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Assigned Seat Number

Agin/Morgan PH2100 0A/0B

Exam II

Spring 2003
Serway, Chapters 6-10

Part I: Qualitative

Write the letter of the correct answer on the answer sheet.

NO PARTIAL CREDIT: SUBMIT ONE ANSWER ONLY.

Note that in qualitative multiple-choice questions, sometimes one answer is clearly correct, while the others are clearly incorrect. However, with some questions you must choose the best or most complete answer.

Note also that even though this section is qualitative, the formula sheet may prove useful for some questions.

20 questions at 3 points each = 50 % of test

1. For an object to execute ***uniform circular motion***, it must have

(a) a tangential force acting on it.
(b) an inward radial force acting on it.
(c) an outward radial force acting on it.
(d) both a tangential and radial force acting on it.

2. Which force is responsible for holding a car on the road in a ***frictionless, banked curve***?

(a) The vertical component of the car's weight.
(b) The vertical component of the normal force on the car.
(c) The horizontal component of the car's weight.
(d) The horizontal component of the normal force on the car.

3. Which force is responsible for holding a car on the road in an ***unbanked curve***?

(a) The car's weight.
(b) The frictional force.
(c) The vertical component of the normal force on the car.
(d) The horizontal component of the normal force on the car.

4. A car rounds curve with a constant radius, and the speed of the car is increasing. The car has

(a) a tangential acceleration but not a centripetal acceleration.
(b) a centripetal acceleration but not a tangential acceleration.
(c) both a tangential acceleration and a centripetal acceleration.
(d) neither a tangential acceleration nor a centripetal acceleration.

5. The definition of work leads to the principle of the conservation of

(a) mass (b) energy (c) linear momentum (d) impulse

6. The ***work-energy theorem*** is generally written as $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$. In this equation, *W* is

(a) the total work done by all the forces acting on mass *m*.
(b) the work done by all the conservative forces acting on mass *m*.
(c) the work done by all the nonconservative forces acting on mass *m*.
(d) the work done by gravity on mass *m*.

7. ***Power*** is

(a) the total amount of work done.
(b) the rate at which work is done.
(c) the total amount of energy an object possesses.
(d) the sum of the kinetic and potential energy of an object.

8. Which of the following statements about kinetic energy is true?

(a) It is never negative.
(b) It is always equal to the potential energy.
(c) It is a quantitative measure of inertia.
(d) It is directly proportional to the speed of an object.

9. Which of the following situations represents a ***decrease*** in gravitational potential energy?

(a) A boy climbs a hill.
(b) A man pushes a box up an incline.
(c) A bomb is dropped from a plane.
(d) A car accelerates from 0 to 60 mph on a horizontal surface.

10. A golf ball and a ping-pong ball are dropped in a vacuum chamber. When each has fallen halfway down, they have the same

(a) velocity (b) potential energy
(c) kinetic energy (d) linear momentum

11. ***Mechanical energy*** remains constant

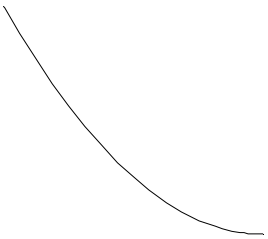
(a) when both conservative and nonconservative forces are present.
(b) when conservative forces are present but nonconservative forces are absent.
(c) when nonconservative forces are present but conservative forces are absent.
(d) only when neither conservative nor nonconservative forces are present.

12. A ball is thrown straight up from the surface of the earth. During its rise upward, which of the following statements is ***true***?

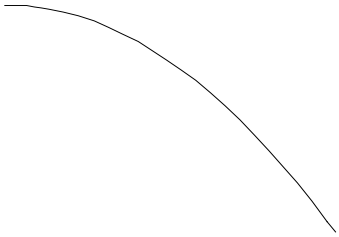
(a) Its kinetic energy increases, while its potential energy decreases.
(b) Its potential energy increases, while its kinetic energy decreases.
(c) Both its kinetic energy and potential energy increase.
(d) Both its kinetic energy and potential energy decrease.

13. A certain playground has three slides of different shapes as shown. Each starts at the same height above the ground, and each stops at ground level. A young child slides down each slide. Neglecting friction, which slide will give him the greatest speed at the bottom of the slide?

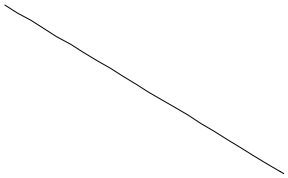
(a)



(b)



(c)



(d) His speed is the same for each slide.

14. What can be said about the conservation of linear momentum for a system of objects?

(a) It is always conserved.
(b) It is conserved only when the net external force on the system is zero.
(c) It is conserved only when the energy of the system is also conserved.
(d) It is conserved only when there is no gravitational force on the system.

15. An ***elastic*** collision conserves

(a) both kinetic energy and linear momentum
(b) kinetic energy but not linear momentum
(c) linear momentum but not kinetic energy
(d) neither kinetic energy nor linear momentum

16. An ***inelastic*** collision conserves

(a) both kinetic energy and linear momentum
(b) kinetic energy but not linear momentum
(c) linear momentum but not kinetic energy
(d) neither kinetic energy nor linear momentum

17. Suppose a body free to rotate about a fixed axis is experiencing a net torque. What ***must*** the body have?

(a) A constant angular velocity
(b) A constant angular acceleration
(c) A changing angular velocity
(d) A changing angular acceleration

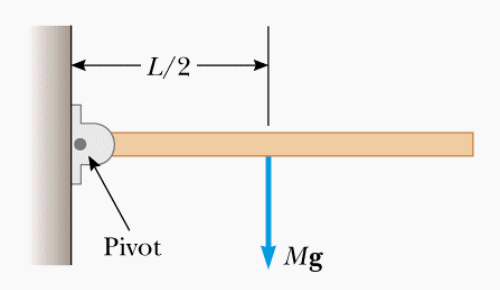
18. Consider a slender rod. Compare its moment of inertia when it rotates about one end to its moment of inertia when it rotates about its center of mass.

(a) They are equal.
(b) The moment of inertia is greater when rotation is about the CM.
(c) The moment of inertia is greater when rotation is about the end.
(d) The relationship cannot be determined from the given information.

19. A bird spots a physics teacher in an amusement park. The teacher is on a ride where he goes around at constant angular velocity ω at distance R from the center. The bird flies in a horizontal circle directly above him. Will a dropping the bird releases while flying directly above the physics teacher's head hit him?

(a) Yes, because it falls straight down.
(b) No, because it falls straight down and will land behind the teacher.
(c) Yes, because it maintains the angular velocity of the bird as it falls.
(d) No, because it maintains the tangential velocity the bird had at the instant it started falling.

20. A uniform rod of length L and mass M is attached at one end to a frictionless pivot and is free to rotate about the pivot in the vertical plane as shown. The rod is released from rest in a horizontal position.



Which of the following statements is ***TRUE***?

(a) The ***angular acceleration*** is constant as it rotates downward.
(b) The ***torque*** is constant as it rotates downward.
(c) When the rod is at 45° from the horizontal, the ***torque*** on it has increased.
(d) When the rod is at 45° from the horizontal, the ***torque*** on it has decreased.

Part II: Quantitative

Write the letter of the correct answer on the answer sheet. Use the backs of these test pages for scratch work.

<u>PARTIAL CREDIT POSSIBLE</u>: Select one (1), two (2), or three (3) choices.

6 points for the single correct answer
4 points if correct answer is among two choices
2 points if correct answer is among three choices
0 if correct answer not present or of more than 3 answers are submitted

10 questions at 6 points each = 50 % of test

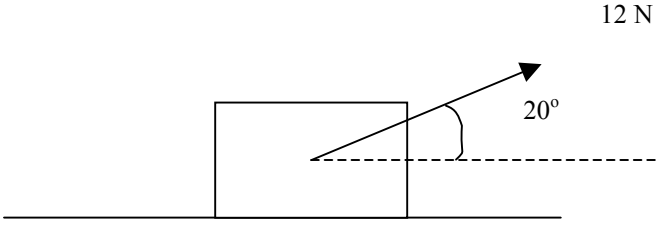
21. A toy cart at the end of a string 0.70 m long moves in a circle on a table. The cart has a mass of 2.0 kg and the string has a breaking point of 40 N. The maximum speed for the motion of the cart is

(a) 1.9 m/s
(b) 3.7 m/s
(c) 12 m/s
(d) 17 m/s
(e) 17 ms

22. A 0.50-kg rock attached to the end of a string swings in a vertical circle of radius 2.0 m. When the rock is at the lowest point on the circle, its speed is 12 m/s. What is the tension in the string at this point?

(a) 23 N
(b) 31 N
(c) 36 N
(d) 41 N
(e) 46 N

23. A force of 12.0 N is exerted on a box at an angle of 20.0° with the horizontal. How much work is done by this force as the box moves through a horizontal distance of 3.00 m?



(a) 12.3 J
(b) 33.8 J
(c) 36.0 J
(d) 38.3 J
(e) 42.6 J

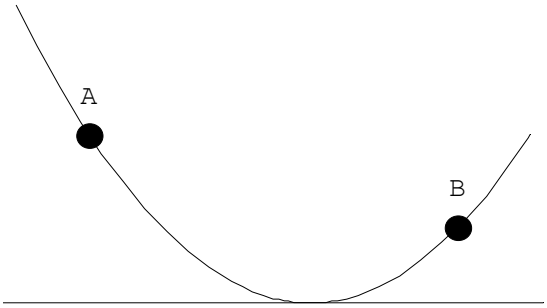
24. At one instant a 2.00-kg particle has a speed of 10.0 m/s. At a later instant, it has a speed of 15.0 m/s. How much work has been done on this particle by all the forces acting on it?

(a) 85 J
(b) 95 J
(c) 105 J
(d) 125 J
(e) 135 J

25. A roller coaster starts from rest at the top of a hill 18 m high. It travels to the bottom of the hill and then continues up the next hill 10 m high. How fast is the roller coaster moving at the top of this second hill, neglecting friction?

(a) 6.4 m/s
(b) 8.1 m/s
(c) 13 m/s
(d) 18 m/s
(e) 27 m/s

26. The figure shows two positions of a bead sliding along a stiff wire track. The bead is released from rest at point *A* and comes to a stop (momentarily) at point *B*. The heights of these points above the horizontal are 50.0 cm and 30.0 cm, respectively. The length of the wire between them is 400 cm. If the bead is 3.00 g and the frictional force is approximately constant throughout the motion, find the value of this frictional force. Watch your units!



(a) 3.83×10^{-2} N
(b) 6.72×10^{-2} N
(c) 1.02×10^{-3} N
(d) 1.47×10^{-3} N
(e) 2.76×10^{-3} N

27. A 2.0-kg gun fires a 10-g bullet at a speed of 1000 m/s. What is the magnitude of the recoil velocity of the gun?

(a) 50 m/s
(b) 20 m/s
(c) 5.0 m/s
(d) 0.50 m/s
(e) 0.05 m/s

28. A 70.0-kg boy and a 50.0-kg girl are sliding on frictionless ice. The are approaching each other at right angles, each with a speed of 6.00 m/s. After colliding they hold on to one another. What is their new speed?

(a) 2.50 m/s
(b) 3.50 m/s
(c) 4.30 m/s
(d) 7.20 m/s
(e) 8.50 m/s

29. A wheel is spinning at 47 rad/s when it undergoes a constant angular acceleration of 0.72 rad/s^2. If the acceleration lasts for 140 revolutions, what is the final angular speed?

(a) 51 rad/s
(b) 59 rad/s
(c) 64 rad/s
(d) 69 rad/s
(e) 72 rad/s

30. Four identical spherical balls of negligible radius have a mass of 2.00 kg each. They are connected to form a square by thin rods of negligible mass and length 3.00 m. The system is to rotate about a fixed axis along one of its diagonals. What torque must be applied to give this system an angular acceleration of 2.00 rad/s^2?

(a) 2.12 N•m
(b) 9.00 N•m
(c) 18.0 N•m
(d) 36.0 N•m
(e) 72.0 N•m