Target : Pre-Medical

Physics

ALLEN RACE
Regular Analysis through Continuous Exercise

TARGET : PRE-MEDICAL 2019

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PRE-MEDICAL 2018-19
PHYSICS
RACES

Contents

1. Which one of the following is not a fundamental quantity ?
   (1) Temperature
   (2) Electric current
   (3) Pressure
   (4) Length

2. Which unit is used for measuring nuclear area of cross-section ?
   (1) mm^2
   (2) Fermi
   (3) Barn
   (4) Curie

3. Which of the following is not correct representation of a unit ?
   (1) Newton
   (2) Sec
   (3) a.m.u.
   (4) All of these

4. Which of the following is not a fundamental unit in SI system ?
   (1) ampere
   (2) candela
   (3) kelvin
   (4) Pascal

5. Which one of the following is unitless quantity ?
   (1) Velocity gradient
   (2) Pressure gradient
   (3) Displacement gradient
   (4) Force gradient

6. What can be the maximum distance of star which can be measured by using parallax method ?
   (1) 1 parsec
   (2) 1 AU
   (3) 100 ly
   (4) Infinite

7. Two physical quantities A and B have different dimensions. Which mathematical operation given below is physically possible ?
   (1) $\sqrt{AB}$
   (2) A(1 + B)
   (3) A − B
   (4) A + B

8. Which of the following equations is dimensionally incorrect ?
   (E = energy, U = potential energy, P = momentum, m = mass, v = speed)
   (1) $E = U + \dfrac{P^2}{2m}$
   (2) $E = mv^2 + \dfrac{P^2}{m}$
   (3) $2E = \dfrac{U}{2} - \dfrac{1}{2}mv^2$
   (4) $E = \dfrac{P^2 U}{2mv^2}$

9. 1 joule of energy is to be converted into new system of units in which length is measured in 10 metre, mass in 10 kg and time in 1 minute. The numerical value of 1 J in the new system is :
   (1) 36×10^{-4}
   (2) 36×10^{-3}
   (3) 36×10^{-2}
   (4) 36×10^{-1}

10. The potential energy of a particle varies with distance x from a fixed origin as
    $U = \dfrac{A\sqrt{x}}{x^2 + B}$, where A and B are dimensional constants then dimensional formula for AB is :-
    (1) $[ML^{7/2} T^{-2}]$
    (2) $[ML^{11/2} T^{-2}]$
    (3) $[M^2 L^{9/2} T^{-2}]$
    (4) $[ML^{13/2} T^{-3}]$

11. Which of the following relation cannot be deduced using dimensional analysis ? [the symbols have their usual meanings]
    (1) $y = A \sin(\omega t + kx)$
    (2) $v = u + at$
    (3) $k = \dfrac{1}{2} mv^2$
    (4) All of these

12. Of the following quantities which one has dimensions different from the remaining three ?
    (1) Energy per unit volume
    (2) Force per unit area
    (3) Product of voltage and charge per unit volume
    (4) Angular momentum per unit mass

13. If momentum (P), area (A) and time (T) are taken to be fundamental quantities, then energy has the dimensional formula :
    (1) $[P^1 A^{-1} T^1]$
    (2) $[P^2 A^1 T^1]$
    (3) $[P^1 A^{-1/2} T^1]$
    (4) $[P^1 A^{1/2} T^{-1}]$

14. Which of the following specification is most accurate ?
    (1) 63.1×10^2 m
    (2) 6.31×10^3 m
    (3) 6310 m
    (4) 0.0631×10^5 m

15. If a = 8 ± 0.08 and b = 6 ± 0.06, Let x = a + b, y = a − b, z = a ×b. The correct order of % error in x,y and z
    (1) x = y < z
    (2) x = y > z
    (3) x < z < y
    (4) x > z < y

16. In an experiment the height of a small object is measured by a Vernier Calliper having least count 0.01 cm is found to be 7.38 cm, then the actual height of object may be :-

(1) 7.40 cm

(2) 7.3942 cm

(3) 7.3792 cm

(4) 7.3882 cm

17. Two resistance are measured in ohm and is given as:-

$R_1 = 3\Omega \pm 1\%$

$R_2 = 6\Omega \pm 2\%$

When they are connected in parallel, the percentage error in equivalent resistance is

(1) 3% (2) 4.5% (3) 0.67% (4) 1.33%

18. The percentage error in measurement of a physical quantity m given by $m = \pi \tan \theta$ is minimum when

(1) $\theta = 45°$

(2) $\theta = 90°$

(3) $\theta = 60°$

(4) $\theta = 30°$

(Assume that error in θ remain constant)

19. The number of significant digits in 0.001001 is :-

(1) 6

(2) 4

(3) 7

(4) 2

20. The sides of a rectangle are (10.5 ± 0.2) cm and (5.2 ± 0.1) cm. Then its perimeter with error limits is :-

(1) (31.4 ± 0.6)cm

(2) (31.4 ± 0.3)cm

(3) (51.6 ± 0.6)cm

(4) (51.6 ± 0.3)cm

21. The Young modulus (Y) of a material is given by $Y = \dfrac{WL}{\pi r^2 \ell}$. If the percentage error in W, L, r and ℓ are 0.5%, 1%, 3%: and 4% respectively then maximum percentage error in Y is -

(1) 7.5 % (2) 9 % (3) 11.5 % (4) 13 %

FRICTION

1. A block of mas which $\mu_s = 0.2$ is applied on t using g = 10

(a) The forc

(b) Its accel

(i) When F

(ii) When F

(iii)When

2. Find value moves. Gi
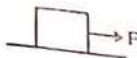
3. Find v body j

4. Find requ res fri

5.

6.

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans	3	3	4	4	3	2	1	4	4	2	4	4	4
Que.	14	15	16	17	18	19	20	21					
Ans	3	3	3	4	1	2	1	3					

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FRICTION　　　　　**TARGET : PRE-MEDICAL 2019**　　　**NURTURE COURSE**

1. A block of mass 1 kg is placed on a surface for which $\mu_s = 0.2$ & $\mu_k = 0.15$, an external force F is applied on the block as shown in the figure, using g = 10 m/sec², find:
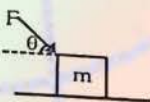   (a) The force of friction on block
   (b) Its acceleration
   (i) When F = 1 N
   (ii) When F = 2 N
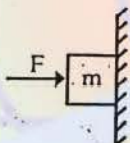   (iii) When F = 2.5 N

2. Find value of pulling force F for which block just moves. Given coefficient of friction for surface is μ
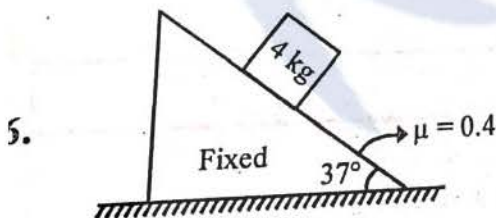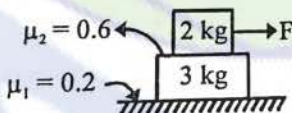
3. Find value of pushing force F for which the body just moves.

4. Find the minimum value of horizontal force (F) required on the block of mass m to keep it at rest on the wall. Given the coefficient of friction between the surfaces is μ.

5. What is the maximum value of force, so that both the blocks will move together?

   $\mu_2 = 0.6$　　2 kg →F
   $\mu_1 = 0.2$　　3 kg

6. For the given arrangement, find:

   4 kg
   Fixed　　37°　$\mu = 0.4$

   (i) Force of friction on the block.
   (ii) Acceleration of the block.
   (iii) Minimum Force required to prevent the downward sliding of block.
   (iv) Minimum Force required to just move the block upwards.

7. A block of mass 10 kg is kept over a rough surface and a force F = 4t is applied on it. At what value of t the block will start moving :-
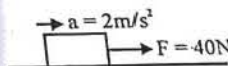
   10 kg → F = 4t
   $\mu = 0.4$
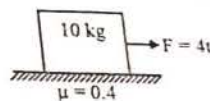
   (1) > 10 s　(2) < 8 s　(3) = 9 s　(4) None

8. A block of mass 10 kg is moving on a rough surface as shown in figure. The frictional force acting on block is :-

   v = 4m/s ←
   10 kg ← F = 20N
   $\mu = 0.6$
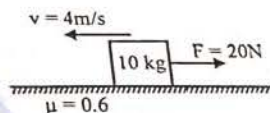
   (1) 20 N　(2) 60 N　(3) 40 N　(4) 80 N

9. A block of mass 10 kg, moving with acceleration 2 m/s² on horizontal rough surface is shown in figure
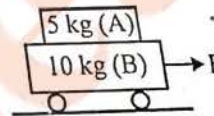
   → a = 2m/s²
   → F = 40N
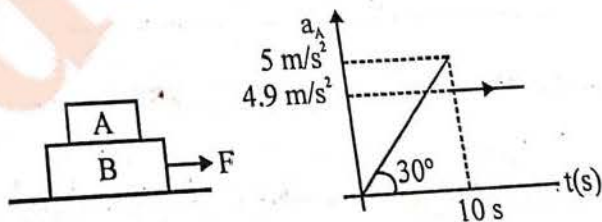
   The value of coefficient of kinetic friction is :-
   (1) 0.2　(2) 0.4　(3) 0.5　(4) 0.1

10. If acceleration of A is 2 m/s² which is smaller than acceleration of B then the value of frictional force applied by B on A is :-

   (1) 50 N
    (2) 20 N
    (3) 10 N
    (4) None of these

    5 kg (A)
    10 kg (B) → F

11. Acceleration of block A varies with time as shown in figure the value of coefficient of kinetic friction between block A and B is

    A
    B → F

    a_A
    5 m/s²
    4.9 m/s²
    30°　10 s　t(s)

    (1) 0.5
    (2) 0.6
    (3) 0.4
    (4) None of these

3

NURTURE COURSE

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12. Block of mass 10 kg is moving on inclined plane with constant velocity 10 m/s. The coefficient of kinetic friction between incline plane and block is :-
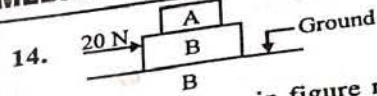
10 m/s, 37°
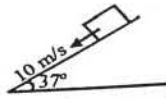
(1) 0.57 (2) 0.75

(3) 0.5 (4) None of these

13.

10 kg A, a_A, 45° Smooth

20 kg B, a_B, 45° rough
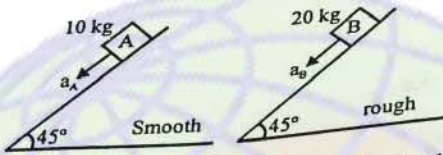
The ratio of acceleration of blocks A placed on smooth incline with block B placed on rough incline is 2 : 1. The coefficient of kinetic friction between block B and incline is :-

(1) 0.5 (2) 0.75

(3) 0.57 (4) None of these

14. 20 N, A, B, Ground, B

Blocks shown in figure moves with constant velocity 10 m/s towards right. All surfaces is contact are rough. The friction force applied by B on A is :-

(1) 0 N

(2) 20 N

(3) 10 N

(4) insufficient data

ANSWERS

1. (i) f = 1N, a = 0   (ii) f = 2 N, a = 0 m/s²   (iii) f = 1.5 N, a = 1 m/s²

2. $F = \dfrac{\mu mg}{\cos\theta + \mu\sin\theta}$ **3.** $F = \dfrac{\mu mg}{\cos\theta - \mu\sin\theta}$ **4.** $F = \dfrac{mg}{\mu}$

5. $\dfrac{40}{3}$N   **6.** (i) 12.8 N   (ii) 2.8 m/s²   (iii) 11.2 N   (iv) 36.8 N

7. 1   **8.** 2   **9.** 1   **10.** 3   **11.** 1   **12.** 2   **13.** 1   **14.** 1

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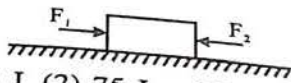
1. A block of mass 2 kg is placed on a smooth horizontal surface. Two forces $F_1 = 20$ N and $F_2 = 5$ N start acting on the block in opposite directions as shown. If block gets displaced by 5 m in the direction of net force then work done by F_2 is :-

(1) $- 75$ J   (2) 75 J   (3) $- 25$ J   (4) 25 J

2. A man of mass 50 kg is standing in an elevator. If elevator is moving up with an acceleration $\dfrac{g}{3}$ then work done by normal reaction of elevator floor on man when elevator moves by a distance 12 m is (g = 10 m/s²) :-

(1) 2000 J   (2) 4000 J   (3) 6000 J   (4) 8000 J

3. A cubical vessel of height 1 m is full of water. Work done by gravity in taking water-out from vessel will be :-

(1) 5000 J   (2) 10,000 J

(3) 5 J   (4) 10 J

. A man pulls a bucket full of water from h metre deep well. If the mass of rope is m and mass of bucket full of water is M, then work done by the man is :-

(1) $\left(\dfrac{M}{2} + m\right) gh$ (2) $\left(\dfrac{M + m}{2}\right) gh$

(3) $\left(M + \dfrac{m}{2}\right) gh$ (4) $(M + m) gh$

The potential energy of a particle of mass 1 kg moving along x-axis given by $U(x) = \left[\dfrac{x^2}{2} - x\right]$ J. If total mechanical energy of particle is 2J then find its maximum speed (in m/s) :-

(1) $\sqrt{5}$ (2) $\sqrt{7}$

(3) $\sqrt{3}$ (4) None

6. The potential energy of an object of mass m moving in xy plane in a conservative field is given by U = ax + by, where x and y are position coordinates of the object. Find magnitude of its acceleration :-

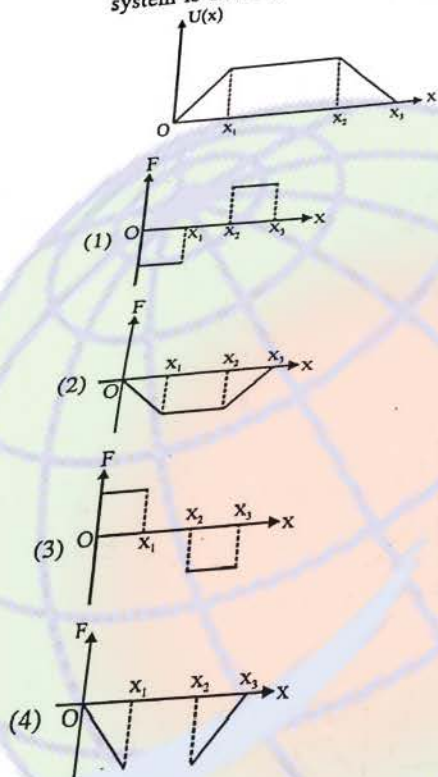(1) $\dfrac{\sqrt{a^2 + b^2}}{m}$ (2) $\dfrac{a^2 + b^2}{m}$

(3) $\sqrt{a^2 + b^2}$ (4) None

7. On a particle placed at origin a variable force $F = - ax$ (where a is a positive constant) is applied. If U(0) = 0, the graph between potential energy of particle U(x) and x is best represented by :-

(1)

(2)

(3)

(4)
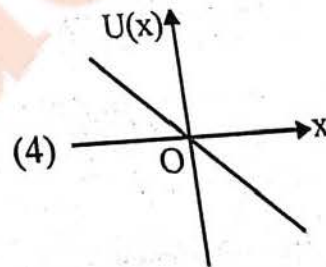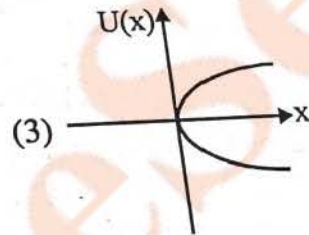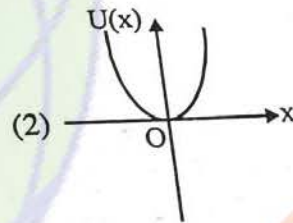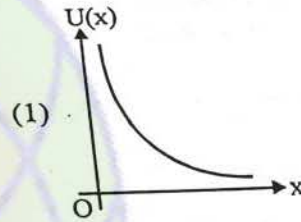
8. The variation of potential energy U of a system is shown in figure. The force acting on the system is best represented by :-

9. A particle located in one dimensional potential field has potential energy function

$$U(x) = \frac{a}{x^2} - \frac{b}{x^3},$$ where a and b are positive constants. The position of equilibrium corresponds to x =

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

(2) $\frac{2b}{3a}$

(3) $\frac{2a}{3b}$

(4) $\frac{3b}{2a}$

1. The position (x moving along x- metre. Find th it in time inte

(1) 576 J

(3) 623 J

2. The veloci along x-a a constar particle

(1) mo

(3)

3. A b of fig a s

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9
Ans	3	4	1	3	1	1	2	1	4

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WORK POWER & ENERGY

1. The position (x) of a particle of mass 2 kg moving along x-axis at time t is given by $x = (2t^3)$ metre. Find the work done by force acting on it in time interval t = 0 to t = 2 s :-

   (1) 576 J   (2) 584 J

   (3) 623 J   (4) None

2. The velocity (v) of a particle of mass m moving along x-axis is given by $v = \alpha\sqrt{x}$, where α is a constant. Find work done by force acting on particle during its motion from x = 0 to x = 2m :-

   (1) $m\alpha^2$ (2) $m\alpha$

   (3) $\dfrac{m\alpha}{2}$ (4) None

3. A block of mass 8 kg is released from the top of an inclined smooth surface as shown in figure. If spring constant of spring is 200 N/m and block comes to rest after compressing spring by 1 m then find the distance travelled by block before it comes to rest :-
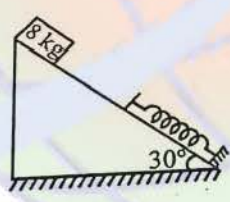

   (1) 2.5 m   (2) 3.5 m

   (3) 2.0 m   (4) None

4. The position (x) of a body moving along x-axis at time (t) is given by $x = 3t^2$, where x is in metre and t is in second. If mass of body is 2 kg, then find the instantaneous power delivered to body by force acting on it at t = 4 s :-

   (1) 288 W

   (2) 280 W

   (3) 290 W

   (4) None

5. A block of mass m is released on the top of a smooth inclined plane of length x and inclination θ as shown in figure. Horizontal surface is rough. If block comes to rest after moving a distance d on the horizontal surface, then coefficient of friction between block and surface is :-
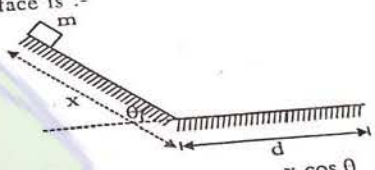
   (1) $\dfrac{x\sin\theta}{2d}$ (2) $\dfrac{x\cos\theta}{2d}$

   (3) $\dfrac{x\sin\theta}{d}$ (4) $\dfrac{x\cos\theta}{d}$

6. A particle of mass 0.1 kg is subjected to a force which varies with distance as shown. If it starts its journey from rest at x = 0, then its velocity at x = 12 m is :-
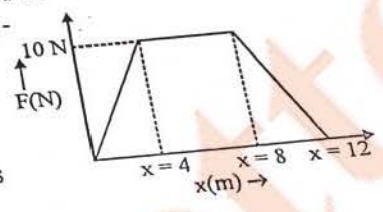
   (1) 0 m/s

   (2) $20\sqrt{2}$ m/s

   (3) $20\sqrt{3}$ m/s

   (4) 40 m/s

7. An unloaded bus can be stopped by applying brakes on straight road after covering a distance x. Suppose, the passenger add 50% of its weight as the load and the braking force remains unchanged, how far will the bus go after the application of the brakes ? (Velocity of bus in both case is same) (Consider negligible friction):-

   (1) Zero   (2) 1.5 x   (3) 2x   (4) 2.5 x

8. A body of mass m accelerates uniformly from rest to velocity v_1 in time interval T_1. The instantaneous power delivered to the body as a function of time t is :-

   (1) $\dfrac{mv_1^2}{T_1^2}t$ (2) $\dfrac{mv_1}{T_1^2}t$

   (3) $\left(\dfrac{mv_1}{T_1}\right)^2 t$ (4) $\dfrac{mv_1^2}{T_1}t^2$

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Together, we will make the difference.

Sitting: Govind Maheshwari (Director), Rajesh Maheshwari (Director)
Standing: Naveen Maheshwari (Director), Brajesh Maheshwari (Director & H.O.D. Physics)

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