PHYSICS

1. Two pendulums with natural frequencies f_1 and f_2 are released in phase at the same instant of time. After what time interval will they come in phase again?

   A. $\frac{1}{f_1}$-$\frac{1}{f_2}$
   B. $\frac{1}{f_1}+\frac{1}{f_2}$
   C. $\frac{1}{f_1 f_2}$
   D. LCM of $\frac{1}{f_1}$ and $\frac{1}{f_2}$

2. A physics student carries out an experiment – he fills a small tub with water and places a wooden vessel with a block of ice in it. He marks the level of water in the tub after he has placed the vessel, which floats on water. Let this level be given by L_1. Now he picks up the ice and drops it into the water. He the marks the level of water as L_2. He then waits for the ice to melt, the water to come to room temperature and again marks the level as L_3. Which of the following is correct :

   A. $L_1 > L_2 > L_3$
   B. $L_1 < L_2 < L_3$
   C. $L_1 = L_2 = L_3$
   D. $L_1 > L_2 = L_3$

3. On a full moon day, the moon rises exactly when the sun sets, say 6 p.m. in the month of June. At what time will the moon rise on the very next day ?

   A. 12/14 hours after 6 p.m.
   B. 14/12 hours after 6 p.m.
   C. 14/12 hours before 6 p.m.
   D. At 6 p.m.

4. In Young's double slit experiment, the distance between the two slits is 0.1 mm, the distance between the slits and the screen is 1 m and the wavelength of the light used is 600 nm. The intensity at a point on the screen is 75 % of the maximum intensity. What is the smallest distance of this point from the central fringe ?

   A. 1 mm
   B. 2 mm
   C. 0.5 mm
   D. 1.5 mm

5. Two identical bodies are made from a material whose specific heat C(T) increases monotonically with temperature. The bodies are initially kept at 300 K and 400 K respectively. They are then brought in contact with each other. Assuming no heat loss to the surroundings, the final common temperature attained by the bodies is :

   A. 350 K
   B. more than 350 K
   C. less than 350 K
   D. Cannot be decided from the information provided

6. A primary rainbow is formed when sunlight gets internally reflected once from the inner surface of a water drop, whereas a secondary rainbow is formed when light gets internally reflected twice from the inner surface of a water drop. Which of the following statements is correct.

   A. The observer sees a primary rainbow with red colour at the top and violet at the bottom
   B. The observer sees a secondary rainbow with red colour on top and violet at the bottom
   C. For both primary and secondary rainbows the red colour is on top and violet is at the bottom
   D. For both primary and secondary rainbows violet colour is on top and red at the bottom

7. The dimension of the permeability μ_0 (in the S. I. system) is (C is the dimension of charge) :

   A. MLC^{-2}
   B. $ML^{-1}C^{-2}$
   C. $ML^{-1}T^{-1}C^{-1}$
   D. $ML^{-1}T^{-1}C^{-2}$

8. Astronomers have concluded that the universe is expanding. They came to this conclusion by observing that :

   A. Light arriving from different parts of the universe are uniformly red shifted.
   B. Light arriving at the telescope from galaxies closer to the earth get more blue shifted than from the more distant ones.
   C. Light arriving at the telescope from points nearer to the earth are more red shifted than from the more distant ones.
   D. Light arriving at the telescope from points farther away from the earth are more red-shifted than from the nearer ones.

9. At time $t = 0$, a container has N_0 radioactive nuclei of element X which undergo fission. The number of X nuclei undergoing decay per second is proportional to the number of X nuclei present in the container with a proportionality constant of λ. In addition c X nuclei are being added to the container per second. How many X nuclei are there after time $t = T$ seconds.

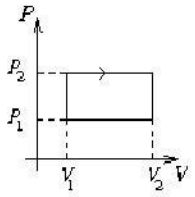
   A. $\frac{c}{\lambda}\exp(-\lambda T) - N_0\exp(-\lambda T)$

   B. $\frac{c}{\lambda}\exp(-\lambda T) + N_0\exp(\lambda T)$

   C. $\frac{c}{\lambda}(1 - \exp(-\lambda T)) + N_0\exp(-\lambda T)$

   D. $\frac{c}{\lambda}(1 + \exp(-\lambda T)) + N_0\exp(-\lambda T)$

10. One mole of a van der Waal's gas obeying the equation of state $(P + \frac{a}{V^2})(V - b) = RT$ undergoes a cyclic quasi-static process that is represented by a rectangle on a PV diagram. The work done by the gas in this process is given by:



   A. $(P_2 - P_1)(V_1 - V_2)$

   B. $(P_2 - P_1)(V_2 - V_1)$

   C. $\left(P_2 - P_1 + a\left[\frac{1}{V_2^2} - \frac{1}{V_1^2}\right]\right)(V_2 - V_1)$

   D. $\left(P_2 - P_1 - a\left[\frac{1}{V_2^2} - \frac{1}{V_1^2}\right]\right)(V_2 - V_1)$