JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON FRIDAY 23rd JANUARY 2026) **TIME : 3:00 PM TO 6:00 PM**

PHYSICS

TEST PAPER WITH SOLUTION

SECTION-A

26. The internal energy of a monoatomic gas is 3nRT. One mole of helium is kept in a cylinder having internal cross section area of 17 cm^2 and fitted with a light movable frictionless piston. The gas is heated slowly by suppling 126 J heat. If the temperature rises by 4 °C, then the piston will move_____cm.

(atmospheric pressure = 10^5 Pa)

(1) 14.5 (2) 1.55

(3) 15.5 (4) 1.45

Ans. (3)

Sol. $\Delta U = 3nR\Delta T$

$\Delta U = 3 \times 1 \times \frac{25}{3} \times 4 = 100$ Joule

$\Delta Q = 126$

$W = 26 = P\Delta V$

$26 = 10^5 \times 17 \times 10^{-4} \Delta x$

$\Delta x = \frac{26}{170} = 15.3$

27. A body of mass 14 kg initially at rest explodes and breaks into three fragments of masses in the ratio 2 : 2 : 3. The two pieces of equal masses fly off perpendicular to each other with a speed of 18 m/s each. The velocity of the heavier fragment is ____m/s.

(1) $10\sqrt{2}$

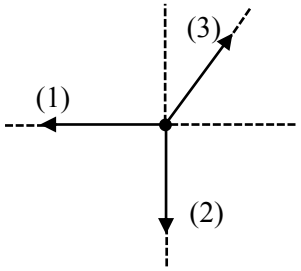
(2) $12\sqrt{2}$

(3) 12

(4) $24\sqrt{2}$

Ans. (2)

Sol.



Apply C.O.M

$M_1V_1 + M_2V_2 + M_3V_3 = 0$

$2(-18i) + 2(-18j) + 3V_3 = 0$

$V_3 = 12i + 12j$

$|V_3| = 12\sqrt{2}$ m/s

28. A block is sliding down on an inclined plane of slope θ and at an instant $t = 0$ this block is given an upward momentum so that it starts moving up on the inclined surface with velocity u. The distance (S) travelled by the block before its velocity become zero, is_____.

(g = gravitational acceleration)

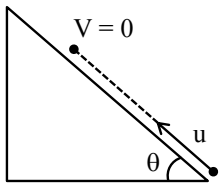
(1) $\frac{u^2}{4g\sin\theta}$ (2) $\frac{2u^2}{g\cos\theta}$

(3) $\frac{u^2}{\sqrt{2}g\cos\theta}$ (4) $\frac{u^2}{2g\cos\theta}$

NTA Ans. (4)

Allen Ans. (Bonus)

Sol.



$a = -g\sin\theta$

$V^2 = U^2 + 2as$

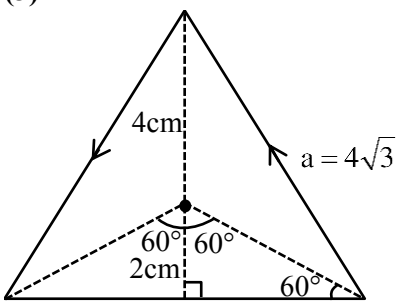
$0 = u^2 - 2g\sin\theta \cdot s$

$s = \frac{u^2}{2g\sin\theta}$

29. The current passing through a conducting loop in the form of equilateral triangle of side $4\sqrt{3}$ cm is 2A. The magnetic field at its centroid is $\alpha \times 10^{-5}$ T. The value of α is _____.
(Given : $\mu_o = 4\pi \times 10^{-7}$ SI units)
(1) $2\sqrt{3}$ (2) $\sqrt{3}$
(3) $3\sqrt{3}$ (4) $\frac{\sqrt{3}}{2}$

Ans. **(3)**

Sol.



$$B = \frac{\mu_0}{4\pi} \times \frac{I}{d} [\sin 60° + \sin 60°] \times 3$$

$$B = 10^{-7} \times \frac{2}{2\times10^{-2}} \left(\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2}\right) \times 3$$

$$= \sqrt{3} \times 10^{-5} \times 3 = 3\sqrt{3} \times 10^{-5}$$

30. A paratrooper jumps from an aeroplane and opens a parachute after 2 s of free fall and starts deaccelerating with 3 m/s^2. At 10 m height from ground, while descending with the help of parachute, the speed of paratrooper is 5 m/s. The initial height of the aeroplane is _____m.
($g = 10$ m/s^2)
(1) 62.5 (2) 92.5
(3) 20 (4) 82.5

Ans. **(2)**

Sol. A to B

$$x_1 = \frac{1}{2} \times 10 \times 2^2 = 20 \text{ m}$$

$$V = 0 + 10 \times 2$$

B to C

$$5^2 = 20^2 - 2(3)x_2$$

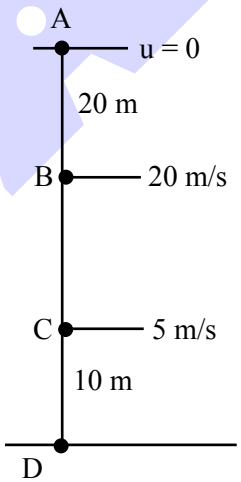
$$x_2 = \frac{375}{6}$$

$$x_2 = 62.5$$

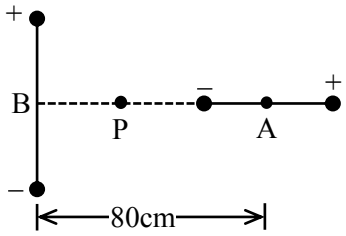
C to D

$$x_3 = 10\text{m}$$

$$H = x_1 + x_2 + x_3 = 92.5$$



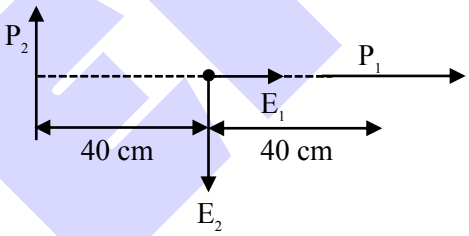
31. Two shorts dipoles (A, B), A having charges $\pm$ 2μC and length 1 cm and B having charges $\pm$ 4μC and length 1 cm are placed with their centres 80 cm apart as shown in the figure. The electric field at a point P, equi-distant from the centres of both dipoles is_____N/C.



(1) $\frac{9}{16}\sqrt{2}\times10^5$ (2) $4.5\sqrt{2}\times10^4$
(3) $9\sqrt{2}\times10^4$ (4) $\frac{9}{16}\sqrt{2}\times10^4$

Ans. **(4)**

Sol.



$$\vec{E}_2 = -\frac{KP_2}{r^3}; \vec{E}_1 = -\frac{2KP_1}{r^3}$$

$$P_1 = 2 \times 10^{-6} \times 10^{-2} = 2 \times 10^{-8}$$

$$P_2 = 4 \times 10^{-6} \times 10^{-2} = 4 \times 10^{-8}$$

$$\vec{E}_{net} \frac{2\times9\times10^9\times2\times10^{-8}}{(0.4)^3} \hat{i} - \frac{9\times10^9\times4\times10^{-8}}{(0.4)^3}\hat{j}$$

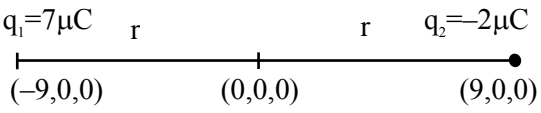
$$\vec{E}_{net} = \frac{9\times10^9\times4\times10^{-8}}{(0.4)^3}[\hat{i} - \hat{j}]$$

$$|\vec{E}_{net}| = \frac{9\times10^4}{16}(\sqrt{2})$$

32. Two charges 7μC and –2 μC are placed at (–9, 0, 0) cm and (9, 0, 0) cm respectively in an external field $E = \frac{A}{r^2}\hat{r}$, where $A = 9 \times 10^5$ N/C.m^2.
Considering the potential at infinity is 0, the electrostatic energy of the configuration is_____J.
(1) 1.4 (2) –90.7
(3) 49.3 (4) 24.3

Ans. **(3)**

Sol.



$$dV = -\vec{E}.\vec{dr}$$

$$\int_0^V dV = -\int_\infty^r \frac{A}{r^2}dr$$

$$V = -\left[\frac{-A}{r^2}\right]_\infty^r \Rightarrow \boxed{V = \frac{A}{r}}$$

$$U = U_{self} + U_{interaction}$$

$$= q_1v_1 = q_2v_2 + \frac{kq_1q_2}{2r}$$

$$= 7\times10^{-6}\frac{A}{9\times10^{-2}} - 2\times10^{-6}\frac{A}{9\times10^{-2}}$$

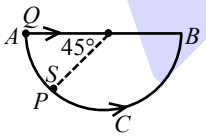
$$-\frac{9\times10^{9}\times14\times10^{-12}}{2\times9\times10^{-2}}$$

$$= \frac{5\times10^{-6}\times9\times10^{5}}{9\times10^{-2}} - 7\times10^{-1}$$

$$= 50 - 0.7$$

$$= 49.3\ J$$

33. A bead P sliding on a frictionless semi-circular string (ACB) and it is at point S at t = 0 and at this instant the horizontal component of its velocity is v. Another bead Q of the same mass as P is ejected from point A at t = 0 along the horizontal string AB, with the speed v, friction between the beads and the respective strings may be neglected in both cases. Let t_p and t_Q be the respective times taken by beads P and Q to reach the point B, then the relation between t_p and t_Q is



(1) $t_P > t_Q$

(2) $t_p < t_Q$

(3) $t_p > 1.25t_Q$

(4) $t_p = t_Q$

Ans. (2)

Sol. Horizontal displacement of Q is more then P.

$$X_Q > X_P$$

Horizontal component of velocity is same

So $t_p = \frac{x_p}{v}$

$$t_Q = \frac{x_Q}{v}$$

$$t_Q > t_p$$

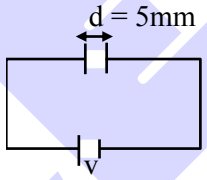
34. A parallel plate capacitor with plate separation 5 mm is charged by a battery. On introducing a mica sheet of 2 mm and maintaining the connections of the plates with the terminals of the battery, it is found that it draws 25% more charge from the battery. The dielectric constant of mica is____.

(1) 2.5 (2) 2.0

(3) 1.5 (4) 1.0

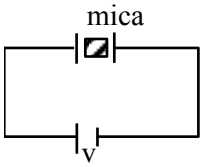
Ans. (2)

Sol.



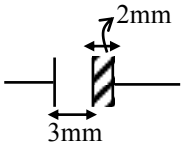
$$C = \frac{\epsilon_0 A}{d}$$

$$Q_1 = CV$$



$$Q_2 = (c_{eq})\ v$$

$$Q_2 = 1.25\ cv$$



$$c_{eq} = \frac{C_1C_2}{C_1+C_2} = \frac{\frac{\epsilon_0 A}{3}\times\frac{K\epsilon_0 A}{2}}{\frac{\epsilon_0 A}{3}+\frac{K\epsilon_0 A}{2}}$$

$$c_{eq} = \frac{(\epsilon_0 A)^2\left(\frac{K}{6}\right)}{\epsilon_0 A\left(\frac{2+3K}{6}\right)} \Rightarrow C_{eq} = \frac{K\epsilon_0 A}{2+3K}$$

$$1.25 \times \frac{\epsilon_0 A}{5} = \frac{K\epsilon_0 A}{2+3K} \Rightarrow 0.25\,(2+3K) = K$$

$$2 + 3K = 4K \Rightarrow K = 2$$

35. To compare EMF of two cells using potentiometer the balancing lengths obtained are 200 cm and 150 cm. The least count of scale is 1 cm. The percentage error in the ratio of EMFs is____

(1) 1.45 (2) 1.65

(3) 1.75 (4) 1.55

NTA Ans. (2)

Allen Ans. (Bonus)

Sol. $\epsilon = \lambda \ell$

Potential gradient

$\epsilon_1 = \lambda \ell_1$

$\epsilon_2 = \lambda \ell_2$

$$y = \frac{\epsilon_1}{\epsilon_2} = \frac{\ell_1}{\ell_2}$$

$$\frac{\Delta y}{y} = \frac{\Delta \ell_1}{\ell_1} + \frac{\Delta \ell_2}{\ell_2}$$

$$\frac{\Delta y}{y} = \frac{1}{200} + \frac{1}{150}$$

$$\frac{\Delta y}{y} \times 100 \left(\frac{1}{200} + \frac{1}{150}\right) \times 100$$

$$= \left(\frac{3+4}{600}\right) \times 100 \Rightarrow \frac{7}{6} = 1.16\%$$

No options matching

36. An air bubble of volume 2.9 cm^3 rises from the bottom of a swimming pool of 5 m deep. At the bottom of the pool water temperature is 17 °C. The volume of the bubble when it reaches the surface, where the water temperature is 27 °C, is____ cm^3. (g = 10 m/s^2, density of water = 10^3 kg/m^3, and 1 atm pressure is 10^5 Pa)

(1) 4.2 (2) 2.0

(3) 3.0 (4) 4.5

Ans. (4)

Sol. For an air bubble rising in water, the no. of moles remain constant

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(P_{atm} + \rho gh)2.9cm^3}{290K} = \frac{(P_{atm})V_2}{300}$$

$V_2 = 4.5\ cm^3$

37. Which of the following pair of nuclei are isobars of the element ?

(1) ${}^{2}_{1}H$ and ${}^{3}_{1}H$

(2) ${}^{236}_{92}U$ and ${}^{238}_{92}U$

(3) ${}^{198}_{80}Hg$ and ${}^{197}_{79}Au$

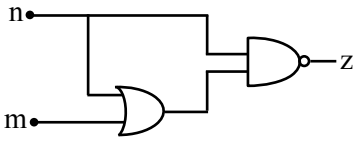
(4) ${}^{3}_{1}H$ and ${}^{3}_{2}H$

Ans. (4)

Sol. Isobars are nuclei that have the same mass number

${}^{3}_{1}H$ & ${}^{3}_{2}He$ have same mass number.

38. For the given logic gate circuit, which of the following is the correct truth table?



(1)

n	m	z
0	0	1
0	1	0
1	1	0
1	0	0

(2)

n	m	z
0	0	0
0	1	1
1	1	0
1	0	1

(3)

n	m	z
0	0	1
0	1	0
1	1	1
1	0	0

(4)

n	m	z
0	0	1
0	1	1
1	1	0
1	0	0

Ans. (4)

Sol. **Gate 1 :** At bottom there is an OR gate with inputs n & m

out put = n + m

Gate 2 : A NAND gate, its Input are direct n & the output of OR gate (n + m)

out put $z = \overline{n.(n+m)}$

since n.(n + m) = (n.n) + (n.m)

= n + n.m = n(1 + m) = n

$\therefore$ output $z = \overline{n.(n+m)} = \bar{n}$

n	m	$z = \bar{n}$
0	0	1
0	1	1
1	1	0
1	0	0

39. One mole of an ideal diatomic gas expands from volume V to 2V isothermally at a temperature 27°C and does W joule of work. If the gas undergoes same magnitude of expansion adiabatically from 27°C doing the same amount of work W, then its final temperature will be (close to) _____ °C.

(1) –189 (2) –56

(3) –30 (4) –117

Ans. **(2)**

Sol. For Isothermal process

$W_{isothermal} = nRT\ell n\left(\frac{V_2}{V_1}\right)$

= 1.R 300. ℓn(2)

= 300 R (0.693)……..(1)

Now for adiabatic process,

It is given work done in Isothermal = work done in adiabatic

$W_{adiabatic} = \frac{nR(T_1 - T_2)}{\gamma - 1}$ ……..(2)

(1) = (2)

$\frac{nR(300 - T_{final})}{1.4 - 1} = 300R(0.693)$

$T_{Final} = 216.84$ K

= –56.3°C

40. A prism of angle 75° and refractive index $\sqrt{3}$ is coated with thin film of refractive index 1.5 only at the back exit surface. To have total internal reflection at the back exit surface the incident angle must be _____.

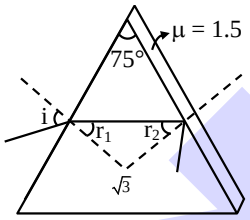
(sin 15° = 0.25 and sin 25° = 0.43)

(1) between 15° and 20° (2) 15°

(3) > 25° (4) < 15°

Ans. **(1, 2, 4)**

Sol.



$r_1 + r_2 = 75°$

For T I R at back surface

$\sqrt{3}\sin r_2 = \frac{3}{2}\sin 90°$

$r_2 \geq 60°$

$r_1 \leq 15°$

$1 \sin i = \sqrt{3}\sin 15°$

$\sin i = 1.73 \times .25$

$\sin i = .433$

$i = 25° \Rightarrow i < 25°$

41. A circular loop of radius 7 cm is placed in uniform magnetic field of 0.2 T directed perpendicular to plane of loop. The loop is converted into a square loop in 0.5 s. The EMF induced in the loop is _____ mV.

(1) 6.6 (2) 13.2

(3) 8.25 (4) 1.32

Ans. **(4)**

Sol. induced EMF = $\frac{d\phi}{dt}$

circumference $\simeq 14\pi$

side length of square loop = $\frac{14\pi}{4} = \frac{7\pi}{2}$

$\Delta\phi = B(A_1 - A_2)$

$= (.2)\left(\left(\frac{7\pi}{2}\right) \times \frac{7\pi}{2} - 49\pi\right) \times 10^{-4}$

$= .2\left(\frac{49\pi^2}{4} - 49\pi\right) \times 10^{-4}$

$\Delta\phi = .2 \times 33.07 \times 10^{-4}$

$\Delta\phi = 6.614 \times 10^{-4}$

EMF = $\frac{6.614 \times 10^{-4}}{\frac{1}{2}}$ V = 13.23×10^{-4} V

EMF = 1.32 mV

42. Suppose a long solenoid of 100 cm length, radius 2 cm having 500 turns per unit length, carries a current $I = 10 \sin(\omega t)$ A, where $\omega = 1000$ rad./s. A circular conducting loop (B) of radius 1 cm coaxially slided through the solenoid at a speed v = 1 cm/s. The r.m.s. current through the loop when the coil B is inserted 10 cm inside the solenoid is $\alpha/\sqrt{2}$ μA. The value of α is _____.

[Resistance of the loop = 10 Ω]

(1) 197 (2) 80

(3) 280 (4) 100

Ans. (1)

Sol. EMF induced $\varepsilon = A\frac{dB}{dt} = A\mu_0 n\frac{di}{dt}$

$\varepsilon = A\mu_0 n\, i_0 \omega \cos\omega t$

current induced $i = \frac{\varepsilon}{R} = \frac{\pi r^2 \mu_0 n i_0 \omega}{R}\cos\omega t$

So $i = \frac{\pi r^2 \mu_0 n i_0 \omega}{\sqrt{2}R}$

$= \frac{\pi \times 10^{-4} \times 4\pi \times 10^{-7} \times 500 \times 10 \times 10^3}{\sqrt{2} \times 10}$

$= \frac{20\pi^2}{\sqrt{2}} \times 10^{-6}$

$\simeq \frac{197}{\sqrt{2}}\mu A$

43. The ratio of speeds of electromagnetic waves in vacuum and a medium, having dielectric constant k = 3 and permeability of $\mu = 2\mu_0$, is

(μ_0 = permeability of vacuum)

(1) 36 : 1

(2) 3 : 2

(3) 6 : 1

(4) $\sqrt{6}$: 1

Ans. (4)

Sol. $\frac{C}{V} = \mu = \sqrt{\varepsilon_r \mu_r}$

$\frac{C}{V} = \sqrt{\frac{3 \times 2}{1}} = \frac{\sqrt{6}}{1}$

44. When an unpolarized light falls at a particular angle on a glass plate (placed in air), it is observed that the reflected beam is linearly polarized. The angle of refracted beam with respect to the normal is _____.

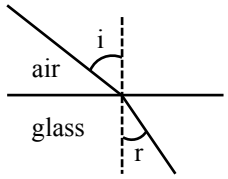
($\tan^{-1}(1.52) = 57.7°$, refractive indices of air and glass are 1.00 and 1.52, respectively)

(1) 39.6° (2) 32.3°

(3) 42.6° (4) 36.3°

Ans. (2)

Sol.



$\tan i = \frac{\mu_2}{\mu_1} = \frac{\mu_g}{\mu_a}$

$\tan i = 1.52$

$i = 57.7°$

$r = 90° - i$

$r = 32.3°$

45. A small metallic sphere of diameter 2 mm and density 10.5 g/cm^3 is dropped in glycerine having viscosity 10 Poise and density 1.5 g/cm^3 respectively. The terminal velocity attained by the sphere is _____ cm/s.

($\pi = \frac{22}{7}$ and g = 10 m/s^2)

(1) 2.0 (2) 1.0

(3) 3.0 (4) 1.5

Ans. (1)

Sol. $V_T = \frac{2r^2 g}{9\eta}(\rho_b - \rho_\ell)$

$V_T = \frac{2}{9}\frac{(.1)^2 \times 10}{(10)}(10.5 - 1.5)$

$V_T = 2$ cm/sec.

SECTION - B

46. The average energy released per fission for the nucleus of $^{235}_{92}U$ is 190 MeV. When all the atoms of 47 g pure $^{235}_{92}U$ undergo fission process, the energy released is $\alpha \times 10^{23}$ MeV. The value of α is _____.

(Avogadro Number = 6×10^{23} per mole)

Ans. (228)

Sol. Total numbers of U-235 atom is

$47\text{ g} = \frac{47}{235}\text{ moles} = \frac{1}{5}\text{moles}$

$\therefore$ Total energy released $= \frac{1}{5} \times 6 \times 10^{23} \times 190$ MeV

$= 228 \times 10^{23}$ MeV

47. The size of the images of an object, formed by a thin lens are equal when the object is placed at two different positions 8 cm and 24 cm from the lens. The focal length of the lens is _____ cm.

Ans. (16)

Sol. $m = \frac{f}{f+u}$

$m_1 = -m_2$

$\frac{f}{f-8} = -\frac{f}{f-24}$

$f - 8 = 24 - f$

$2f = 32$

$f = 16$ cm

48. A ball of radius r and density ρ dropped through a viscous liquid of density σ and viscosity η attains its terminal velocity at time t, given by $t = A\,\rho^a\, r^b\, \eta^c\, \sigma^d$, where A is a constant and a, b c and d are integers. The value of $\frac{b+c}{a+d}$ is _____.

Ans. (1)

Sol. $T = (ML^{-3})^a L^b (ML^{-1}T^{-1})^c (ML^{-3})^d$

$T = M^{a+c+d}\, L^{-3a-c-3d+b}\, T^{-c}$

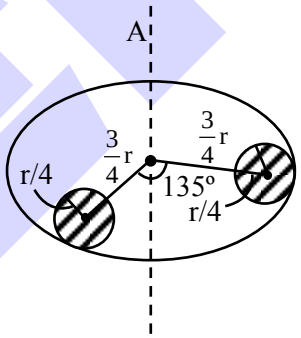
on comparing

$c = -1$; $a + c + d = 0$; $-3a - c - 3d + b = 0$

$b = 2$; $a + d = 1$

$b + c = 1$

49. Suppose there is a uniform circular disc of mass M kg and radius r m shown in figure. The shaded regions are cut out from the disc. The moment of inertia of the remainder about the axis A of the disc is given by $\frac{x}{256}Mr^2$. The value of x is _____.



Ans. (109)

Sol. $M = \sigma\pi R^2$

$\sigma\pi R^2 = 16\,m$

$m = \frac{\sigma\pi R^2}{16}$

$I_{system} = \frac{MR^2}{2} - 2\left(\frac{mR^2}{2\times 16} + \frac{9mR^2}{16}\right)$

$= \frac{MR^2}{2} - 2 \times \frac{19mR^2}{32}$

$= \frac{MR^2}{2} - \frac{19}{16}mR^2$

$= \frac{MR^2}{2} - \frac{19}{256}MR^2$ becoz $m = \frac{M}{16}$

$= \frac{(128-19)(MR^2)}{256}$

$= \frac{109MR^2}{256}$

50. The velocity of sound in air is doubled when the temperature is raised from 0°C to α°C. The value of α is _____.

Ans. **(819)**

Sol. $V = \sqrt{\frac{\gamma RT}{M}}$

$\frac{V_1}{V_2} = \frac{\sqrt{T_1}}{\sqrt{T_2}}$

$\frac{V_0}{2V_0} = \sqrt{\frac{273}{T_2}}$

$\frac{1}{4} = \frac{273}{T_2}$

$T_2 = 4 \times 273 = \alpha + 273$

$\alpha = 3 \times 273$

$\alpha = 819°C$

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