magnetic dipole? Explain.
109. State and explain the principle of conservation of angular momentum.	123. What is potential gradient? State its SI unit and
110. Obtain an expression for average power dissipated in a pure resistive circuit.	potentiometer.
111. Describe construction and working of a photo cell with the help of neat diagram.	124. State and explain the limitations of first law of thermodynamics.
112. At what temperature will the rms velocity of a gas be four times its value at STP?	125. Explain the output characteristics of common emitter configuration of n-p-n transistor.
113. Find the radius of the wire of length 25 m needed to prepare a coil of resistance 25Ω . (Resistivity of material of wire is $3.142 \times 10^{-7} \Omega m$)	126. Find the ratio of the potential differences that must be applied across the parallel and series combination of two capacitors C_1 and C_2 in the ratio 1:2 such that the energy stored in the two cases is the same.
accelerates protons in a 1.7 T magnetic field. Calculate the kinetic energy (maximum) of protons when they leave the cyclotron.	127. The electron in the hydrogen atom is moving with a speed of 2.3×10^6 m/s in an orbit of radius 0.53Å.
115. A 25 watt lamp is connected to a.c. potential of peak value 100 V. Calculate the rms value of the current	electron.
116. Explain how nuclear size of an atom is estimated.	photoelectric effect is 1.7×10^{15} Hz. When light of frequency 2.2×10^{15} Hz is incident on the metal surface, the kinetic energy of the emitted photoelectrons is 3.3×10^{-19} J. Calculate Planck's
117. Find the angular acceleration of a particle in circular motion which slows down from 300 r.p.m.	constant.
to 0 r.p.m. in 20 s.	a beaker of mercury. The mercury level inside the
of oxygen and nitrogen at 127°C. Find the ratio of pressure in two tanks.	tube is found to be 0.536 cm below the level in the reservoir. Determine the angle of contact between the mercury and glass. (Given T = 0.485 N/m, $\mu = 13.6 \times 10^3 \text{ kg/m}^3$)
119. Prove that the inductance of parallel wires of (μ_0)	120 Two organ pines onen at both ands are
length <i>l</i> in the same circuit is given by $L = \left(\frac{p_0}{\pi}\right) \ln \left(\frac{d}{d}\right)$	sounded together and 5 beats are heard per second.
$\left(\frac{a}{a}\right)$ where $\left(\frac{a}{a}\right)$ is the radius of wire and d is separation between wire axes.	The length of shorter pipe is 0.25 m. Find the length of the other pipe. (Given: Velocity of sound in air =
120. Distinguish between streamline flow and	same for both pipes.) 350 m/s and end correction at one end = 0.015 m,
121 State the characteristics of a single slit	131. Explain how can a gas be expanded at constant temperature.
diffraction pattern.	132. Explain the term choke coil.

133. State limitations and advantages of cyclotron.	144. Derive an expression for the energy stored in a magnetic field.
134. Derive an expression for potential energy of a system of two point charges.	145. Describe Davission and Germer expertiment.
135. Assuming expressions for path difference between two light waves for bright bands and dark bands. Obtain an expression for the band width	146. What is a perfect black body? How can it be realized in practice?
136. A particle executing SHM has velocities v_1 and v_2 when it is at distance x_1 and x_2 from the centre of the path. Show that the time period is given by	147. What is the natural frequency of LC circuit? What is the reactance of this circuit at this frequency?
$T = 2\pi \sqrt{\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$	148. Explain construction and working of moving coil galvanometer (MCG) with a neat labelled diagram.
137. Distinguish between light emitting diode and photo-diode.	149. Derive an expression for excess pressure inside a liquid drop.
138. Draw a neat labelled diagrams of-(a) To determine unknown resistance using meter bridge.	150. Explain the mechanism of a refrigerator with the help of a schematic diagram.
(b) Kelvin's meter bridge circuit for the measurement of galvanometer resistance and(c) Internal resistance of a cell using potentiometer.	151. Show that all harmonics are present on a stretched string between two rigid supports.
139. A pipe open at both the ends has a fundamental frequency of 600 Hz. The first overtone of a pipe closed at one end has the same frequency of the first overtone of the open pipe. How long are the two pipes?	152. In a double-slit arrangement the slits are separated by a distance equal to 100 times the wavelength of the light passing through the slits.(i) What is the angular separation between the central maximum and an adjacent maximum.(ii) What is the distance between these maxima on a
140. A horizontal force of 1 N is required to move a metal plate of area 10^{-2} m ² with a velocity of 2 ×	screen 50 cm from the slits?
10^{-2} m/s, when it rests on a layer of oil 1.5×10^{-3} m thick. Find the coefficient of viscosity of coil.	153. Describe construction and working of a van de Graaff generator.
141. The half-life of ${}^{238}_{92}$ U undergoing α -decay is 4.5×10^9 years. What is the activity of 1g sample of ${}^{238}_{92}$ U?	154. Explain how a potentiometer is used to compare the emf of two cells by connecting the cells individually.
142. In a capacitor of capacitance 20μ F, the distance between the plates is 2 mm. If a dielectric slab of width 1 mm and dielectric constant 2 is inserted between the plates what is the new	155. State principle of moving coil galvanometer. Explain construction of moving coil galvanometer with a neat labelled diagram.
capacitance?	156. A magnetic needle placed in uniform magnetic field has magnetic moment of 2×10^{-2} Am ² and
143. A double-slit arrangement produces interference fringes for sodium light ($\lambda = 589$ nm) that are 0.20° apart. What will be the angular fringe separation if the entire arrangement is immersed in water, (n = 1.33)?	moment of inertia of 7.2×10^{-7} kg m ² . It performs 10 complete oscillations in 6 sec. What is the magnitude of the magnetic field ?

 174. Show that the average energy per molecule is proportional to the absolute teinperature T of the gas 2000 calories of radiant heat is incident on a body. If the body absorbs 550 calories of heat, find the coefficient of emission of the body. 175. (a) State the demerits of potentiometer. (b) Draw neat labelled diagram of potentiometer as voltage divider. A voltmeter has a range of 0–20 V and a resistance of 500Ω. Explain how can be it used to measure voltages from 0–200 volt? 176. State and prove principle of parallel axes. 	180. Obtain an expression for the workdone by a gas in an isothermal process. The molar specific heat of He at constant volume is 12.47 J/mol.K. Two moles of He are heated at constant pressure so that the rise in temperature is 10 K. Find the increase in internal energy of the gas. 181. Obtain an expression for angle of banking when a vehicle moves along a curved banked road neglecting friction. The radius of curvature of road is 60 m. If angle of banking is 27°, find maximum speed with which vehicle can turn along this curve, (g = 9.8 m/s ²)
 176. State and prove principle of paraflet axes. 177. Obtain an expression for orbital magnetic moment of an electron rotating about the nucleus in an atom. 178. State the laws of simple pendulum. The speeds of a particle performing linear SHM are 8 units and 6 units at respective displacements of 6 cm and 8 cm. Find its period and amplitude. 179. Explain the primary and secondary sources of light with examples. What is the resolving power of telescope if the diameter of the objective of the telescope is 1.22 m and the wavelength of light is 5000 Å? 	182. State and explain Stefan's law of radiation. Energy is emitted from a hole in an electric furnace at the rate of 20 W, when the temperature of the hole is 727°C. What is the area of the hole? ($\sigma = 5.7 \times 10^{-8} \text{ J/Wm}^2 \text{ K}^4$) 183. Obtain the differential equation of linear simple harmonic motion. At what distance from the mean position is the speed of a particle performing SHM half its maximum speed. (Given: Path length of SHM = 10 cm) 184. Derive conditions for occurrence of dark and bright fringes on screen in Young's double slit interference experiment. Also determine fringe width.
THE RA	185. Show that the work done in pulling a loop through the magnetic field appears as heat energy in the loop.
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