

**PHY 231C, INTRODUCTORY PHYSICS I,
EXAM III, Nov. 10, 2003**

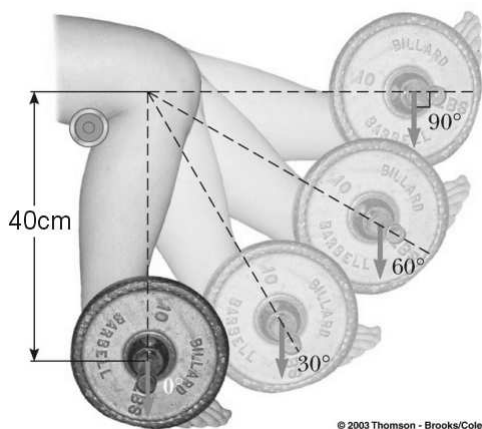
Choose the best answer. For T/F problems, choose only ONE answer.

1. Halley's comet moves about the Sun in an elliptical orbit, with its closest approach to the Sun being 0.59 A.U. and its greatest distance being 35 A.U. (1 A.U. = Earth-Sun distance). If the comet's speed at closest approach is 54 km/s, what is the speed when it is furthest from the Sun?

- (a) 1.80 km/s
- (b) 0.91 km/s
- (c) 0.69 km/s
- (d) 0.58 km/s
- (e) 0.47 km/s

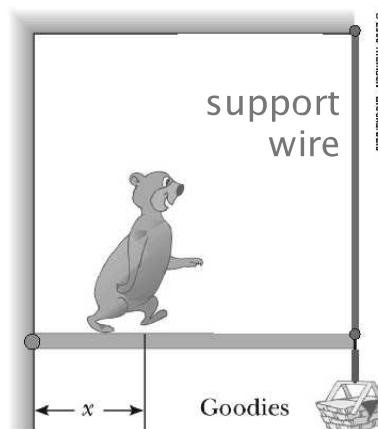
2. A solid 11-kg cylinder rolls without slipping on a rough surface. At an instant when its center of gravity has a speed of 5 m/s. Determine the total kinetic energy.

- (a) 149 J
- (b) 172 J
- (c) 206 J
- (d) 240 J
- (e) 319 J



3. As part of a physical therapy program following a knee operation, a 9.5-kg object is attached to an ankle and leg lifts are done as sketched in the figure above. What is the torque exerted by the knee when the weight is at the 30-degree angle shown above?

- (a) 18.6 Nm
- (b) 7.89 Nm
- (c) 5.40 Nm
- (d) 4.00 Nm
- (e) 3.25 Nm

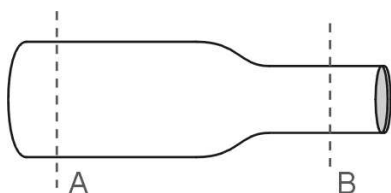


4. A hungry 700-N bear walks out on a beam in an attempt to retrieve some "goodies" hanging at the end as shown above. The beam is uniform, weighs 200 N, and is 5 m long. The goodies weigh 70 N. When the bear is at $x=0.75$ m, what is the tension in the blue support wire?

- (a) 114 N
- (b) 165 N
- (c) 201 N
- (d) 275 N
- (e) 299 N

5. The density of ice is 920 kg/m^3 , and that of sea water is 1030 kg/m^3 . What fraction of the total volume of an iceberg is exposed?

- (a) 0.067
- (b) 0.085
- (c) 0.107
- (d) 0.133
- (e) 0.169



6. An incompressible fluid moves through a pipe that has a radius of 30 cm at point A and narrows to a radius of 20 cm at point B . Which ONE statement is true? If all are true, choose e . (Assume non-viscous laminar flow).

- (a) The amount of mass that passes A in one second equals the amount of mass that passes B in one second.
- (b) The density of the fluid at A equals the density of the fluid at B .
- (c) The pressure of the fluid at A is higher than the pressure at B .
- (d) The velocity of the fluid at A is lower than the velocity at B .
- (e) All of the above statements are true?

7. A constant volume gas thermometer has a pressure of 6930 Pa at 23°C . What would the pressure be for -83°C ?

- (a) 9050 Pa
- (b) 6930 Pa
- (c) 6010 Pa
- (d) 4450 Pa
- (e) 3490 Pa

8. In an effort to reduce heating costs in his bunker, Dictator Dan doubles the thickness of his concrete walls. Which ONE statement is true?

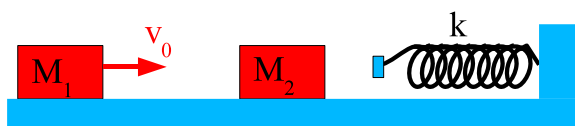
- (a) The conductivity of the wall is doubled.
- (b) The R -value of the wall is doubled.
- (c) The conductivity of the wall is halved.
- (d) The R -value of the wall is halved.
- (e) None of the above are true.

9. Heat is added to 1.2 kg of ice at -20°C . How many kilocalories are required to change the ice to steam at 150°C ? DATA: $L_f = 80 \text{ cal/g}$, $L_v = 540 \text{ cal/g}$, $C_{\text{water}} = 1 \text{ cal/(g}^\circ\text{C)}$, $C_{\text{ice}} = 0.53 \text{ cal/(g}^\circ\text{C)}$, $C_{\text{steam}} = 0.48 \text{ cal/(g}^\circ\text{C)}$.

- (a) 906 kcal
- (b) 877 kcal
- (c) 841 kcal
- (d) 786 kcal
- (e) 698 kcal

10. The operating temperature of tungsten filament in a 60 watt lamp is 3000°C . If its emissivity is 0.5, what is its surface area in square mm?

- (a) 3.29 mm^2
- (b) 4.56 mm^2
- (c) 5.04 mm^2
- (d) 8.10 mm^2
- (e) 18.4 mm^2



11. The mass M_1 enters from the left with velocity v_0 and strikes a mass $M_2 > M_1$ which is initially at rest. The collision between the blocks is perfectly elastic. The mass M_2 then compresses the spring an amount x . Which ONE statement is FALSE.

- (a) Immediately after the collision the mass M_1 will move to the left.
- (b) The kinetic energy of M_2 immediately AFTER the collision is less than the kinetic energy of M_1 BEFORE the collision.
- (c) The magnitude of the momentum of M_2 immediately AFTER the collision is greater than the magnitude of the momentum of M_1 BEFORE the collision.
- (d) The magnitude of the momentum of M_1 immediately AFTER the collision is less than the magnitude of the momentum of M_1 BEFORE the collision.
- (e) The maximum energy stored in the spring equals the initial kinetic energy of M_1 .