Model Question (NEB)

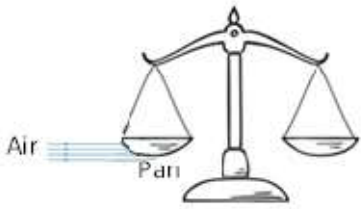
Grade: XII Subject: Physics (102)

Full marks: 75 (11 marks Obj+ 64 marks Sub) **Time: 3 Hours**

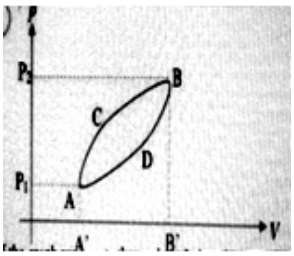
Group A: Multiple Choice Questions (11×1 = 11) Time 25 Minutes

Tick the correct answer.

1. Which of the following is a correct formula for calculating radius of gyration of a rotating object?
   A) k2= I/m B) k= I/m C) k= m/I D) k = (I/m)2
2. A horizontal stream of air is blown under one of the pans of a beam balance as shown in the figure. What will be the effect of this on the pan?
   A) goes up. B) goes down
   C) remains unaffected D) rotates

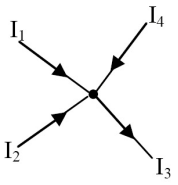


3. What will be the height of a capillary on the surface of the Moon if it is „*h*“ on Earth?
   A) *h* B) *h*/6 C) 6*h* D) zero
4. What is the coefficient of performance of an ideal refrigerator working between ice point and room temperature (27oC)?
   A) 0 B) 0.1 C) 1 D) 10
5. A thermodynamic system is taken from A to B via C and then returned to A via D as shown in the p-V diagram.
   The area of which segment of the graph represents the total work done by the system?

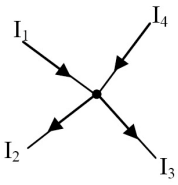


   A) P1ACBP2P1 B) ACBB‟A‟A C) ACBDA
   D) ADBB‟A‟A
6. Which one of the following directly affects the quality of sound?
   A) shape of the source B) frequency C) intensity
   D) wave form

7. A diffraction pattern is obtained using a beam of red light. What will be the effect on the diffraction pattern if the red light is replaced with white light?
   A) All bright fringes become white.
   B) All bright fringes, except the central one, become white.
   C) All bright fringes become colourful.
   D) All bright fringes, except the central one, become colourful.
8. In which one of the following diagrams the currents are related by the equation I1 - I 2 = I 3 - I 4?



A)



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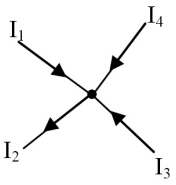
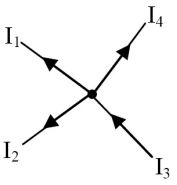


C)



D)

9. A coil having N turns and cross-section area A carries current *I*. Which physical quantity does the product *NIA* represent?
   A) magnetic flux of the coil B) magnetic flux density of the coil
   C) magnetic moment of the coil D) magnetic susceptibility of the coil

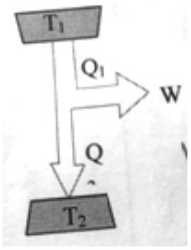
10. What happens to the neutral temperature if the cold junction of a thermocouple is decreased?
A) increases B) decreases
C) remains the same D) approaches inversion temperature
11. What is the point where the seismic waves start called?
A) epicentre B) hypocentre C) metacentre D) seismic centre

Attempt all the questions.

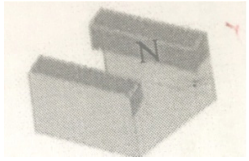
Group B: Short Answer Questions (8×5 = 40)

1. (i) Define „surface tension". [1]
(ii) Establish a relation between surface tension and surface energy of a liquid. [2]
(iii) Two spherical rain drops of equal size are falling vertically through air with a certain terminal velocity. If these two drops were to coalesce to form a single drop and fall with a new terminal velocity, explain how the terminal velocity of the new drop compares to the original terminal velocity. [2]
2. Angular speed of a rotating body is inversely proportional to its moment of inertia.
(i) Define „moment of inertia". [1]
(ii) Explain why angular velocity of the Earth increases when it comes closer to the Sun in its orbit. [2]
(iii) If the Earth were to shrink suddenly, what would happened to the length of the day? Give reason. [2]
Or
(i) State Bernoulli principle. [1]
(ii) Derive Bernoulli"s equation. [2]
(iii) You can squirt water from a garden hose a considerably greater distance by partially covering the opening with your thumb. Explain how this works. [2]
3. (i) Define „harmonics" in music. [1]
(ii) Calculate the frequency of a monotonous sound produced by a 30 cm long flute open at both ends and being played in the first harmonic. [Velocity of sound in air= 330 ms-1] [2]
(iii) The flute mentioned in question (ii) was being played by a passenger on a stationary bus. The bus then moves uniformly. Explain what change in the pitch of the flute sound, if any, a person sitting on a bench at the bus park will feel when the bus starts moving. [2]
4. (i) State the second law of thermodynamics. [1]
(ii) A refrigerator transfers heat from a cold body to hot body. Does this not violate the second law of thermodynamics? Give reason. [2]
(iii) In the given figure, a heat engine absorbs $Q1$ amount of heat from a source at temperature $T1$ and rejects $Q2$ amount of heat to a sink at temperature $T2$ doing some external work W.

(a) Obtain an expression for the efficiency of this heat engine. [1]
(b) Under what condition does the efficiency of such engine become zero percentage, if at all? [1]



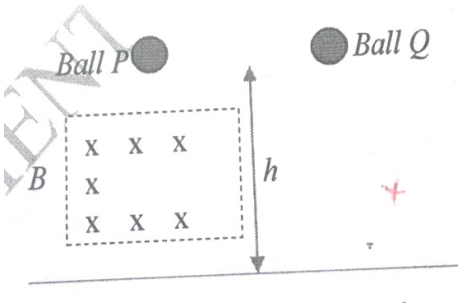
5. A student wants to measure the magnetic flux density between the poles of two weak bar magnets mounted on a steel yoke as shown in the figure. The magnitude of the flux density is between 0.02T and 0.04T.



(i) Define Magnetic flux density. [1]
(ii) One way of measuring the magnetic flux density could be the use of a Hall probe.
Suggest one reason why Hall probe is not a suitable instrument to measure the magnetic flux density for the arrangement shown in the above figure. [1]
(iii) Another method of measuring the magnetic flux density for the arrangement shown in the above figure is to insert a current-carrying wire between the poles of the magnet. Explain how

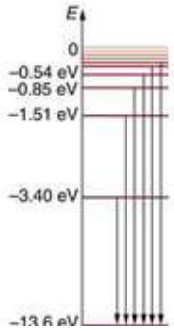
the magnetic flux density can be determined using this method. You are allowed to use any additional apparatus. [3]

6. (a) Law of electromagnetic induction can be expressed mathematically as .
(b) (i) State what the symbols and [2]
(ii) Explain the significance of the negative sign. [1]
(ii) Two identical copper balls are dropped from the same height as shown in the figure. Ball P passes through a region of uniform horizontal magnetic filed of flux density *B*.
Explain why ball P takes longer than ball Q to reach the ground. [2]



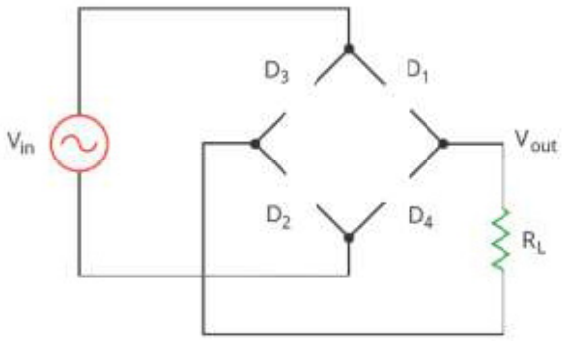
7. Ultraviolet radiation of frequency 1.5 × 1015Hz is incident on the surface of an aluminium plate whose work function is 6.6×10-19J.
(i) Show that the maximum speed of the electrons emitted from the surface of the aluminium is 8.6 × 105ms–1. [3]
(ii) State and explain what change, if any, occurs to the maximum speed of the emitted electrons when the intensity of the ultraviolet radiation is increased. [2]

8. (i) State Bohr"s postulates of atomic model. [3]
(ii) The figure shows Lymen series of energy transmission in hydrogen atom.
Calculate the frequency of a photon emitted by an electron jumping from the second excited state to the ground level. [2]



Or
(i) Sketch the symbol of a p-n junction diode and indicate the polarity of its ends. [1]

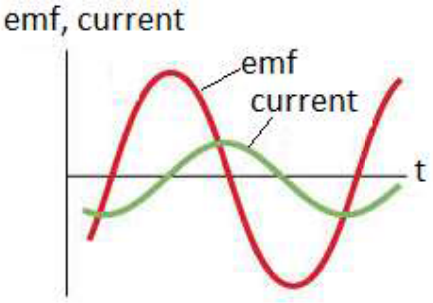
(ii) Copy the outline of a diode bridge rectifier and complete it by adding diodes in the gaps. [2]



(iii) Explain what will happen if one of the four diodes is damaged so that it stops conducting totally in any direction. Sketch a graph to show how the pd across the Load RL would vary with time in this situation. [2]

Section C: Long Answer Questions. (3 × 8 = 24)

9. Earthquake sets rocks and buildings in motion. When a rock is subjected to compression, a restoring force develops inside it. This restoring force is given by an equation F= -Ax where x is displacement and A is a constant.
(i) Prove that this force will make the rock vibrate with simple harmonic motion. [2]
(ii) Show that the speed of an object undergoing simple harmonic motion is given by the expression v = ±ω√(A2-x2) where the symbols carry standard meanings. [2]
(iii) Calculate the maximum speed of a building shaken by S-waves of 21Hz and amplitude 0.05m. [2]
(v) Explain why tall buildings are more susceptible to damage by S-waves which generally have low frequency. [2]



10. The figure below shows the variation of emf and current with time in a typical LRC circuit.
(i) Explain whether the phase constant is postive or negative. [2]

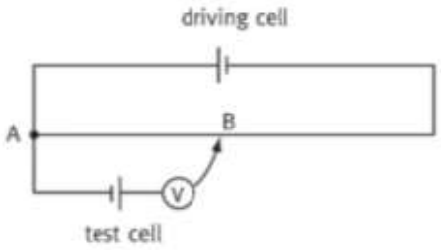
(ii) Sketch a phasor diagram for the given case. [2]

(iii) Is the circuit more inductive or capacitive? Explain. [2]

(iv) To increse the rate at which energy is transferred to the resistive load, should the inductance be increased or decreased? Justify your answer. [2]

Or

A student sets up a circuit as shown in the figure given below to measure the emf of a test cell.



(a) Explain why he is unable to find a balance point and state the change he must make in order to achieve the balance. [2]

(b) State how he would recognize the balance point. [1]

(c) He obtained the balance point for distance 37.5cm using standard cell of emf 1.50V. And for the test cell, the balance distance AB was 25.0 cm. Calculate the emf of the test cell. [2]

(d) He could have used an ordinary voltmeter to measure the emf of the test cell directly. The student, however, argues that the above instrument is more precise than an ordinary voltmeter. Justify his logic. [2]

11. (a) Explain what is meant by quantization of charge. [2]

(b) In a Millikan‟s oil drop experiment, an oil drop of weight 1.5 x 10- 14N is held stationary between plates 10mm apart by applying a p.d. of 470V between the plates.