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JEE Main 2020

Errors in JEE-Main

Memory-Based Questions

Error's in JEE-Main (Jan.2020)

Physics

7th Jan. (1st Shift)

Q. A beam of electromagnetic radiation of intensity 6.4×10^{-5} W/cm^2 is comprised of wavelength, $\lambda = 310$ nm. It falls normally on a metal (work function $\varphi = 2eV$) of surface area of 1 cm^2. If one in 10^3 photons ejects an electron total number of electrons ejected in 1 s is 10^x (hc = 1240 eVnm, 1eV = 1.6×10^{-19} J), then x is _____

7th Jan. (2nd Shift)

Q. Under an adiabatic process, the volume of an ideal gas gets doubled. Consequently the mean collision time between the gas molecule changes from τ_1 to τ_2. If $\frac{C_p}{C_v} = \gamma$ for this gas then a good estimate for $\frac{\tau_2}{\tau_1}$ is given by:

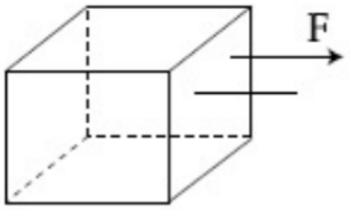
A. $\left(\frac{1}{2}\right)^{\gamma}$ B. $\frac{1}{2}$

C. $\left(\frac{1}{2}\right)^{\frac{\gamma+1}{2}}$ D. 2

Q. An emf of 20 V is applied at time t = 0 to a circuit containing in series 10 mH inductor and 5 Ω resistor. The ratio of the currents at time $t = \infty$ and at t = 40 s is close to:
(Take $e^2 = 7.389$)

A. 1.06 B. 1.15

C. 1.46 D. 0.84



Q. Consider a uniform cubical box of side a on a rough floor that is to be moved by applying minimum possible force F at a point b above its centre of mass (see figure). If the coefficient of friction is μ=0.4, the maximum possible value of $100\times\frac{b}{a}$ for box not to topple before moving is _____ .

8th Jan. (1st Shift)

Q. **14.** The dimension of stopping potential V_0 in photoelectric effect in units of Planck's constant 'h', speed of light 'c' and Gravitational constant 'G' and ampere A is:

A. $h^2G^{3/2}c^{1/3}A^{-1}$ B. $h^1G^{3/2}c^{1/3}A^{-1}$

C. $h^2G^{5/3}c^{1/3}A^{-1}$ D. $h^{-2/3}c^{-1/3}G^{4/3}A^{-1}$

Q. **21.** A body A, mass m = 0.1 kg has an initial velocity of $2\hat{i}\ ms^{-1}$. It collides elastically with another body, B of the same mass which has an initial velocity of $5\hat{i}\ ms^{-1}$. After collision, A moves with a velocity $\vec{v}=\left(\hat{i}+\hat{j}\right)$. The energy of B after collision is written as $\frac{x}{10}$J. The value of x is_____.

Q. **24.** A particle is moving along the x-axis with its coordinates with time 't' given by $x(t) = 10 + 8t - 3t^2$. Another particle is moving along the y-axis with its coordinate as a function of time given by $y(t) - 5 - 8t^3$. At t = 1 s, the speed of the second particle as measured in the frame of the first particle is given as $\sqrt{v}$. Then v (in m/s) is_____.

Q. **23.** A one metre long (both ends open) organ pipe is kept in a gas that has double the density of air at STP. Assuming the speed of sound in air at STP is 300 m/s, the frequency difference between the fundamental and second harmonic of this pipe is_____Hz.

8th Jan. (1st Shift)

Q. A simple pendulum is being used to determine the value of gravitational acceleration g ata certain place. The length of the pendulum is 25.0 cm and a stop watch with 1 s resolution measures the time taken for 40 oscillations to be 50 s. The accuracy in g is:

A. 4.40% B. 3.40%

C. 5.40% D. 2.40%

9th Jan. (1st Shift)

Q. Radiation, with wavelength 6561 Å falls on a metal surface to produce photoelectrons. The electrons are made to enter a uniform magnetic field of 3×10^{-4}T. If the radius of the largest circular path followed by the electrons is 10 mm, the work function of the metal is cod is:

A. 1.1 eV B. 1.8 eV C. 1.6 eV D. 0.8 eV

Ans. D

9th Jan. (2nd Shift)

Q. Two gases-argon (atomic radius 0.07 nm, atomic weight 40) and xenon (atomic radius 0.1 nm, atomic weight 140) have the same number density and are at the same temperature. The ratio of their respective mean free times is closest to:

A. 2.3 B. 3.67

C. 4.67 D. 1.83

Q. For the four sets of three measured physical quantities as given below. Which of the following options is correct?

(i) $A_1 = 24.36, B_1 = 0.0724, C_1 = 256.2$

(ii) $A_2 = 24.44, B_2 = 16.082, C_2 = 240.2$

(iii) $A_3 = 25.2, B_3 = 19.2812, C_3 = 236.183$

(iv) $A_4 = 25, B_4 = 236.191, C_4 = 19.5$

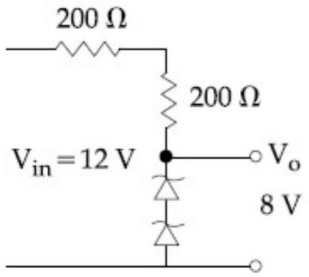
A. $\begin{matrix} A_4+B_4+C_4 & < & A_1+B_1+C_1 & = \\ A_2+B_2+C_2 & = & A_3+B_3+C_3 & \end{matrix}$

B. $\begin{matrix} A_1+B_1+C_1 & < & A_3+B_3+C_3 & < \\ A_2+B_2+C_2 & < & A_4+B_4+C_4 & \end{matrix}$

C. $\begin{matrix} A_1+B_1+C_1 & = & A_2+B_2+C_2 & = \\ A_3+B_3+C_3 & = & A_4+B_4+C_4 & \end{matrix}$

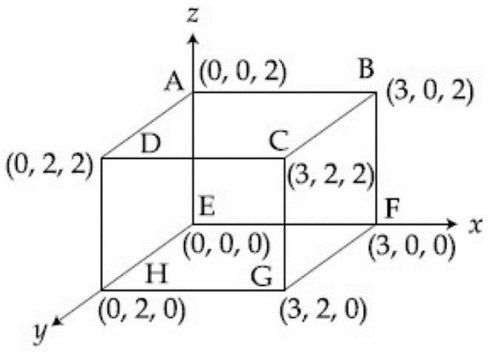
D. $\begin{matrix} A_4+B_4+C_4 & < & A_1+B_1+C_1 & < \\ A_3+B_3+C_3 & < & A_2+B_2+C_2 & \end{matrix}$

Q. The circuit shown below is working as a 8 V dc regulated voltage source. When 12 V is used as input, the power dissipated (in mW) in each diode is; (considering both zener diodes are identical) _____.



Q. Starting at temperature 300 K, one mole of an ideal diatomic gas ($\gamma = 1.4$) is first compressed adiabatically from volume V_1 to $V_2 = \frac{V_1}{16}$. It is then allowed to expand isobarically to volume $2V_2$. If all the process are the quasi-static then the final temperature of the gas (in °K) is (to the nearest integer) _____.

Q. An electric field $\vec{E} = 4x\hat{i} - \left(y^2 + 1\right)\hat{j}$ N/C passes through the box shown in figure. The flux of the electric field through surfaces ABCD and BCGF are marked as ϕ_I and ϕ_{II} respectively. The difference between $\left(\phi_I - \phi_{II}\right)$ is (in Nm^2/C)_____.



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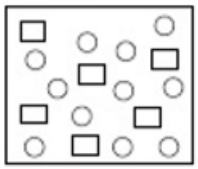
Chemistry

Q. In the figure shown below reactant A (represented by square) is in equilibrium with product B (represented by circle). The equilibrium constant is



A. 4 B. 1
C. 2 D. 8

Ans. A

Q. The sum of the total number of bonds between chromium and oxygen atoms in chromate and dichromate ions is_____

Ans. 12

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Maths

7 Jan.2020 (First -Shift)

Q. A vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}\left(\alpha, \beta \in R\right)$ lies in the plane of the vectors $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then

A. $\vec{a}.\hat{i} + 1 = 0$ B. $\vec{a}.\hat{i} + 3 = 0$

C. $\vec{a}.\hat{k}+4=0$ D. $\vec{a}.\hat{k}+2=0$

Ans. D

Sol:

$\vec{a}=\lambda\left(\hat{b}+\hat{c}\right)=\lambda\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}+\frac{\hat{i}-\hat{j}+4\hat{k}}{3\sqrt{2}}\right)$

$\vec{a}=\frac{\lambda}{3\sqrt{2}}\left(4\hat{i}+2\hat{j}+4\hat{k}\right)\Rightarrow\frac{\lambda}{3\sqrt{2}}\left(4\hat{i}+2\hat{j}+4\hat{k}\right)$

$=\alpha\hat{i}+2\hat{j}+\beta\hat{k}$

$\Rightarrow\alpha=4$ and $\beta=4$

So, $\vec{a}=4\hat{i}+2\hat{j}+4\hat{k}$

None of the given option is correct

Q. If f(a + b + 1 – x) = f(x), for all x, where a and b are fixed positive real numbers, then $\frac{1}{a+b}\int_a^b x\left(f(x)+f(x+1)\right)dx$ is equal to

A. $\int_{a+1}^{b+1}f(x)\,dx$ B. $\int_{a+1}^{b+1}f(x+1)\,dx$

C. $\int_{a-1}^{b-1}f(x+1)\,dx$ D. $\int_{a-1}^{b-1}f(x)\,dx$

Ans. A

Sol:

$I=\frac{1}{(a+b)}\int_a^b x\left(f(x)+f(x+1)\right)dx$ .....(1)

$=\frac{1}{(a+b)}\int_a^b (a+b-x)\left(f(a+b-x)+f(a+b+1-x)\right)dx$

$I=\frac{1}{(a+b)}\int_a^b (a+b-x)\left(f(x+1)+f(x)\right)dx$ .....(2)

Equation (1) + (2)

$2I=\frac{1}{(a+b)}\int_a^b (a+b)\left(f(x+1)+f(x)\right)dx$

$I=\frac{1}{2}\left[\int_a^b f(x+1)dx+\int_a^b f(x)dx\right]$

$=\frac{1}{2}\left[\int_a^b f(a+b+1-x)dx+\int_a^b f(x)dx\right]$

$=\frac{1}{2}\left[\int_a^b f(x)dx+\int_a^b f(x)dx\right]$

$I=\int_a^b f(x)\,dx$

Let x = T + 1

$=\int_{a-1}^{b-1}f(T+1)dT$

$I=\int_{a-1}^{b-1} f(x+1)dx$

Hence, option (C) is correct.

In option (A) $\int_{a+1}^{b+1} f(x)\,dx$

Put x = t + 1

$$\int_a^b f(t+1)dt=\int_a^b f(t)\,dt$$

Hence, (A) option also correct.

8 Jan. 2020 (Second-Shift)

Q. Let S be the set of all functions $f:[0,1]\to R$, which are continuous on [0,1] and differentiable on (0, 1). Then for every f in S, there exists a $c\in(0,1)$, depending on f, such that

A. $|f(c)-f(1)|<(1-c)|f'(c)|$

B. $|f(c)-f(1)|<|f'(c)|$

C. $|f(c)+f(1)|<(1+c)|f'(c)|$

D. $\frac{f(1)-f(c)}{1-c}=f'(c)$

Ans. B

Sol.

Option (A), (B), (C) are incorrect for f(x) = constant.

9 Jan. 2020 (Second-Shift)

Q. If $x = 2\sin\theta - \sin 2\theta$ and $y = 2\cos\theta - \cos 2\theta$, $\theta\in[0,2\pi]$, then $\frac{d^2y}{dx^2}$ at $\theta = \pi$ is

A. $\frac{3}{2}$ B. $-\frac{3}{4}$

C. $\frac{3}{4}$ D. $-\frac{3}{8}$

Ans. D

Sol:

$x = 2\sin\theta - \sin 2\theta$

$$\Rightarrow\frac{dx}{d\theta}=2\cos\theta-2\cos2\theta=4\sin\left(\frac{\theta}{2}\right)\sin\left(\frac{3\theta}{2}\right)$$

$$y=2\cos\theta-\cos2\theta$$

$$\Rightarrow\frac{dy}{d\theta}=-2\sin\theta+2\sin2\theta=4\sin\frac{\theta}{2}\cos\frac{3\theta}{2}$$

$$\Rightarrow \frac{dy}{dx} = \cot\left(\frac{3\theta}{2}\right) \Rightarrow \frac{d^2y}{dx^2} = \frac{-\frac{3}{2}\operatorname{cosec}^2\left(\frac{3\theta}{2}\right)}{4\sin\left(\frac{\theta}{2}\right)\sin\frac{3\theta}{2}}$$

$$\Rightarrow \left(\frac{d^2y}{dx^2}\right)_{\theta=\pi} = \frac{3}{8}$$

Answer should be $\frac{3}{8}$. No option is correct

Q. If 10 different balls are to be placed in 4 distinct boxes at random, then the probability that two of these boxes contain exactly 2 and 3 balls is :

A. $\frac{945}{2^{11}}$ B. $\frac{965}{2^{11}}$

C. $\frac{945}{2^{10}}$ D. $\frac{965}{2^{10}}$

Ans. C

Sol:

10 different balls in 4 different boxes.

$$\frac{1}{4^{10}}\left(4! \times \frac{10!}{2! \times 3! \times 0! \times 5!} + 4! \times \frac{10!}{2! \times 3! \times 1! \times 4!} + 4! \times \frac{10!}{(2!)^2 \times 2! \times (3!)^2 \times 2!}\right)$$

$$\frac{16065}{2^{15}}$$

Maths (8 Jan 1st Shift 2020)

Q. Let $f(x) = (\sin(\tan^{-1}x) + \sin(\cot^{-1}x))^2 - 1$, $|x| > 1$. If $\frac{dy}{dx} = \frac{1}{2}\frac{d}{dx}\left(\sin^{-1}\left(f(x)\right)\right)$ and $y\left(\sqrt{3}\right) = \frac{\pi}{6}$, then $y\left(-\sqrt{3}\right)$ is equal to:

A. $\frac{5\pi}{6}$ B. $-\frac{\pi}{6}$

C. $\frac{\pi}{3}$ D. $\frac{2\pi}{3}$

Ans. A

Q. Ley y = y(x) be a solution of the differential equaion, $\sqrt{1-x^2}\,\frac{dy}{dx}+\sqrt{1-y^2}=0, |x|<1.$ If $y\left(\frac{1}{2}\right)=\frac{\sqrt{3}}{2}$, then $y\left(\frac{-1}{\sqrt{2}}\right)$ is equal to

A. $-\frac{\sqrt{3}}{2}$ B. $\frac{1}{\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$ D. $-\frac{1}{\sqrt{2}}$

Ans. B

Sol:

$$\frac{dy}{dx}=-\frac{\sqrt{1-y^2}}{1-x^2}$$

$$\text{so, } \frac{dy}{\sqrt{1-y^2}}+\frac{dx}{\sqrt{1-x^2}}=0$$

Integrating, $\sin^{-1}x + \sin^{-1}y = c$

$$\text{so, } \frac{\pi}{6}+\frac{\pi}{3}=c$$

$$\text{Hence, } \sin^{-1}x+\sin^{-1}y=\frac{\pi}{2}$$

$$\text{Put } x=-\frac{1}{\sqrt{2}}, \sin^{-1}y=\frac{3\pi}{4}(\text{Not possible})$$

Q. An urn contains 5 red marbles, 4 black marbles and 3 white marbles. Then the number of ways in which 4 marbles can be drawn so that at the most three of them are red is ....

Ans. 490

Sol:

The question does not mention that whether same coloured marbles are distinct or identi-cal. So, assuming they are distinct our required answer = 490

And, if same coloured marbles are identical then required answer = (2 + 3 + 4 + 4) = 13

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