Phys.12- Q2W1- Test 1- Circular Motion and Gravitation

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

A child rides a bicycle in a circular path with a radius of 2.0 m. The tangential speed of the bicycle is 2.0 m/s. The combined mass of the bicycle and the child is 43 kg.

_____ 1. What is the magnitude of the centripetal force on the bicycle?
  a. 86 N
  b. 4.0 N
  c. 3.7 kN
  d. 43 N

_____ 2. If you want to open a swinging door with the least amount of force, where should you push on the door?
  a. It does not matter where you push.
  b. close to the hinges
  c. as far from the hinges as possible
  d. in the middle

_____ 3. What quantity measures the output force of a machine relative to the input force?
  a. efficiency
  b. leverage
  c. torque
  d. mechanical advantage

_____ 4. Newton's law of universal gravitation
  a. is equivalent to Kepler's first law of planetary motion.
  b. can be used to derive Kepler's third law of planetary motion.
  c. can be used to disprove Kepler's laws of planetary motion.
  d. does not apply to Kepler's laws of planetary motion.

_____ 5. A ball is whirled on a string, then the string breaks. What causes the ball to move off in a straight line?
  a. centripetal force
  b. centrifugal force
  c. centripetal acceleration
  d. inertia

_____ 6. What is the efficiency of a machine that requires 1.00×10^2 J of input energy to do 35 J of work?
  a. 29%
  b. 65%
  c. 2.9%
  d. 35%

_____ 7. The centripetal force on an object in circular motion is
  a. in the plane of the object's motion and in the same direction as the tangential speed.
  b. in the plane of the object's motion and in the direction opposite the tangential speed.
  c. in the plane of the object's motion and perpendicular to the tangential speed.
  d. perpendicular to the plane of the object's motion.

_____ 8. Suppose a doorknob is placed at the center of a door. Compared with a door whose knob is located at the edge, what amount of force must be applied to this door to produce the torque exerted on the other door?
  a. one-half as much
  b. one-fourth as much
  c. four times as much
  d. two times as much

_____ 9. An iron bar is used to lift a slab of cement. The force applied to lift the slab is 4.0×10^2 N. If the slab weighs 6400 N, what is the mechanical advantage of the bar?
  a. 16
  b. 6000
  c. 6.3%
  d. 1.6

_____ 10. What quantity measures the work done by a machine relative to the work done on a machine?
  a. mechanical advantage
  b. leverage
  c. torque
  d. efficiency

_____ 11. If the torque required to loosen a nut on a wheel has a magnitude of 40.0 N•m and the force exerted by a mechanic is 133 N, how far from the nut must the mechanic apply the force?
  a. 30.1 cm
  b. 15.0 cm
  c. 60.2 cm
  d. 1.20 m

_____ 12. Which of the following can be a centripetal force?
  a. tension
  b. friction
  c. gravity
  d. all of the above

____ 13. When an object is moving with uniform circular motion, the object's tangential speed
    a. is directed toward the center of motion.
    b. is circular.
    c. is constant.
    d. is perpendicular to the plane of motion.

____ 14. The degree to which an object attracts other objects is measured by the object's
    a. gravitational field strength.   c. weight.
    b. inertial mass.   d. gravitational mass.

____ 15. An object's tendency to resist acceleration is measured by the object's
    a. gravitational field strength.   c. inertial mass.
    b. gravitational mass.   d. weight.

Problem

16. A bucket filled with water has a mass of 33 kg and is attached to a rope wound around a cylinder with a radius of 0.043 m at the top of a well. What torque does the weight of the water and bucket produce on the cylinder? $(g = 9.81 \text{ m/s}^2)$

    A- 10 N.m
    B- 12 N.m
    C- 14 N.m
    D- 16 N.m

17. A new planet is discovered orbiting a star with a mass 3.5×10^{31} kg at a distance of 1.2×10^{11} m. Assume that the orbit is circular. What is the orbital speed of the planet? $(G = 6.673 \times 10^{-11} \text{ N•m}^2/\text{kg}^2)$

    A- 0.4 x 10^5 m/s
    B- 1.4 x 10^5 m/s
    C- 2.4 x 10^5 m/s
    D- 3.4 x 10^5 m/s

18. A satellite in a circular orbit experiences a centripetal acceleration of 8.89 m/s^2. The tangential speed of the satellite is 7.76×10^3 m/s. What is the altitude of the satellite? $(r_E = 6.38 \times 10^6$ m$)$

    A- 290 km
    B- 390 km
    C- 490 km
    D- 590 km

19. A boy can raise a rock that weighs 95 N by using a lever and applying a force of 17 N. What is the mechanical advantage of the lever?

    A. 2.6
    B. 3.6
    C. 4.6
    D. 5.6

20. A 69.8 kg student sits at a desk 1.75 m away from a 78.9 kg student. What is the magnitude of the gravitational force between the two students? $(G = 6.673 \times 10^{-11} \text{ N•m}^2/\text{kg}^2)$

    A- 0.20 x 10^{-7} N
    B- 1.20 x 10^{-7} N
    C- 2.20 x 10^{-7} N
    D- 3.20 x 10^{-7} N

21. How much energy would be required to do 971 J of work with a machine that was 25% efficient?

        A- 0.9 x 10^3 J
        B- 1.9 x 10^3 J
        C- 2.9 x 10^3 J
        D- 3.9 x 10^3 J

22. A 35 kg child moves with uniform circular motion while riding a horse on a carousel. The horse is 3.2 m from the carousel's axis of rotation and has a tangential speed of 2.6 m/s. What is the child's centripetal acceleration?

        A- 1.1 m/s^2
        B- 2.1 m/s^2
        C- 3.1 m/s^2
        D- 4.1 m/s^2

23. A new moon is discovered orbiting Neptune with an orbital speed of 9.11×10^3 m/s. Neptune's mass is 1.0×10^{26} kg. What is the radius of the new moon's orbit? What is the orbital period? Assume that the orbit is circular. ($G = 6.673 \times 10^{-11}$ N•m^2/kg^2)

        A- 6.0 x 10^7 m; 3.5 x 10^4 s
        B- 7.0 x 10^7 m; 4.5 x 10^4 s
        C- 8.0 x 10^7 m; 5.5 x 10^4 s
        D- 9.0 x 10^7 m; 6.5 x 10^4 s

24. A 4.2 m board with a mass of 19 kg is pivoted at its center of gravity. A helium balloon attached 0.24 m from the left end of the board produces an upward force of 7.1 N. A 3.5 kg book is placed 0.74 m from the left end of the board, and another book of 1.7 kg is placed 0.77 m from the right end of the board. Find the torque on the board and the direction of rotation.

        A- 13 N.m counterclockwise
        B- 15 N.m counterclockwise
        C- 17 N.m counterclockwise
        D- 19 N.m counterclockwise

25. The centripetal force on an object in circular motion is
    a. perpendicular to the plane of the object's motion.
    b. in the plane of the object's motion and perpendicular to the tangential speed.
    c. in the plane of the object's motion and in the same direction as the tangential speed.
    d. in the plane of the object's motion and in the direction opposite the tangential speed.

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