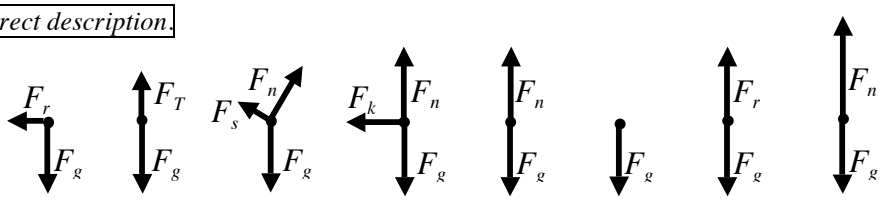
Dynamics Review Sheet

Match the Free Body Diagram with the correct description.

1. Book at rest on a level table
2. Freefalling body (no air friction)
3. Person on elevator accelerating up
4. Car skidding to rest (no air friction)
5. Mass #2 from Newton's 2nd Law Lab
6. Skydiver falling at terminal velocity
7. Mass at rest on incline, held by friction
8. Football at peak of path (with air friction)



Multiple choice. Circle the best answer.

9. A 60-kilogram skydiver is falling at constant speed near the surface of Earth. The magnitude of the force of air friction acting on the skydiver is
   A. 0 N
   B. 5.88 N
   C. 58.8 N
   D. 588 N

10. Two masses exert a gravitational force *F* on each other. If the mass of each is doubled and the distance between them is tripled, the force between them is:
   A. $12F$
   B. $\frac{4}{9}F$
   C. $\frac{3}{4}F$
   D. $\frac{4}{3}F$

11. A child is riding on a merry-go-round. As the speed of the merry-go-round is doubled, the magnitude of the centripetal force acting on the child
   A. remains the same
   B. is doubled
   C. is halved
   D. is quadrupled

12. A 1,200-kilogram car traveling at 10 meters per second hits a tree that is brought to rest in 0.10 second. What is the magnitude of the net force acting on the car to bring it to rest?
   A. 120 N
   B. 1200 N
   C. 12,000 N
   D. 120,000 N

13. A satellite is observed to move in a circle about the earth at a constant speed. This means that the force acting upon it is:
   A. zero
   B. opposite of the satellite's velocity
   C. perpendicular to the satellite's velocity
   D. parallel to the satellite's velocity

14. If the sum of all the forces acting on a moving object is zero, the object will
   A. slow down and stop
   B. change the direction of its motion
   C. accelerate uniformly
   D. continue moving with constant velocity

15. As a ball falls, the action force is the pull of the earth's mass on the ball. The reaction force is the
   A. air resistance acting against the ball.
   B. acceleration of the ball.
   C. pull of the ball's mass on the earth.
   D. non-existent in this case.

16. A net force of 10 newtons accelerates an object at 5 meters per second squared. What net force would be required to accelerate the same object at 1.0 meters per second squared?
   A. 1.0 N
   B. 2.0 N
   C. 5.0 N
   D. 50.0 N

17. (HONORS ONLY) A force applied to a 100-kilogram rocket gives it an upward acceleration 15 meters per second squared. The magnitude of the applied force is equal to:
   A. 520 N
   B. 1500 N
   C. 2480 N
   D. 14700 N

18. (HONORS ONLY) If a net force is applied to a 1000-kilogram car traveling at 38 meters per second, the car is brought to rest in 100 meters. If the braking force is doubled, what maximum speed can the car have and still come to rest in 100 meters?
   A. 53.7 m/s
   B. 76.0 m/s
   C. 26.9 m/s
   D. 19 m/s

Problem solving. Show all your work including general equation, substitutions, calculations & units.

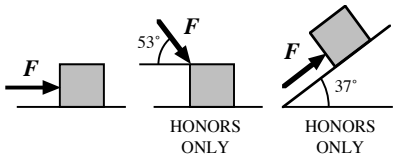
19. An advertisement claims that a certain 1060-kilogram car can be accelerated from rest to 80 kilometers per hour in 9.4 seconds. How large a net force must act on the car to give it this acceleration?

20. A rope pulls upward on a bucket weighing 54 newtons. The bucket is accelerating upward at 0.77 m/s^2. What is the tension in the rope?

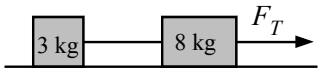
21. The gravitational field strength on the surface of the moon is 1.63 N/kg. An astronaut weighs 960 N on earth. (a) What is the astronaut's mass? (b) What does the astronaut weigh on the moon? (c) What is the astronaut's mass on the moon?

22. Two identical spherical balls are placed so their centers are 2.1 m apart. The force between them is 3.4×10^{-11} N. What is the mass of each ball?

23. A 6-kg block is pushed with an force F of 75 N, as shown in the drawings to the right. The coefficient of kinetic friction between the block and the surface is 0.22. What is the force of friction in each case, and what is the acceleration in each case?

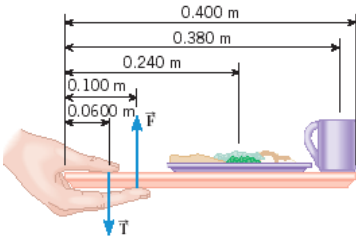


24. The tension in the rope used to pull the two blocks shown in the drawing to the right is 58 N. (a) Find the acceleration of the blocks if there is no surface friction. (b) Find the acceleration of the blocks if the coefficient of kinetic friction between the blocks and the surface is 0.33. (c) HONORS ONLY: Find the tension in the rope between the blocks, using the case of friction and no friction.



25. A 500 kg racecar travels at a constant speed around a circular track whose radius is 1.6 km. (a) If the car travels once around the track in 2.0 minutes, what is the magnitude of the centripetal acceleration of the car? (b) If the force of static friction from the road on the tires is 1200 N, how fast can the car travel around the track without slipping?

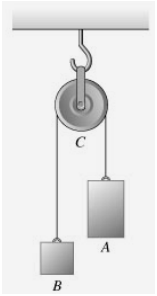
26. A lunch tray is being held in one hand, as shown. The mass of the tray itself is 0.28 kg, and its center of gravity is located at its geometrical center. On the tray is a 1.0-kg plate of food and a 0.295-kg cup of coffee. Find the force ***T*** exerted by the thumb and the force ***F*** exerted by the four fingers.



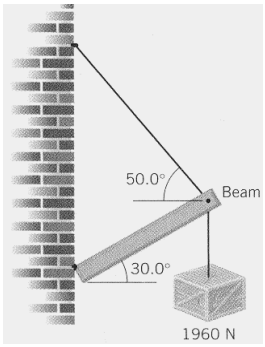
27. Our solar system is in the Milky Way galaxy. The nearest galaxy is Andromeda, a distance of 2 x 10^{22} m away. The masses of the Milky Way and Andromeda galaxies are 7 x 10^{41} kg and 6 x 10^{41} kg, respectively. Treat the galaxies as particles and find the magnitude of the gravitational force exerted on the Milky Way by the Andromeda galaxy.

28. Titan, a moon of Saturn, has on orbital period of 15.95 days and an orbital radius of 1.22 x 10^9 m. From this data, determine the mass of Saturn.

29. A device called *Atwood's Machine*, shown in the drawing to the right, can be used to determine g, the gravitation field strength. Mass A = 5.1 kg, mass B = 2.7 kg, and the pulley C is massless. If a student measures the acceleration of the system as 3.0 m/s^2, what is the student's measured value for g?



30. HONORS ONLY: A 1220 N uniform beam is attached to a vertical wall at one end and is supported by a cable at the other end. A 1960 N crate hangs from the far end of the beam. Use the data shown in the drawing to the right. (a) Find the magnitude of the tension in the wire. (b) Find the magnitude of the horizontal and vertical components of the force that the wall exerts on the left end of the beam.



Answers

1 E **2** F **3** H **4** D **5** B **6** G **7** C **8** A **9** D **10** B **11** D **12** D **13** C **14** D **15** C **16** B **17** C **18** A **19** 2506 N **20** 58.2 N **21** (a) 98 kg (b) 160 N (c) 98 kg **22** 1.50 kg **23** (a) 12.9 N, 10.3 m/s^2 right (b) 26.1 N, 3.17 m/s^2 right (c) 10.3 N, 4.88 m/s^2 up **24** (a) 5.27 m/s^2 (b) 2.04 m/s^2 (c) 15.8 N for both **25** (a) 4.39 m/s^2 (b) 62.0 m/s **26** 61.4 N, 76.8 N **27** 7.0 x 10^{28} N **28** 5.66 x 10^{26} kg **29** 9.75 m/s^2 **30** 2260, 1453, 1449 N