

Elements of Physics

Test 2 practice questions

1. Earth's gravity attracts a person with a force of 120 lbs. What is the force with which the Earth is attracted towards the person?
2. For reasons known only to them, a group of extraterrestrials offers you your choice of three gold ingots. One weighs 10 lb on Earth, the second weighs 10 lb on Jupiter, and the third weighs 10 lb on the Moon. On which planet should you choose the ingot that weighs 10 lb in order to get the most gold?
3. There are three vector quantities: centripetal force, velocity, and centripetal acceleration, associated to an object in uniform circular motion. Which pair of these three vectors is perpendicular?
4. Six identical blocks of steel, each with mass 10.0 kg, are taken to the Moon. What is their combined mass on the Moon?
5. Two cars that have the same mass are moving around a circular track at the same constant speed. The track is perfectly level. If car 1 is at the inner edge of the track and car 2 is at the outer edge, then explain why the frictional force (acting as centripetal force) on car 1 is greater than the frictional force on car 2.
6. A cyclist races around a circular track at the constant speed of 20 m/s. The radius of the track is 50 m. Find the acceleration of the cyclist.
7. A car travels around a curve with constant speed. Then what is the direction of the acceleration of this car?
8. Car A travels with speed v around curve number one, which has a radius r . Car B travels with speed $2v$ around curve number two, which has a radius $2r$. How many times is car A's acceleration bigger than that of car B?
9. According to Newton's Law of Gravitation, if the distance between two bodies is doubled by what factor the attractive force between them get smaller? Try to show a calculation.
10. Consider a circular racing track. Two cars are simultaneously circling around this track, one clockwise, and the other one counterclockwise. What is the direction of the centripetal acceleration (or force) on each car? (See also problem # 13 below)
11. If a curve is banked to accommodate cars traveling at 15 m/s, what will happen during an ice storm (no friction with the road) to a car moving at a slower speed?
12. Two cyclists of different mass take a turn on a level road. They follow the same path and are moving the same constant speed for the turn. What can you say about the relative sizes of their centripetal acceleration (or force)?
13. If two bicyclists move around a circular track of radius 100 m, at the same speed, 10 m/s, but in opposite directions, find the magnitude of the accelerations of both bicyclists.

14. Acceleration due to gravity is 9.8 m/s^2 on the surface of Earth, and at orbits 200 miles above the surface of Earth, where the space shuttle orbits, the acceleration is (choose one) less than, greater than, or equal to 9.8 m/s^2 .
15. A brick of mass 4 kg moving with a constant velocity of 2.5 m/s and suddenly enters and slides across a horizontal rough surface and eventually comes to a stop. Compute the initial and the final kinetic energy of the block. Is there a loss of energy? If yes, then what happened to the lost kinetic energy of the brick?
16. Name a quantity (property) possessed by a moving object, but not by a stationary object?
17. Which has the greater kinetic energy—a 1-ton car moving at 30 m/s or a half-ton car moving at 60 m/s?
18. When work is done by a force on an object, then is it true that the work done is equal to the change of total energy of the object plus any energy appearing as heat, light, or sound.?
19. -----
20. Jim exerts a (horizontal) force of 500 N against a 100-kg desk and the desk does not move. Virgil exerts a force of 400 N against a 60-kg desk and moves it 2 m in the direction of the push. Mike exerts a force of 200 N against a 50-kg desk and moves it 4 m in the direction of the push. Who has done the most work?
21. Suppose you climb the stairs of a ten-story building, each story is about 30 m high, and your mass is 70 kg. How much potential energy did you gain?
- 22.. Virgil rides a skateboard (combined mass 100 kg) at 4 m/s, and Jill rides a bicycle (combined mass 64 kg) at 5 m/s. Who has greater kinetic energy?
23. An object with a kinetic energy of 50 J is stopped in a distance of 0.01 m. Find the force that stops the object. (Hint: use work-energy theorem: work done = change in kinetic energy to find the work then use formula for work to find the force.)
24. How much energy is needed for a 0.1-kg frog to jump to a height of 1.0 meter?
25. -----
26. A box is pushed across a rough horizontal floor by a force acting parallel to the floor in the direction of motion. Is it the force of gravity or the friction force or both which doing no work during the motion? Why?
27. Find the potential energy of a spring of constant 342 N/m that has been stretched a distance of 28 cm from its equilibrium.
28. A ball at the end of a string is swinging as a simple pendulum. Assuming no loss in energy due to friction, at what position is the potential energy of the ball maximum, and where is its kinetic energy maximum?

30. Suppose you are stranded on a frozen lake, where there is no friction. What would you do to make yourself to move toward the shore? What physics principle do you use?
31. A bowling ball of mass 16 kg, moving to the east at a speed of 1.4 m/s, collides head-on with a stationary volleyball of the same diameter but with a mass of 0.75 kg. After the collision, the volleyball moves with a speed of 6 m/s. How fast and to what direction will the bowling ball move? (Use conservation of momentum)
32. What is the quantity which is conserved in the collision of a car and a truck?
33. Force F , acting for time T and over a distance D , gives impulse I . For how long must half of this force to act to produce the same impulse?
34. Two people sit face to face on nice skateboards that are free to roll without friction. They push each other with a force of 50 N and move apart. Person X, whose mass (including the skateboard) is 80 kg, moves to the left at a speed of 3 m/s. With what speed and to what direction will Person Z, whose mass (including the skateboard) is 60 kg, move?
35. A 25-kg child runs at 4.0 m/s and jumps onto a shopping cart and holds on for dear life. The cart has mass 15 kg. Assuming the child rides on the cart after the collision. Find the speed of the child and shopping cart just after the child jumps on it.
36. A painter of mass 80 kg climbs 3.0 m up a ladder in 8 seconds at a constant rate. What is the momentum gained by the painter? (Hint: find the velocity first then the momentum)
37. Suppose two boys are trapped on the ice atop a frozen pond, and that the ice is completely frictionless. The boys are initially at rest and apart so they can not reach each other, but they do have a baseball. They begin to play catch with the ball. What will happen if they play this game long enough?
38. -----
39. A racquetball is dropped from a height of one meter. It bounces off the floor and rises to a height of 0.8 m. What kind of collision is the collision with the floor? Explain why.
40. A toy car and a toy truck at rest have a compressed spring in between them. The truck has more mass than the car. The spring is released and the two cars move in opposite directions. Do their momentum have the same magnitude? (Hint: use conservation of momentum). What can you say about their energies
41. -----
42. It is a fact that distance between the earth and the moon is increasing. When the distance between the earth and the moon reaches twice as much it is now, then what will be the force of gravity between the earth and the moon?