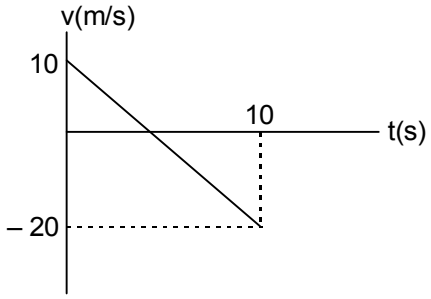
# JEE Scholarship Test
# Sample Paper

**Time: 60 Minutes** **Maximum Marks: 120**

1. All questions carry equal marks.
2. There are 30 questions in the test. For each question you will be **awarded 4 marks** for the correct answer and **zero mark** for unattempted questions. In all other cases, **minus one (–1) mark** will be awarded.

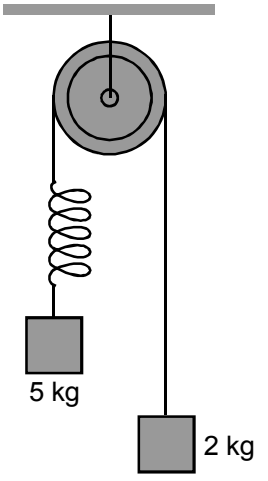
## Part – A : Physics

**1.** Velocity-time graph of a particle moving in a straight line is as shown in figure. Mass of the particle is 2 kg. Work done by all the forces acting on the particle in time interval between t = 0 to t = 10 s is



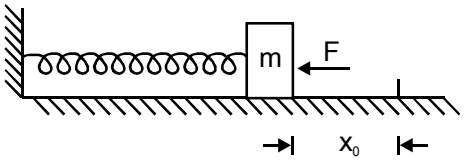

(a) 300 J (b) – 300J
(c) 400 J (d) – 400 J

**2.** System shown in figure is released from rest with mass 2 kg in contact with the ground. Pulley and spring are massless and the friction is absent everywhere. The speed of 5 kg block when 2 kg block leaves the contact with the ground is (force constant of the spring k = 40 N/m and g = 10 m/s$^2$)




(a) $\sqrt{2}$ m/s (b) $2\sqrt{2}$ m/s
(c) 2 m/s (d) $\sqrt{2}$ m/s

**3.** A spring of stiffness *k* is kept compressed by applying horizontal force on *m* by a length $x_0$(= mg/K). If the force *F* is withdrawn suddenly, the block oscillates and finally stops. In consequence, frictional loss is equal to 50% of the initial potential energy stored in the spring. The coefficient of friction the between block and the ground is




(a) $\frac{1}{2}$ (b) $\frac{2}{3}$
(c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{3}}$

**4.** A ball of mass *m* moving with a velocity *u* collides head on with the second ball of mass *m* at rest. If the coefficient of restitution is *e*, then the ratio of the velocities of the first and the second ball after the collision is

(a) $\frac{1-e}{1+e}$ (b) $\frac{1+e}{1-e}$
(c) $\frac{1+e}{2}$ (d) $\frac{1-e}{2}$

**5.** A ball collides directly with a similar ball at rest. The first ball is brought to rest by the impact. If half of the initial kinetic energy is lost during the impact, the value of coefficient of restitution is

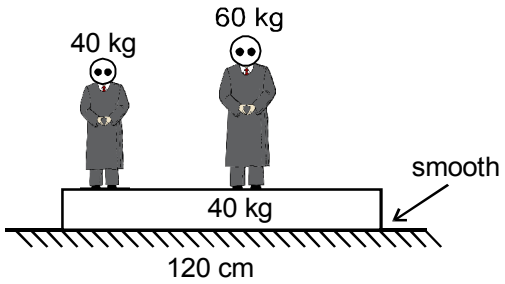
(a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{1}{\sqrt{3}}$
(c) $\frac{1}{\sqrt{2}}$ (d) $\frac{\sqrt{3}}{2}$

**6.** A body *X* with a momentum *p* collides with another identical stationary body *Y* one dimensionally. During the collision *Y* gives an impulse *J* to body *X*. Then coefficient of restitution is

(a) $\frac{2J}{p}-1$ (b) $\frac{J}{p}+1$

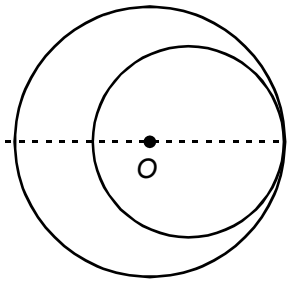
(c) $\frac{J}{p}-1$ (d) $\frac{J}{2p}-1$

**7.** Two men 'A' and 'B' are standing on a plank. 'B' is at the middle of the plank and 'A' is at the left end of the plank. Lower surface of the plank is smooth. System is initially at rest and masses are as shown in figure. 'A' and 'B' start moving such that the position of 'B' remains fixed with respect to ground, then 'A' meets 'B'. Then the point where A meets B is located at




(a) the middle of the plank
(b) 30 cm from the left end of the plank
(c) the right end of the plank
(d) none of these

**8.** A circular plate of uniform thickness has a diameter of 28 cm. A circular portion of diameter 21 cm is removed from the plate as shown. *O* is the centre of mass of complete plate. The position of centre of mass of remaining portion will shift towards left from '*O*' by




(a) 5 cm (b) 9 cm
(c) 4.5 cm (d) 5.5 cm

**9.** Two particles of equal masses have velocity $\vec{v}_1 = 3\hat{i}\ m/s$ and $\vec{v}_2 = 2\hat{j}\ m/s$ at any instant. The first particle has a constant acceleration $\vec{a}_1 = (3\hat{i}+3\hat{j})\ m/s^2$ while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a

(a) circle (b) parabola
(c) straight line (d) ellipse

**10.** A uniform ball of radius r rolls without slipping down from the top of a sphere of radius R. The angular velocity of the ball when it breaks from the sphere is

(a) $\sqrt{\frac{5g(R+r)}{17r^2}}$ (b) $\sqrt{\frac{10g(R+r)}{17r^2}}$

(c) $\sqrt{\frac{5g(R-r)}{10r^2}}$ (d) $\sqrt{\frac{10g(R+r)}{7r^2}}$

## Part – B : Chemistry

**11.** Which of the following reaction will be favoured by low pressure in the forward direction?

(a) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(b) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(c) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(d) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

**12.** When pressure is applied to the equilibrium ice $\rightleftharpoons$ water, which of the following phenomenon will happen?
(a) More ice will be formed
(b) More water will be formed
(c) Water vapour will be formed
(d) Equilibrium will not be affected

**13.** The expected freezing point depression of 0.0100 m $[CO(NH_3)_6]Cl_3$ is:
(Given $K_f$ for water = 1.86°C/m)
(a) 0.0744°C (b) – 0.744°C
(c) – 0.0744°C (d) 7.44°C

**14.** A binary solid ($A^+B^-$) has a zinc blende structure with $B^-$ ions constituting the lattice and $A^+$ ions occupying 25% tetrahedral holes. The formula of solid is:
(a) AB (b) $AB_3$
(c) $AB_2$ (d) $A_2B$

**15.** The freezing point of an aqueous solution containing both 5% and 10% urea and glucose respectively (by weight) will be:
(a) – 3.04 (b) – 2.304
(c) – 1.304 (d) – 0.304

**16.** Degree of dissociation of HCl is 95%. 0.192g of the acid is present in 0.5L of a solution. The pH of the solution is:
(a) 3 (b) 2
(c) 1 (d) 4

**17.** For the reaction

$O_2 \rightleftharpoons O_3, \Delta H = +ve$, formation of ozone is favoured by
(a) decrease of pressure

(b) decrease of temp.
(c) removal of inert gas (if present initially) at constt. pressure
(d) addition of alkaline Pyrogallol

**18.** Which of the following cannot have a conjugate base?
(a) $H_2PO_2^-$ (b) $OH^-$
(c) $H_2O_2$ (d) $HSO_4^-$

**19.** For the reaction A + B $\rightleftharpoons$ C + D, equilibrium concentration of [C] = [D] = 0.5 M, if we start with 1 mole of each of A and B. Percentage of A converted into C, if we start with 2 moles of A and 1 mole of B is:
(a) 25% (b) 40%
(c) 66.66% (d) 33.33%

**20.** 40 ml of 0.1 M ammonia solution is mixed with 20 ml of 0.1 M HCl. What is the pH of the mixture? ($pk_b$ of ammonia solution is 4.74)
(a) 4.74 (b) 2.26
(c) 9.26 (d) 5.00

## Part – C : Mathematics

**21.** If $z = (i)^{(i)^{(i)}}$, where $i = \sqrt{-1}$, then |z| is equal to
(a) 1 (b) $e^{-\pi/2}$
(c) $e^{-\pi}$ (d) None of these

**22.** For any two complex numbers $z_1$ and $z_2$ $|\sqrt{7}z_1 + 3z_2|^2 + |3z_1 - \sqrt{7}z_2|^2$ is always equal to
(a) $4(|z_1|^2 + |z_2|^2)$ (b) $8(|z_1|^2 + |z_2|^2)$
(c) $2(|z_1|^2 + |z_2|^2)$ (d) None of these

**23.** $\sum\sum_{0\le i<j\le n} {}^nC_i$ is equal to
(a) $n.\ 2^{n-1}$ (b) $(n+1).2^{n-1}$
(c) $(n+1).2^n$ (d) $n.2^n$

**24.** The remainder when $4^{101}$ is divided by 101 is
(a) 4 (b) 64
(c) 84 (d) 36

**25.** Total number of term, that are dependent of the value of x, in the expansion of $\left(x^2 - 2 + \frac{1}{x^2}\right)^n$ is equal to
(a) 2n + 1 (b) 2n
(c) n (d) n + 1

**26.** The coefficient of $x^k$, in the expansion of $1 + (1 + x) + (1 + x)^2 + ..... + (1 + x)^n$ is equal to
(a) ${}^{n+1}C_k$ (b) ${}^nC_{k+1}$
(c) ${}^{n+1}C_{k+1}$ (d) None of these

**27.** Total number of term, that are dependent of the value of x, in the expansion of $(x_1 + x_2 + x_3 + ..... + x_n)^m$ is equal to
(a) ${}^{n+m}C_m$ (b) ${}^{n+m-1}C_m$
(c) ${}^{n+m+1}C_m$ (d) ${}^{n+m+1}C_{m+1}$

**28.** Total number of ways of selecting two numbers from the set {1, 2, 3, 4, ..., 3n} so that their sum is divisible by 3 is equal to
(a) $\frac{2n^2 - n}{2}$ (b) $\frac{3n^2 - n}{2}$
(c) $2n^2 - n$ (d) $3n^2 - n$

**29.** Domain of $f(x) = \sqrt{\frac{x-1}{x-2\{x\}}}$, where {.} denotes the fractional part of x, is
(a) $(-\infty, 0) \cup (0, 2]$ (b) [1, 0)
(c) $(-\infty, \infty) \sim [0, 2)$ ( d )
$(-\infty, 0) \sim (0, 1] \cup [2, \infty)$

**30.** Range of $f(x) = \sin^{-1}\left[x^2 + \frac{1}{2}\right] + \cos^{-1}\left[x^2 - \frac{1}{2}\right]$, where [.] denotes the greatest integer function, is
(a) $\left\{\frac{\pi}{2}, \pi\right\}$ (b) $\{\pi\}$
(c) $\left\{\frac{\pi}{2}\right\}$ (d) None of these