Conceptual Physics Semester I Midterm Prep Package

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Energy is changed from one form to another with no net loss or gain.
a. Sometimes true
b. Always false
c. Always true

____ 2. As a pendulum swings back and forth
a. at the end points of its swing, its energy is all potential.
b. at the lowest part of its swing, its energy is all kinetic.
c. kinetic energy is transformed into potential energy.
d. potential energy is transformed into kinetic energy.
e. all of the above

____ 3. An object that has kinetic energy must have
a. acceleration.
b. a force applied to maintain it.
c. momentum.
d. none of the above

____ 4. Mechanical energy can be in the form of
a. kinetic energy.
b. potential energy.
c. both kinetic and potential energy.
d. neither kinetic nor potential energy.

____ 5. Suppose an object is in free fall. Each second the object falls
a. the same distance as in the second before.
b. a larger distance than in the second before.
c. with the same instantaneous speed.
d. with the same average speed.
e. none of the above

____ 6. A ball is thrown straight up. At the top of its path its acceleration is
a. 0 m/s^2.
b. about 5 m/s^2.
c. about 10 m/s^2.
d. about 20 m/s^2.
e. about 50 m/s^2.

____ 7. In order to increase the final momentum of a golf ball, we could
a. increase the force acting on it.
b. follow through when hitting the ball.
c. increase the time of contact with the ball.
d. swing as hard as possible.
e. all of the above

____ 8. Which of the following has the largest momentum?
a. A large truck parked in a parking lot

b. A tightrope walker crossing Niagara Falls
c. The science building at your school
d. A pickup truck traveling down the highway
e. A dog running down the street

____ 9. Two objects, A and B, have the same size and shape, but A is twice as heavy as B. When they are dropped simultaneously from a tower, they reach the ground at the same time, but A has a higher
a. acceleration.
b. momentum.
c. speed.
d. all of the above
e. none of the above

____ 10. A table tennis ball moving forward with 5 units of momentum strikes and bounces backward off a heavy bowling ball that is initially at rest and free to move. The bowling ball is set in motion with a momentum of
a. less than 5 units.
b. 5 units.
c. more than 5 units.
d. not enough information.

____ 11. Compared to its weight on Earth, a 10-kg object on the moon will weigh
a. the same amount.
b. less.
c. more.

____ 12. Which of the following would exert the most pressure on the ground?
a. A woman standing in running shoes
b. A woman standing on skis
c. A woman standing in high-heel shoes

____ 13. Bronco the skydiver falls toward Earth. The attraction of Earth on Bronco pulls him down. The reaction to this force is
a. Bronco finally pushing against Earth's surface.
b. Bronco pulling up on Earth.
c. Earth's surface finally pushing against Bronco.
d. neither A, B, nor C

____ 14. Two people pull on a rope in a tug-of-war. Each pulls with 400 N of force. What is the tension in the rope?
a. 0 N
b. 400 N
c. 600 N
d. 800 N
e. none of the above

____ 15. A scalar is a quantity that has
a. direction.
b. magnitude.
c. time.
d. color.

____ 16. When representing velocity as a vector,
a. the direction of the arrow shows the direction of motion.
b. the length of the arrow represents the speed.

c. the length of the arrow is drawn to a suitable scale.
d. all of the above
e. none of the above

____ 17. At what part of a path does a projectile have minimum speed?
a. When it returns to the ground
b. Halfway to the top
c. At the top of its path
d. When it is thrown
e. There's not enough information to say.

____ 18. Which best approximates the resultant of a pair of 6-unit vectors at right angles to each other?
a. 0 units.
b. 6 units.
c. 8 units.
d. 12 units.

____ 19. What is the resultant of a 3-unit vector and 4-unit vector at right angles to each other?
a. 1 unit.
b. 5 units.
c. 7 units.
d. none of the above

Essay

20. Write a short paragraph explaining the difference between speed and velocity, and give examples of both.

21. Suppose you are on an airplane moving at high speed. If you flip a coin straight up it will land in your lap rather than a great distance behind you. Explain.

Problem

22. What is the work done in lifting 60 kg of blocks to a height of 20 m?

23. What amount of work is done on a chair that is pushed 9 m across a floor by a horizontal 30-N net force?

24. A toy cart moves with a kinetic energy of 10 J. If its speed is doubled, what will its kinetic energy be?

25. A car traveling at 50 km/h will skid 20 m when its brakes are locked. If the same car is traveling at 150 km/h, what will be its skidding distance?

26. What amount of work can a 600-W motor do in 4 minutes?

27. A couch potato might consume 7 million J of energy in a day. What is this rate of energy consumption in watts?

28. A 30-kg girl runs up the staircase to a floor 5 m higher in 8 seconds. What is her power output?

29. At what height does a 1000-kg mass have a potential energy of 1 J relative to the ground?

30. The 4.0-kg head of an ax is moving at 4.0 m/s when it strikes a log and penetrates 0.01 m into the log. What is the average force the blade exerts on the log?

31. An anvil hanging vertically from a long rope in a barn is pulled to the side and raised like a pendulum 1.60 m above its equilibrium position. It then swings to its lowermost point where the rope is cut by a sharp blade. The anvil then has a horizontal velocity with which it sails across the barn and hits the floor, 10.0 m below. How far horizontally along the floor will the anvil land?

32. A jet on an aircraft carrier can be launched from 0 to 40 m/s in 2 seconds. What is the acceleration of the jet?

33. An apple falls from a tree and 0.5 second later hits the ground. How fast is the apple falling when it hits the ground?

34. What speed must you toss a ball straight up so that it takes 4 s to return to you?

35. You toss a ball at 5 m/s straight upward. How much time will the ball take to reach the top of its path?

36. What is the hang time of a person who can jump a vertical distance of 0.6 m?

37. What vertical distance can a person with a 0.7 s hang time jump?

38. How much time does a car with an acceleration of 5 m/s^2 take to go from 5 m/s to 40 m/s?

39. A crate falls from an airplane flying horizontally at an altitude of 1250 m. Neglecting air drag, how long will the crate take to strike the ground?

40. If a projectile fired beneath the water, straight up, breaks through the surface at a speed of 13 m/s, to what height above the water will it ascend?

41. A stone is dropped from a cliff. After it has fallen 10 m, what is the stone's velocity?

42. What is the average momentum of a 50-kg skateboarder who covers 400 m in 50 s?

43. A 10-kg cement block moving horizontally at 6 m/s plows into a bank of sand and comes to a stop in 2 s. What is the average impact force on the bank?

44. A 5-kg blob of clay moving horizontally at 4 m/s has a head-on collision with a 4-kg blob of clay that moves toward it at 2 m/s. What is the speed of the two blobs stuck together immediately after the collision?

45. A 10-kg bowling ball moving at 4 m/s bounces off a spring at about the same speed that it had before bouncing. What is the change in momentum of the bowling ball?

46. A loaded freight car has 5 times as much mass as an empty freight car. If the loaded car coasts at 5 m/s and collides with and attaches to the empty car at rest, what will be the speed of both cars after collision?

47. A 50-kg cart moving at 100 km/h collides head-on with an approaching 50-kg cart moving at 10 km/h (in the opposite direction). If the two carts stick together, what will be their speed?

48. A 30-kg girl and a 50-kg boy face each other on friction-free roller skates. The girl pushes the boy, who moves away at a speed of 3 m/s. What is the girl's speed?

49. A 70-kg free-floating astronaut fires 0.10-kg of gas at a speed of 30 m/s from her propulsion pistol. What is the astronaut's recoil speed?

50. Assume that a 15-kg ball moving at 8 m/s strikes a wall perpendicularly and rebounds elastically at the same speed. What is the amount of impulse given to the wall?

51. A person weighs 650 N. What is the mass of the person?

52. On the surface of Jupiter, the acceleration due to gravity is about 3 times that of Earth. What would be the mass of a 170-kg rock on Jupiter?

53. You push with 27 N on a 10-kg chest, and there is a 7-N force of friction. How fast will the chest accelerate?

54. A 400,000-kg airplane in takeoff uses the 40,000 N thrust of each one of its four engines. What is the acceleration of the plane during takeoff?

55. An unbalanced force of 30 N gives an object an acceleration of 6.0 m/s^2. What force would be needed to give it an acceleration of 1.0 m/s^2?

56. A certain unbalanced force gives a 20-kg object an acceleration of 2.0 m/s^2. What acceleration would the same force give a 30-kg object?

57. A net force of 1.0 N acts on a 4.0-kg object, initially at rest, for 4.0 seconds. What is the distance the object moves during that time?

58. Suppose that you exert 300 N horizontally on a 50-kg crate on a factory floor, where friction between the crate and the floor is 100 N. What is the acceleration of the crate?

59. A 20-kg block of cement is pulled upward (not sideways!) with a force of 400 N. What is the acceleration of the block?

60. Bronco the skydiver, whose mass is 80 kg experiences 200 N of air resistance. What is the acceleration of his fall?

61. If you push off the ground with a force of 350 N when you jump upward, what force pushes Earth downward?

62. A pair of blocks, one 2 times as massive as the other, are connected by a compressed spring. When the spring is released, the blocks fly apart. Compared to the heavier block, how many times as fast does the lighter block accelerate?

63. A 60-kg person on in-line skates pushes against a wall with a force of 30 N and recoils. What acceleration does that person experience?

64. A fighter punches a sheet of paper in midair, and brings it from rest up to a speed of 40 m/s in 0.08 s. What is the force of impact on the paper if the mass of the paper is 0.01 kg?

65. What engine thrust (in newtons) is required for a rocket of mass 35 kg to leave the launching pad?

66. A motorboat is driven across a river at 3.0 km/h at right angles to a current that is flowing at 10.0 km/h. What is the resulting speed of the motorboat?

67. A package falls out of a helicopter that is traveling horizontally at 70 m/s. It falls into the water below 8.0 seconds later. Assuming no air resistance, what is the horizontal distance it travels while falling?

68. Kyle throws a ball horizontally from the top of a building that is 5.0 m high. He hopes the ball will reach a swimming pool that is at the bottom of the building, 12.0 m horizontally from the edge the building. If the ball is to reach the pool, with what initial speed must Kyle throw it with?

69. An airplane whose airspeed is 295 km/h flies parallel to the direction of a wind with a speed of 40.0 km/h. What are the two possible speeds of the plane relative to the ground?

70. Consider an escalator at an angle of 45° above the horizontal that moves with a velocity of 2.0 m/s. What is the horizontal component of the escalator's velocity?

71. A ball is thrown horizontally from the top of a tall cliff. Neglecting air drag, what vertical distance has the ball fallen 2.0 seconds later?

72. A projectile shot with an initial velocity of 51 m/s at an angle of 45° follows a parabolic path and hits a stationary balloon at the top of its trajectory. With what speed does the projectile hit the balloon?

73. A ball is thrown upward. Its initial vertical component of velocity is 30 m/s, and its initial horizontal component of velocity is 10 m/s. What are the horizontal and vertical components of the ball’s velocity 5 s later?

74. In a standing jump, the hang time of a certain athlete is 0.8 second. What is her hang time when she jumps the same height while moving horizontally?