Short Answer
(5 Points Each)

1. A 2.70 kg brick is dropped 4.30 m and experiences a constant drag force of 3.80 N while it falls. How fast is it moving when it hits the ground?

2. A 0.60 kg stone is placed in a sling that is 1.3 m long and is spun around such that the tension in the sling’s tether is 270 N. How fast will the stone be traveling when released from the sling?

3. A spring hangs from the ceiling with no mass attached to it. When 1.80 kg is attached, it stretches 16.0 cm. The mass is then removed, and the spring is taken down from the ceiling. How much energy will it take to compress the spring by 30.0 cm?
Multiple Choice
(5 Points Each)

1. Is it possible for an object to accelerate without changing its speed?
   (a) Yes
   (b) No
   (c) Only if it’s going in a circle
   (d) Both (a) and (c) are correct

2. In physics, power is defined as the rate of energy transfer in time, i.e. \( P = \frac{dW}{dt} \), where \( W \) is work. The units of power are called watts (as in the wattage of light bulbs or electronics). Which of the following is the equivalent unit for a watt in terms of the SI base units (kg, m, s)?
   (a) \( \text{kg m/s}^2 \)
   (b) \( \text{kg}^2 \text{ m}^2/\text{s}^2 \)
   (c) \( \text{kg m}^2/\text{s}^3 \)
   (d) \( \text{kg m}^3/\text{s}^2 \)

3. An object moves in a circular path with constant speed. Is the object’s acceleration constant?
   (a) Yes, because it’s just equal to \( v^2/r \)
   (b) No, because its direction is constantly changing
   (c) Yes, because it always points towards the center of the circular path
   (d) Both (a) and (c) are correct
4. A pair of identical billiard balls undergo a perfectly elastic collision in which the second ball was originally at rest. After the collision, how does the speed of the first ball compare to that of the second ball?

(a) It is half that of the second ball  
(b) It is twice that of the second ball  
(c) It’s the same as that of the second ball  
(d) After the collision, the first ball is at rest

5. Is it better to design bike helmets to be hard and sturdy or to crumple and break upon impact?

(a) Hard and sturdy  
(b) Crumple and break
Problems
(30 Points Each)

1. Two blocks resting on a frictionless surface are held together by a string. The block on the left has mass $m_1$, and the block on the right has a mass of $m_2$. A spring that is attached to the left block (but not the right block) is compressed between them. The tension in the string holding them together is $T$, and the spring between them is compressed to one half its relaxed length, which is $\ell$. If the string holding them together is cut, how fast will the right block be moving after they fly apart?
2. If the speed of Earth’s rotation were increased, the apparent weight of objects on Earth’s surface would decrease. Speeding up the Earth’s rotation would also shrink the length of the day. What would the length of the day be if Earth rotated so fast that objects on the equator felt weightless? The radius of Earth is approximately $6.37 \times 10^6$ m.