

forces - practice problems

1. A 6 kg box has three horizontal forces on it: 18 N right, 10 N left, and 4 N right. What is the box's horizontal acceleration?

2. A 2500 g textbook rests on a flat table next to a pencil and notebook. What are the force of gravity and the normal force on the book?

3. An 80 kg person stands on a scale in an elevator accelerating upward at 150 cm/s^2 . The elevator display says floor 12, but the scale reading comes from the normal force. What normal force does the floor apply to the person?

4. A 60 kg person stands in an elevator accelerating downward at 2.0 m/s^2 . What normal force does the floor apply to the person?

5. A backpack weighs 735 N on Earth. What is its mass?

6. A 3000 g rock is taken to the Moon and to Mars. What is its weight on each world? Use 1.6 m/s^2 for the Moon and 3.711 m/s^2 for Mars.

7. A sample weighs 22.3 N on Mars, where gravity is 3.711 m/s^2 . What is the sample's mass?

8. A falling crate has a weight of 686 N downward and air resistance of 196 N upward. The crate is 1.2 m tall, but treat it as a single object. What is its mass and acceleration?

9. A skydiver has a mass of 70 kg and is falling at terminal velocity, so the acceleration is zero. What upward air resistance force acts on the skydiver?

10. A 10 kg box slides without friction on a 30° ramp. Find the force of gravity, the normal force, the downhill component of gravity, and the acceleration.

11. A 25 kg sled slides without friction down a 20° hill. Find the normal force and the acceleration down the hill.

12. A 16 kg object has 85 N downward, 22 N upward, 140 N left, 78 N right, and 55 N right acting on it. Find the horizontal and vertical acceleration.

13. A 4 kg lamp hangs motionless from a vertical cable. What is the tension in the cable?

14. A 15 kg crate is lifted upward by a rope with acceleration 1.2 m/s^2 . What is the tension in the rope?

15. A 20 kg box sits in an elevator moving upward at 3.0 m/s . What is the normal force on the box?

16. A 12 kg crate is lowered by a rope with acceleration 0.75 m/s^2 downward. What is the tension in the rope?

17. A dog pulls forward with 80 N while a leash pulls backward and upward at 45° . The dog is not accelerating. What is the total tension in the leash?

18. A 30 kg cart pulls a 10 kg cart with a rope on a frictionless floor. A 0.080 kN force pulls the 30 kg cart forward. What is the acceleration of the system and the tension in the rope?

19. A 5 kg cart pulls a 3 kg cart with a rope on a frictionless floor. Both accelerate left at 2 m/s^2 . What is the rope tension, and what applied force pulls the 5 kg cart left?

20. A 12 kg block on a frictionless table is connected by a massless rope over a pulley to a hanging 4 kg block. What is the acceleration and rope tension?

21. Two hanging masses are connected over a frictionless pulley. One mass is 8 kg and the other is 5 kg. What is the acceleration and rope tension?

22. Two hanging masses are connected over a frictionless pulley. One mass is 15 kg and the other is 9 kg. What is the acceleration and rope tension?

23. An 18 kg box is held at rest on a frictionless 25° ramp by a rope pulling up the ramp. What are the tension and normal force?

24. A 70 kg person stands on a scale in an elevator. The scale reads 0.735 kN. What is the elevator's acceleration?

25. A 100 kg package falls with 260 N of air resistance upward. What is its acceleration?

26. A 5000 g sign hangs at rest from two vertical ropes. The ropes share the force equally. What is the tension in each rope?

27. A 20 kg sled is pulled across frictionless ice by a rope with 100 N of tension at 30° above horizontal. What are the normal force and horizontal acceleration?

28. A 30 kg cart starts from rest on a frictionless floor. A rope pulls it horizontally with 90 N for 0.0667 min. What is the cart's acceleration, and how far does it move?

29. A 1200 kg car moving at 72 km/h must stop in 50 m. What constant net force is needed to stop it?

30. A 10 kg block on a frictionless 30° ramp is connected over a light pulley to a hanging 6 kg block. The ramp is 2.0 m long, but that length is not needed for the force calculation. Find the acceleration and the tension. The 6 kg block moves downward.