JEE-ADVANCED-2013-P1-Model

Time:09:00 A.M to 12:00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 11 – 15)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 16 – 20)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 31 – 35)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 36 – 40)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Single Correct Choice	2	0	10	20
Sec – II(Q.N : 51 – 55)	Questions with Multiple Correct Choice	4	-1	5	20
Sec – III(Q.N : 56 – 60)	Questions with Integer Answer Type	4	-1	5	20
Total				**20**	**60**

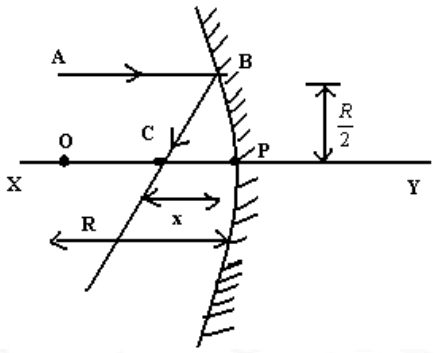
PHYSICS: Max.Marks : 60

SECTION I

Single Correct Answer Type

This section contains **10 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. A light ray (AB) incident parallel to principal axis (XY) at a distance of R/2 (R is radius of curvature of the concave mirror) from principal axis as shown. BCD is the reflected ray which intersects principal axis at C. The value of x, if O be centre of curvature and P is the pole of the mirror, is

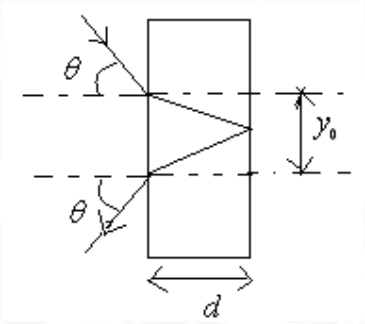


A) $\frac{R}{2}$ B) $\frac{3R}{8}$ C) $R\left(1-\frac{1}{\sqrt{3}}\right)$ D) $\frac{R}{\sqrt{3}}$

2. In a certain polytropic process the volume of Argon (ideal gas) was increased to 4 times. Simultaneous the pressure is decreased to 8 times. The molar heat capacity of the gas for this process will be

A) $\frac{-R}{2}$ B) $\frac{-3R}{2}$ C) $-2R$ D) $\frac{-2R}{3}$

3. A ray of light incident from air on a glass plate of refractive index n is partly reflected and partly refracted at the two surfaces of the glass. The displacement y_0 in the figure is



A) $\frac{2d\sin\theta}{\sqrt{n^2-\sin^2\theta}}$ B) $\frac{2d\sin\theta}{\sqrt{\sin^2\theta-\frac{1}{n^2}}}$

C) $\frac{2d\sqrt{n^2-\sin^2\theta}}{\sin\theta}$ D) $\frac{2d\sin\theta}{n}$

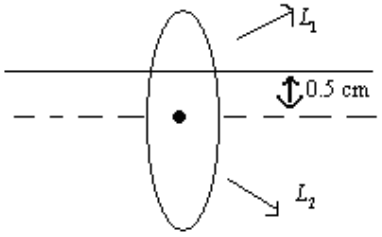
4. The maximum attainable temperature of an ideal gas of 'n' moles in a process in which the pressure P is related to its volume V as $P=P_0\,e^{-\alpha V}$ (P_0 *and* α are positive constants of appropriate dimensions) will be

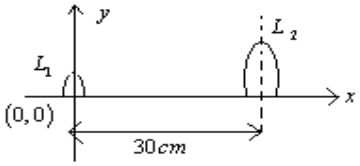
A) $nP_0/(\alpha R)$ B) $P_0/(n\alpha R)$ C) $P_0/(ne\alpha R)$ D) $P_0e/(n\alpha R)$

5. In a YDSE arrangement the separation between screen and slits is 12m, while the separation between the slits is 2mm and wavelength of light used is 5000 Å. Intensity due to each slit is $1\ \frac{w}{m^2}$. A point 'P' is located above the central maxima at a distance equal to the wavelength. If the slits are separating at a rate of 1 m/s, the rate at which intensity at P is changing is 10^{-12} times

A) $-\frac{\pi}{18} w/m^2 s$ B) $\frac{\pi}{18} w/m^2 s$ C) $\frac{\pi}{6} w/m^2 s$ D) $\frac{-\pi}{6} w/m^2 s$

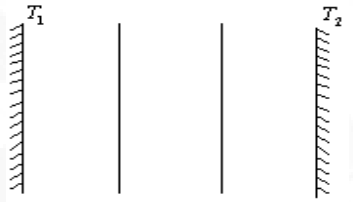
6. A thin convex lens of focal length 50 cm is cut into two pieces 0.5cm above the principal axis as shown. The parts are now placed on the x – axis. The co-ordinates of the image of an object placed at (-100, 0)





A) $\left(\frac{355}{6}, \frac{-1}{8}\right)$ B) $\left(\frac{175}{6}, \frac{-1}{8}\right)$ C) $\left(\frac{175}{6}, \frac{-5}{8}\right)$ D) $\left(\frac{355}{6}, \frac{-5}{8}\right)$

7. Two large black plane surfaces are maintained at constant temperatures T_1 and $T_2(T_1 > T_2)$. Two thin black plates are placed between the two surfaces and in parallel to these. After some time, steady conditions are obtained. By what factor (η) is the steady heat flow reduced due to the presence of black plates?



A) $\eta = \frac{1}{2}$ B) $\eta = \frac{1}{3}$ C) $\eta = 1$ D) $\eta = \frac{1}{4}$

8. A liquid having co-efficient of cubical expansion 'γ' is filled in the container fully having co-efficient of linear expansion as α. On heating, the liquid overflows. Then which of the following relations is correct?

A) $\gamma = 2\alpha$ B) $\gamma = 3\alpha$ C) $\gamma > 3\alpha$ D) $\gamma = 3\alpha$

9. A mass of liquid with volume V_1 completely turns into a gas of volume V_2 at a constant pressure P and temperature T. The heat of vaporization is L for the given mass. Then the change in the internal energy of the system is

A) $PV_2 - PV_1$ B) $L - PV_2 + PV_1$

C) Zero D) $L + PV_2 - PV_1$

10. In Young's Double Slit Experiment, the wavelength of red light is 7800 A^0 and that of blue light is $5200A^0$. The value of n for which n^{th} bright band due to red light coincides with $(n+1)^{th}$ bright band due to blue light, is :

A) 2 B) 4 C) 6 D) 3

SECTION II

Multiple Correct Answer(s) Type

This section contains **5 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct.**

11. A circular hole is made in a plate kept over a smooth horizontal surface.. The plate is now heated. Which of the following statements is/are correct?

A) radius of the hole may decrease

B) tensile stress is developed in the material of plate

C) volume of the plate material will increase

D) compressive stress is developed in the material of plate

12. When the temperature of a copper coin is raised by 80 ^{0}C, its diameter increases by 0.2%,

A) percentage rise in the area of a face is 0.4%

B) percentage rise in the thickness is 0.4%

C) percentage rise in the volume is 0.6%

D) coefficient of linear expansion of copper is 0.25 x 10^{-4} / ^{0}C .

13. A monatomic & a diatomic gas both at the N.T.P. having same no. of moles are compressed adiabatically to half of initial volume.

A) Increase in temp, will be more for the diatomic gas

B) Increase in temp, will be more for the monatomic gas

C) Increase in temp, will be some for the both gases.

D) Increase in pressure will before for the monatomic gas

14. A thin biconvex lens is prepared from glass of refractive index $\mu_2 = \frac{3}{2}$. The two convex surfaces have equal radii of 20 cm each. One of the surfaces is silvered from outside to make it reflecting. The lens now is placed in a large medium of refractive index $\mu_1 = 5/3$. It acts as a

A) Converging mirror
B) Diverging mirror
C) Concave mirror of focal length 12.5 cm
D) Convex mirror of focal length 12.5cm

15. Choose the correct statement(s):

A) In a reversible adiabatic expansion, the product of pressure and volume decrease.

B) The rms translational speed for all ideal gases at the same temperature is not the same but it depends on the molecular mass.

C) If temperature of an ideal gas is doubled from $100°C$ to $200°C$, the average kinetic energy of each particle is also doubled.

D) The magnitude of momentum of a Helium atom in a sample of Helium gas at 200K will be less than the magnitude of momentum of a Hydrogen molecule in a sample of Hydrogen gas at 400K

SECTION III
Integer Answer Type

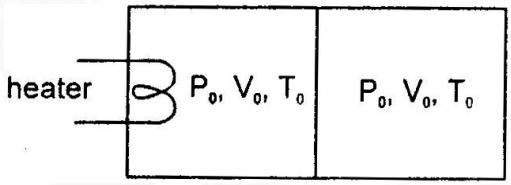
This section contains **5 questions.** The answer to each question is single digit integer, ranging from 0 to 9 (*both inclusive*).

16. A central portion with width of d = 0.5 mm is removed from a convergent lens having a focal length f = 10 cm. An ideal slit source is placed at a distance a = 5cm from it. The slit is illuminated by monochromatic light of wavelength $\lambda = 5000A^0$. The distance where a screen should be placed on the opposite side of lens to observe three interference bands is 'd' [in cm] Find the value of d/3.

17. A steel wire is rigidly fixed at both ends. Its length, mass and cross sectional area are 1m, 0,1kg and $10^{-6}\,m^2$ respectively. Then the temperature of the wire is lowered by 20 ^{0}C. If the transverse waves are setup by plucking the wire at 0.25m from one end and assuming that wire vibrates with minimum number of loops possible for such a case. Find n if the frequency of vibration is 15+n hertz. [coefficient of linear expansion of steel = 1.21 x 10^{-5} / ^{0}C and Young's modulus = 2 x 10^{11} N/m^2].

18. The sum of lengths of an aluminium and steel rod at 0 ^{0}C is n/4 m, so that at all temperatures their difference in length is 0.25m. (take coefficient of linear expansion for aluminium and steel at 0^{0}C as 22 x 10^{-6} / ^{0}C and 11 x 10^{-6} / ^{0}C respectively.)find n

19. A non-conducting, movable piston separates a non-conducting container in two equal part each of volume V_0. A diatomic gas is filled in the left part and a monatomic gas is filled in the right part of the container. Initially both the gas have temperature T_0 and pressure P_0. Now the gas on the left is heated slowly until the gas on the right is compressed to volume $\frac{V_0}{8}$.



If total heat given by the heater is(150+n)P_0 V_0, find n

20. A point object is placed in air at a distance d from the pole of a refracting convex surface on its principal axis & at t = 0 it starts moving with speed c perpendicular to its principle axis as shown figure. The radius of the convex surface is d. The ratio of speed of image to speed of object at t = 0 i0073