

STUDYNEST | CLASS 11 PHYSICS QUESTION PAPER 1

Chapter 4: Laws of Motion

Maximum Marks: 40 | Suggested time: 60 minutes

Instructions: Answer all questions. Show calculation steps and units. Original practice paper, not an official examination.

Section A 1-mark questions - $8 \times 1 = 8$ marks

1. What measures translational inertia? [1]
2. Second law at constant mass? [1]
3. Do action-reaction forces act on one body? [1]
4. Momentum formula? [1]
5. Net force at equilibrium? [1]
6. Kinetic-friction direction? [1]
7. What provides centripetal force? [1]
8. Maximum static friction? [1]

Section B 2-mark questions - $6 \times 2 = 12$ marks

9. 5 kg under net force 20 N: a ? [2]
10. 0.2 kg changes velocity +10 to -5 m/s: Δp ? [2]
11. 10 kg resting on level floor, $g=9.8$: N ? [2]
12. 2 kg at 6 m/s in radius 3 m: force? [2]
13. 50 N for .2 s: impulse? [2]
14. Why does swimmer push water backwards? [2]

Section C 3-mark questions - $4 \times 3 = 12$ marks

15. 6 kg trolley pulled 30 N, friction 6 N: a ? [3]
16. 0.15 kg ball at 20 m/s stops in .05 s: average force? [3]
17. 10 kg block on frictionless 30° incline, $g=10$: a, N ? [3]
18. 2 kg at 5 m/s in radius 2.5 m: radial force? [3]

Section D 4-mark questions - $2 \times 4 = 8$ marks

19. 4 kg block released on frictionless 30° incline: speed after 3 s, $g=10$? [4]
20. 0.5 kg ball rebounds +12 to -8 m/s in .1 s: average force? [4]

End of question paper.

FORMULA AND EQUATION REFERENCE

Chapter-specific equations worth knowing

- Newton's second law: $F_{\text{net}}=ma$; momentum $p=mv$.
- Impulse: $J=F_{\text{avg}} \Delta t = \Delta p = m(v-u)$.
- Weight $W=mg$; on a level surface with no other vertical acceleration, $N=mg$.
- Kinetic friction magnitude $f_k=\mu_k N$; maximum static friction $f_{s,\text{max}}=\mu_s N$.
- On a frictionless incline: $a=g \sin(\theta)$; normal force $N=mg \cos(\theta)$.
- Centripetal force requirement: $F_c=mv^2/r$; the inward net force provides it.
- For constant acceleration: $v=u+at$; $s=ut+(1/2)at^2$.

Use each equation only when its assumptions apply; keep units consistent.

STUDYNEST

STEP-BY-STEP SOLUTIONS

Solutions are grouped here after the question paper and formula reference.

Question 1

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Mass.

Final answer: Mass.

Question 2

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: $F=ma$.

Final answer: $F=ma$.

Question 3

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: No.

Final answer: No.

Question 4

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: $p=mv$.

Final answer: $p=mv$.

Question 5

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Zero.

Final answer: Zero.

Question 6

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Opposes relative sliding.

Final answer: Opposes relative sliding.

Question 7

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: Inward resultant of actual forces.

Final answer: Inward resultant of actual forces.

Question 8

Principle / definition: Recall the relevant definition or equation from the formula reference.

Apply it to this question: $\mu_s N$.

Final answer: $\mu_s N$.

Question 9

Working: Newton's second law: $a=F_{\text{net}}/m=20/5=4 \text{ m/s}^2$.

Final answer: 4 m/s^2 .

Question 10

Working: Change in momentum $\Delta p=m(v-u)=0.2(-5-10)=0.2(-15)=-3 \text{ kg m/s}$.

Final answer: -3 kg m/s .

Question 11

Working: At rest on a level floor, vertical forces balance: $N=mg=10(9.8)=98 \text{ N}$.

Final answer: 98 N .

Question 12

Working: $F_c=mv^2/r=2(6^2)/3=72/3=24 \text{ N}$.

Final answer: 24 N .

Question 13

Working: Impulse $J=F \Delta t=50(0.2)=10 \text{ N s}$.

Final answer: 10 N s .

Question 14

Working: The swimmer pushes water backward. By Newton's third law, the water exerts an equal and opposite forward force on the swimmer.

Final answer: Water exerts a forward reaction.

Question 15

Working: Net horizontal force = $30 - 6 = 24$ N. Acceleration $a = F_{\text{net}}/m = 24/6 = 4$ m/s².

Final answer: 4 m/s².

Question 16

Working: $a = (v - u)/t = (0 - 20)/0.05 = -400$ m/s². Average force $F = ma = 0.15(-400) = -60$ N; the minus sign means opposite to the initial motion.

Final answer: -60 N.

Question 17

Working: Along the incline: $a = g \sin 30 = 10(0.5) = 5$ m/s². Normal force $N = mg \cos 30 = 100(0.866) = 86.6$ N.

Final answer: 5 m/s²; 86.6 N.

Question 18

Working: Radial force $F = mv^2/r = 2(5^2)/2.5 = 50/2.5 = 20$ N inward.

Final answer: 20 N inward.

Question 19

Working: Acceleration down the smooth incline is $a = g \sin 30 = 5$ m/s². Released from rest, $v = u + at = 0 + 5(3) = 15$ m/s.

Final answer: $a = 5$ m/s²; $v = 15$ m/s.

Question 20

Working: $\Delta p = m(v - u) = 0.5(-8 - 12) = 0.5(-20) = -10$ N s. Average force = $\Delta p / \Delta t = -10/0.1 = -100$ N, opposite the initial direction.

Final answer: $\Delta p = -10$ N s; force = -100 N.

STUDYNEST