Forces in Action Questions – OCR A Level Physics

Praneel Physics

1. A 2.5 kg block rests on a horizontal table. Calculate the normal force acting on it. **(P)**

Answer: 24.5 N

2. A 5 kg object hangs vertically from a rope. What is the tension in the rope at rest? **(P)**

Answer: 49 N

3. A 4 kg box is pulled across a smooth horizontal surface at 30° to the horizontal with 20 N. Calculate the horizontal component of the force. **(P)**

Answer: 17.3 N

4. A 3 kg box is on a rough surface, with $\mu = 0.3$. Find the max static friction force. **(P)**

Answer: $\boxed{8.82 \text{ N}}$

5. A 10 kg light is suspended by two cables each angled 45° to the horizontal. Find the tension in each cable. **(P)**

Answer: $\boxed{69.3 \text{ N}}$

6. A 6 kg object is on a 20° slope. Calculate the component of its weight parallel to the slope. **(PP)**

Answer: 20.1 N

7. A crane lifts a 200 kg load vertically at constant velocity. Find the tension in the cable. **(PP)**

Answer: 1960 N

8. A 12000 N car rests on a 15° incline. Find the perpendicular contact force from the slope. **(PP)**

Answer: $\boxed{11589 \text{ N}}$

9. A 10 kg box is pushed across a floor with 40 N. $\mu_k = 0.2$. Find its acceleration. **(PP)**

Answer: $\boxed{2.04 \text{ m/s}^2}$

10. A ladder of weight 150 N leans against a smooth vertical wall at 60°. Find the normal force from the floor. **(PP)**

Answer: $\boxed{75 \text{ N}}$

11. A 2.5 kg mass hangs in equilibrium between two strings angled 60° and 45° to the ceiling. Calculate the tension in each string. **(PPP)**

Answer: $\boxed{\text{Tension 1} \approx 19.3 \text{ N, Tension 2} \approx 25.8 \text{ N}}$

12. A crate of 50 kg is pulled up a rough slope inclined at 25° with $\mu = 0.15$ by a rope parallel to the slope. Find the minimum force required to move it up at constant speed. **(PPP)**

Answer: 311.5 N

13. A 15 kg sign is supported by a horizontal beam hinged at a wall, with a support wire at 30° to the beam. Find the tension in the wire. **(PPP)**

Answer: 294 N

14. A 3 kg block is connected to a 2 kg hanging mass over a frictionless pulley. Find the acceleration of the system. **(PPP)**

Answer: $\boxed{1.96 \text{ m/s}^2}$

15. A 5 m uniform beam (mass 40 kg) is supported at both ends. A 20 kg mass is placed 1.5 m from the left support. Calculate the reaction forces at both supports. **(PPP)**

Answer: $\boxed{\text{Left: 288 N, Right: 104 N}}$

16. A spring extends by 8 cm under a 4 N load. What is the spring constant? Then calculate extension under 6 N. **(PP)**

Answer: 50 N/m; 0.12 m

17. A 60 kg climber hangs from a rope attached to a cliff. The rope is angled 20° to the horizontal. Find the tension. **(PPP)**

Answer: 171.7 N

18. A uniform rod of length 2 m and weight 200 N rests horizontally, supported at each end. A 300 N weight is placed 0.5 m from the left. Find the force at each support. **(PPP)**

Answer: Left: 400 N, Right: 100 N

19. A 1.5 m long uniform beam of weight 120 N is supported horizontally by a hinge at one end and a cable at the other end making a 45° angle above the horizontal. Find the tension in the cable. **(PPP)**

Answer: 85 N

20. A person of 70 kg stands 2 m from the left end of a 4 m long uniform plank of weight 200 N. The plank rests on two supports at its ends. Calculate the force at each support. **(PPP)**

Answer: Left: 735 N, Right: 145 N