IITIAN'S SPECTRUM
IIT JEE/NEET FOUNDATION

IITIAN'S SPECTRUM
Prudent Minds, Promising Path

Founder-Director
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B.Tech (IIT)

PHYSICS

DPS-3
DAILY PRACTICE SHEET

Class XI

Laws of Motion

INSTRUCTIONS

- DPS contains 45 topicwise questions and 5 exam section questions.
- Each question has four options out of which only one option is correct.
- Mark the correct answer in the OMR Sheet given at the end of the DPS.
- Each question carries 4 marks.
- For every incorrect answer deduct 1 mark.

Time : 50 minutes
Marks : 200

Date: .....

Newton's Laws of Motion

1. A bullet of mass 40 g moving with a speed of 90 m s^{-1} enters a heavy wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is
(a) 180 N (b) 250 N (c) 270 N (d) 220 N

2. A body of mass 0.4 kg starting at origin at $t = 0$ with a speed of 10 m s^{-1} in the positive x-axis direction is subjected to a constant $F = 8$ N towards negative x-axis. The position of the body after 25 s is
(a) −6000 m (b) −8000 m
(c) +4000 m (d) +7000 m

3. A constant retarding force of 50 N is applied to a body of mass 10 kg moving initially with a speed of 10 m s^{-1}. The body comes to rest after
(a) 2 s (b) 4 s (c) 6 s (d) 8 s

4. A stone is dropped from a height h. It hits the ground with a certain momentum p. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by
(a) 68% (b) 41% (c) 200% (d) 100%

5. A body of mass 10 kg moves at a constant speed of 10 m s^{-1}. A constant force then acts for 4 seconds on the body and gives it a speed of 2 m s^{-1} in opposite direction. Magnitude of the force acting on the body is
(a) 30 N (b) 20 N (c) 15 N (d) 10 N

6. A 140 g ball, in horizontal flight with a speed v_1 of 39.0 m s^{-1}, is struck by a bat. After leaving the bat, the ball travel in the opposite direction with speed v_2 = 39.0 m s^{-1}. If the impact time Δt for the ball-bat collision is 1.20 ms, what average net force acts on the ball ?
(a) 1308 N (b) 1090 N
(c) 9100 N (d) 980 N

7. A body of mass 4 kg is accelerated upon by a constant force, travels a distance of 5 m in the first second and a distance of 2 m in the third second. The force acting on the body is
(a) 6 N (b) 8 N (c) 2 N (d) 4 N

8. The force on a particle of mass 10 g is $(10\hat{i} + 5\hat{j})$ N. If it starts from rest, what would be its position at time $t = 5$ s?
(a) $(12500\,\hat{i} + 6250\,\hat{j})$ m
(b) $(6250\,\hat{i} + 12500\,\hat{j})$ m
(c) $(12500\,\hat{i} + 12500\,\hat{j})$ m
(d) $(6250\,\hat{i} + 6250\,\hat{j})$ m

9. A 1 kg particle strikes a wall with velocity 1 m s^{-1} at an angle of 60° with the wall and reflects at the same angle. If it remains in contact with wall for 0.1 s, then the force is
(a) 0 (b) $10\sqrt{3}$ N (c) $30\sqrt{3}$ N (d) $40\sqrt{3}$ N

10. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u} = (30\,\hat{i} + 40\hat{j})$ m s^{-1}. If a constant force $(-6\hat{i} - 5\hat{j})$ N acts on the body, the time in which the y component of the velocity becomes zero, is
(a) 5 s (b) 20 s (c) 40 s (d) 80 s

Conservation of Momentum

11. A 100 kg gun fires a ball of 1 kg horizontally from a cliff of height 500 m. It falls on the ground at a distance of 400 m from the bottom of the cliff. The recoil velocity of the gun is (Take $g = 10$ m s^{-2})
(a) 0.2 m s^{-1} (b) 0.4 m s^{-1}
(c) 0.6 m s^{-1} (d) 0.8 m s^{-1}

12. A shell of mass 200 g is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m s^{-1}, then the recoil speed of the gun is
(a) 16 cm s^{-1} (b) 8 cm s^{-1}
(c) 8 m s^{-1} (d) 16 m s^{-1}

13. A stationary bomb explodes into three pieces. One piece of 2 kg mass moves with a velocity of 8 m s^{-1} at right angles to the other piece of mass 1 kg moving with a velocity of 12 m s^{-1}. If the mass of the third piece is 0.5 kg, then its velocity is

(a) 10 m s^{-1} (b) 20 m s^{-1}
(c) 30 m s^{-1} (d) 40 m s^{-1}

14. A cannon ball is fired with a velocity 200 m s^{-1} at an angle of 60° with the horizontal. At the highest point of its flight, it explodes into 3 equal fragments, one falling vertically downwards with a velocity 100 m s^{-1}. The second going vertically upwards with a velocity 100 m s^{-1}, the third fragment will be moving with the velocity

(a) 100 m s^{-1} in horizontal direction
(b) 300 m s^{-1} in horizontal direction
(c) 300 m s^{-1} in a direction making an angle of 60° with the horizontal
(d) 200 m s^{-1} in a direction making an angle of 60° with the horizontal.

15. Two ice skaters A and B approach each other at right angles. Skater A had a mass 30 kg and velocity 1 m s^{-1} and skater B has a mass 20 kg and velocity 2 m s^{-1}. They meet and cling together. The final velocity of the couple is

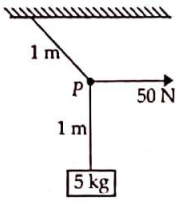
(a) 2 m s^{-1} (b) 1.5 m s^{-1}
(c) 1 m s^{-1} (d) 2.5 m s^{-1}

16. A man of 50 kg is standing at one end on a boat of length 25 m and mass 200 kg. If he starts running and when he reaches the other end, he has a velocity 2 m s^{-1} with respect to the boat. The final velocity of the boat is (in m s^{-1})

(a) $\frac{2}{5}$ (b) $\frac{2}{3}$ (c) $\frac{8}{5}$ (d) $\frac{8}{3}$

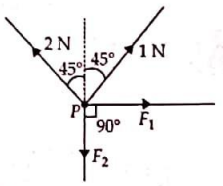
Equilibrium of Particles

17. A block of mass 5 kg is suspended by a massless rope of length 2 m from the ceiling. A force of 50 N is applied in the horizontal direction at the midpoint P of the rope, as shown in the figure.
The angle made by the rope with the vertical in equilibrium is
(Take $g = 10$ m s^{-2})



(a) 30° (b) 40° (c) 60° (d) 45°

18. There are four forces acting at a particle P produced by strings as shown in figure, which is at rest. The forces F_1 and F_2 are

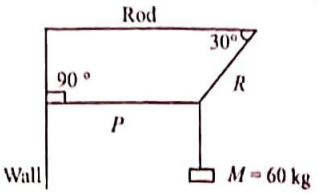


(a) $\frac{1}{\sqrt{2}}$ N, $\frac{3}{\sqrt{2}}$ N (b) $\frac{3}{\sqrt{2}}$ N, $\frac{1}{\sqrt{2}}$ N
(c) $\frac{1}{\sqrt{2}}$ N, $\frac{1}{\sqrt{2}}$ N (d) $\frac{3}{\sqrt{2}}$ N, $\frac{3}{\sqrt{2}}$ N

19. Three concurrent co-planar forces 1 N, 2 N and 3 N acting along different directions on a body

(a) can keep the body in equilibrium if 2 N and 3 N act at right angle.
(b) can keep the body in equilibrium if 1 N and 2 N act at right angle.
(c) cannot keep the body in equilibrium.
(d) can keep the body in equilibrium if 1 N and 3 N act at an acute angle.

20. A body of mass 60 kg is suspended by means of three strings P, Q and R as shown in the figure is in equilibrium. The tension in the string P is



(a) 130.9 g N
(b) 60 g N
(c) 50 g N
(d) 103.9 g N

21. A mass M is tied to the top of two identical poles of height H using massless strings of equal length. The mass is at height h above the ground at equilibrium. If the distance between poles is L the tension in each string will be

(a) $\frac{Mg\sqrt{\left(\frac{L}{2}\right)^2+(H-h)^2}}{2(H-h)}$

(b) $\frac{Mg\sqrt{L^2+H^2}}{2(H-h)}$

(c) $\frac{Mg\sqrt{L^2+H^2}}{2H}$

(d) $\frac{Mg\sqrt{h^2+L^2}}{2L}$

22. A mass of 10 kg is suspended from a spring balance. It is pulled aside by a horizontal string so that it makes an angle of 60° with the vertical. The new reading of the balance is

(a) $10\sqrt{3}$ kg wt (b) $20\sqrt{3}$ kg wt
(c) 20 kg wt (d) 10 kg wt

Common Forces in Mechanics

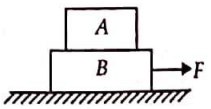
23. A block is gently placed on a long conveyor belt moving with 11 m s^{-1}. If the coefficient of friction between block and belt is 0.4, then the block will slide on the belt up to distance of

(a) 10.21 m (b) 15.43 m
(c) 20.3 m (d) 25.6 m

24. A block of mass m rests on a rough inclined plane. The coefficient of friction between the surface and the block is μ. At what angle of inclination θ of the plane to the horizontal will the block just start to slide down the plane?

(a) $\theta = \tan^{-1}\mu$ (b) $\theta = \cos^{-1}\mu$
(c) $\theta = \sin^{-1}\mu$ (d) $\theta = \sec^{-1}\mu$

25. In figure, the coefficient of friction between the floor and the block B is 0.1. The coefficient of friction between the blocks B and A is 0.2. The mass of A is $m/2$ and of B is m. What is the maximum horizontal force F can be applied to the block B so that two blocks move together?



(a) 0.15mg (b) 0.05mg
(c) 0.1mg (d) 0.45mg

26. The minimum force required to start pushing a body up a rough (frictional coefficient μ) inclined plane is F_1 while the minimum force needed to prevent it from sliding down is F_2. If the inclined plane makes an angle θ with the horizontal such that $\tan\theta = 2\mu$, then the ratio $\frac{F_1}{F_2}$ is

(a) 4 (b) 1 (c) 2 (d) 3

27. To determine the coefficient of friction between a rough surface and a block, the surface is kept inclined at 45° and the block is released from rest. The block takes a time t in moving a distance d. The rough surface is then replaced by a smooth surface and the same experiment is repeated. The block now takes a time $t/2$ in moving down the same distance d. The coefficient of friction is

(a) 3/4 (b) 5/4 (c) 1/2 (d) $1/\sqrt{2}$

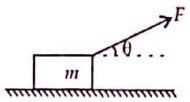
28. A body of mass 50 kg is rest on an inclined plane of angle 30° with the horizontal. The coefficient of friction between the body and the plane is

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

29. A boy presses a book against the front wall such that the book does not move. The force of friction between the wall and the book is

(a) towards right (b) towards left
(c) downwards (d) upwards

30. A wooden block of mass m resting on a rough horizontal table is pulled by a force F as shown in figure. If μ is the coefficient of friction between block and table, its acceleration will be



(a) $\frac{\mu F\cos\theta}{m}$

(b) $\frac{\mu F\sin\theta}{m}$

(c) $\frac{F}{m}(\cos\theta+\mu\sin\theta)-\mu g$

(d) $\frac{F}{m}(\cos\theta-\mu\sin\theta)$

31. Force required to move a mass of 1 kg at rest on a horizontal rough plane ($\mu = 0.1$ and $g = 9.8\ m\ s^{-2}$) is

(a) 0.98 N (b) 0.49 N (c) 9.8 N (d) 4.9 N

Circular Motion

32. A small object placed on a rotating horizontal turn table just slips when it is placed at a distance 4 cm from the axis of rotation. If the angular velocity of the turn-table is doubled, the object slips when its distance from the axis of rotation is

(a) 1 cm (b) 2 cm (c) 4 cm (d) 8 cm

33. A disc revolves with a speed $33\frac{1}{3}$ rev min^{-1}, and has a radius of 15 cm. Two coins A and B are placed at 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15, which of the coins will revolve with the disc?

(a) A (b) B
(c) Both A and B (d) Neither A nor B

34. A stone of mass 5 kg is tied to a string of length 10 m is whirled round in a horizontal circle. What is the maximum speed with which the stone can be whirled around if the string can withstand a maximum tension of 200 N?

(a) 10 m s^{-1} (b) 15 m s^{-1}
(c) 20 m s^{-1} (d) 25 m s^{-1}

35. A block of mass m is placed on a smooth sphere of radius R. It slides when pushed slightly. At what distance h, from the top, will it leave the sphere?

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

36. A cyclist is travelling with velocity v on a banked curved road of radius R. The angle θ through which the cyclist leans inwards is given by

(a) $\tan\theta=\frac{Rg}{v^2}$ (b) $\tan\theta = v^2Rg$

(c) $\tan\theta=\frac{v^2g}{R}$ (d) $\tan\theta=\frac{v^2}{Rg}$

37. A car is racing on a circular track of 180 m radius with a speed of 32 m s^{-1}. What should be the banking angle of the road to avoid skidding of the vehicle at this speed without taking into consideration the friction between the tyre and the road ?

(a) 45° (b) 60° (c) 30° (d) 15°

Solving Problems in Mechanics

38. Two blocks of masses 8 kg and 12 kg are connected at the two ends of a light inextensible string. The string passes over a frictionless pulley. The acceleration of the system is

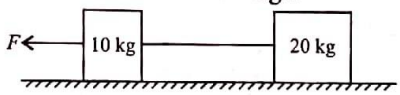
(a) $\frac{g}{4}$ (b) $\frac{g}{5}$ (c) $\frac{g}{8}$ (d) $\frac{g}{6}$

39. A monkey of mass 40 kg climbs on a massless rope which can stand a maximum tension of 500 N. In which of the following cases will the rope break?

(Take $g = 10\ m\ s^{-2}$)

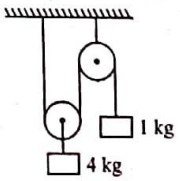
(a) The monkey climbs up with an acceleration of 5 m s^{-2}
(b) The monkey climbs down with an acceleration of 5 m s^{-2}
(c) The monkey climbs up with a uniform speed of 5 m s^{-1}
(d) The monkey falls down the rope freely under gravity.

40. Two blocks of masses 10 kg and 20 kg are connected by a massless string and are placed on a smooth horizontal surface as shown in the figure. If a force $F = 600$ N is applied to 10 kg block, then the tension in the string is



(a) 100 N (b) 200 N (c) 300 N (d) 400 N

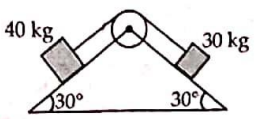
41. In the system shown in the figure, the acceleration of 1 kg mass is



(a) $\frac{g}{4}$ downwards (b) $\frac{g}{2}$ downwards

(c) $\frac{g}{2}$ upwards (d) $\frac{g}{4}$ upwards

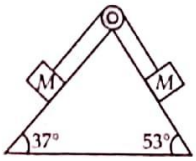
42. Two blocks of masses of 40 kg and 30 kg are connected by a weightless string passing over a frictionless pulley as shown in the figure. The acceleration of the system would be



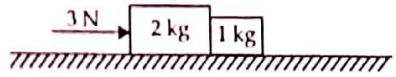
(a) 0.7 m s^{-2} (b) 0.8 m s^{-2}
(c) 0.6 m s^{-2} (d) 0.5 m s^{-2}

43. The acceleration of system of two bodies over the wedge as shown in figure is

(a) $1\ m\ s^{-2}$
(b) $2\ m\ s^{-2}$
(c) $0.5\ m\ s^{-2}$
(d) $10\ m\ s^{-2}$

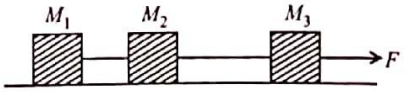


44. Two blocks of 2 kg and 1 kg are in contact on a frictionless table. If a force of 3 N is applied on 2 kg block, then the force of contact between the two blocks will be



(a) 0 N (b) 1 N (c) 2 N (d) 3 N

45. Three masses M_1, M_2 and M_3 are lying on a frictionless table. The masses are connected by massless threads as shown. The mass M_3 is pulled by a constant force F as shown. The tension in the thread between masses M_2 and M_3 is



(a) $\left(\frac{M_1+M_2}{M_1+M_2+M_3}\right)F$ (b) $\left(\frac{M_2+M_3}{M_1+M_2+M_3}\right)F$

(c) $\left(\frac{M_1+M_3}{M_1+M_2+M_3}\right)F$ (d) $\left(\frac{M_1-M_2}{M_1+M_2+M_3}\right)F$

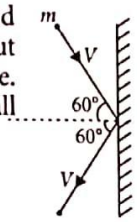
EXAM SECTION

46. Two identical balls A and B having velocities of $0.5\ m\ s^{-1}$ and $-0.3\ m\ s^{-1}$ respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be

(a) $-0.5\ m\ s^{-1}$ and $0.3\ m\ s^{-1}$
(b) $0.5\ m\ s^{-1}$ and $-0.3\ m\ s^{-1}$
(c) $-0.3\ m\ s^{-1}$ and $0.5\ m\ s^{-1}$
(d) $0.3\ m\ s^{-1}$ and $0.5\ m\ s^{-1}$

(NEET Phase II 2016)

47. A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure. The value of impulse imparted by the wall on the ball will be



(a) mV (b) $2mV$

(c) $\frac{mV}{2}$ (d) $\frac{mV}{3}$

(NEET Phase II 2016)

48. A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is

(a) $\sqrt{\frac{g}{R}\frac{(\mu_s+\tan\theta)}{(1-\mu_s\tan\theta)}}$ (b) $\sqrt{\frac{g}{R^2}\frac{(\mu_s+\tan\theta)}{(1-\mu_s\tan\theta)}}$

(c) $\sqrt{gR^2\frac{(\mu_s+\tan\theta)}{(1-\mu_s\tan\theta)}}$ (d) $\sqrt{gR\frac{(\mu_s+\tan\theta)}{(1-\mu_s\tan\theta)}}$

(NEET Phase I 2016)

49. Two stones of masses m and $2m$ are whirled in horizontal circles, the heavier one in a radius $\frac{r}{2}$ and the lighter one in radius r. The tangential speed of lighter stone is n times that of the value of heavier stone when they experience same centripetal forces. The value of n is

(a) 4 (b) 1
(c) 2 (d) 3

(AIPMT 2015)

50. Three blocks A, B and C, of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is

(a) 8 N (b) 18 N (c) 2 N (d) 6 N

(AIPMT 2015)

OMR SHEET

Use HB pencil only and darken each circle completely.
Mark only one choice for each question as indicated.

Correct marking ● ⓑ ⓒ ⓓ
Wrong marking ⊗ ⓐ ◑ ⊙

1. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	31. ⓐⓑⓒⓓ	37. ⓐⓑⓒⓓ	43. ⓐⓑⓒⓓ	49. ⓐⓑⓒⓓ
2. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	20. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	32. ⓐⓑⓒⓓ	38. ⓐⓑⓒⓓ	44. ⓐⓑⓒⓓ	50. ⓐⓑⓒⓓ
3. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ	33. ⓐⓑⓒⓓ	39. ⓐⓑⓒⓓ	45. ⓐⓑⓒⓓ	
4. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	34. ⓐⓑⓒⓓ	40. ⓐⓑⓒⓓ	46. ⓐⓑⓒⓓ	
5. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	35. ⓐⓑⓒⓓ	41. ⓐⓑⓒⓓ	47. ⓐⓑⓒⓓ	
6. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ	36. ⓐⓑⓒⓓ	42. ⓐⓑⓒⓓ	48. ⓐⓑⓒⓓ	

SELF CHECK

No. of questions attempted .....
No. of questions correct .....
Marks scored in percentage .....

Check your score! If your score is

> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
90-75%	GOOD WORK !	You can score good in the final exam.
74-60%	SATISFACTORY !	You need to score more next time.
< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.