Physics 200 **Name: ____________________**

Midterm Review (Work and Energy)

Multiple Choice:

1. A 2.0 kg ball is raised to a height of 3.0 m and then released. After the ball hits the ground, bounces a few times and then comes to rest, which statement is true? [U=PE; K=KE; Q=Thermal Energy ("heat")]
   A. U = 0, K = 0 and Q = 60 J
   B. U = 0 J, K = 60J and Q = 0
   C. U = 0 J, K = 0 J and Q = 0 J
   D. U = 60 J, K = 0 J and Q = 60 J
   E. U = 20 J, K = 20 J and Q = 20

2. A simple pendulum with a string length of 0.75 m and a mass of 1.5 kg swings back and forth. At the lowest point in the swing,
   A. U is a maximum and K is a maximum.
   B. U is a minimum and K is a maximum.
   C. U is a maximum and K is a minimum.
   D. U is a minimum and K is a minimum.

3. The potential energy of a box on a shelf, relative to the floor, is a measure of
   A. the work done putting the box on the shelf from the floor.
   B. the weight of the box times the distance above the floor.
   C. the energy the box has because of its position above the floor.
   D. all of these.

4. In which case below is the most work done?
   A. Lifting 60.0 N to a height of 3.0 m in 20.0 s
   B. Lifting 100.0 N to a height of 3.0 m in 30.0 s
   C. Pushing a box with a 40.0 N force horizontally 1.5 m along a frictionless surface in 2.00 s
   D. The work is the same in all three cases.

5. Power is
   A. the rate at which energy is expended.
   B. work per unit of time.
   C. the rate at which work is done.
   D. all of the above.

6. The law of conservation of energy is a statement that
   A. energy must be conserved and you are breaking a law if you waste energy.
   B. the supply of energy is limited so we must conserve.
   C. the total amount of energy is constant.
   D. energy can be used faster than it is created.

7. A 8000-N car is traveling at 10 m/s along a horizontal road when the brakes are applied. The car skids to a stop in 4.0 s. How much kinetic energy does the car lose in this time?
   A. 5.0×10^3 J   B. 6.0×10^6 J   C. 2.0×10^5 J D. 8.0×10^5 J   E. 4.0×10^4 J

8. A 2-kg object is moving at 3 m/s. A 4-N force is applied in the direction of motion and then removed after the object has traveled an additional 5 m. The work done by this force is:
   A. 20 J   B. 18 J   C. 15 J   D. 12 J   E. 38 J

9. A sledge (including load) weighs 5000 N. It is pulled on level snow by a dog team exerting a constant horizontal force on it. The coefficient of kinetic friction between sledge and snow is 0.050. How much work is done by the dog team pulling the sledge 1000 m at constant speed?
   A. 2.5×10^4 J   B. 2.5×10^5 J   C. 5.0×10^5 J D. 2.5×10^6 J   E. 5.0×10^6 J

10. The amount of work (done by an external force, friction, etc.) required to stop a moving object is equal to the:
    A. velocity of the object.
    B. kinetic energy of the object.
    C. mass of the object times its acceleration.
    D. mass of the object times its velocity.
    E. square of the velocity of the object.

11. A woman lifts a barbell 2.0 m in 5.0 s. If she lifts the same barbell the same distance in 10 s, the <u>work</u> done by her is:
    A. four times as great
    B. two times as great
    C. the same
    D. half as great
    E. one-fourth as great

12. A woman lifts a barbell 2.0 m in 5.0 s. If she lifts the same barbell the same distance in 10 s, the <u>power</u> of this lift is:
    A. four times as great
    B. two times as great
    C. the same
    D. half as great
    E. one-fourth as great

<u>Multiple Choice Answers</u>:

1. A	2. B	3. D	4. B	5. D
6. C	7. E	8. A	9. C	10. B
11. C	12. D			

Work and Energy Problems

1. (II) A box of mass 5.0 kg is accelerated by a force across a floor at a rate of $2.0\,\mathrm{m/s^2}$ for 7.0 s. Find the net work done on the box.

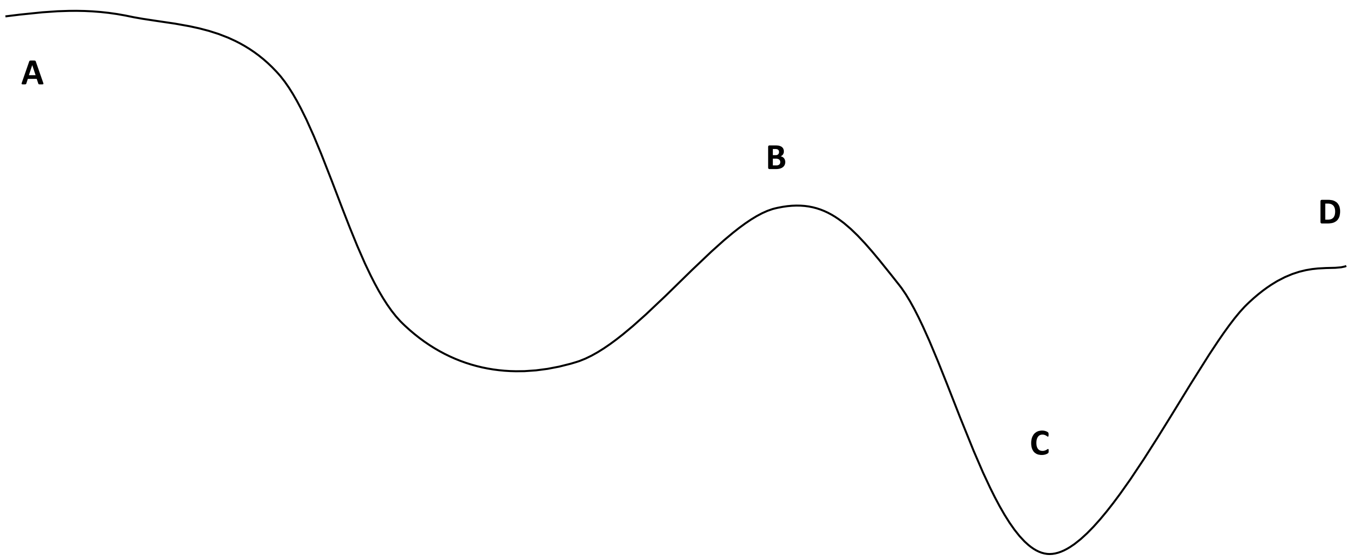
2. (I) How much work must be done to stop a 1250-kg car traveling at $105\,\mathrm{km/h}$?

3. (I) A spring has a spring stiffness constant, *k*, of $440\,\mathrm{N/m}$. How much must this spring be stretched to store 25 J of potential energy?

4. (I) By how much does the gravitational potential energy of a 64-kg pole vaulter change if his center of mass rises about 4.0 m during the jump?

5. (II) A vertical spring (ignore its mass), whose spring stiffness constant is $950\,\mathrm{N/m}$, is attached to a table and is compressed down 0.150 m. (*a*) What upward speed can it give to a 0.30-kg ball when released? (*b*) How high above its original position (spring compressed) will the ball fly?

6. (II) A roller coaster (500 kg) starts from rest at a height of 15 m. Find its total energy, its potential energy, its kinetic energy and its speed at each of the locations indicated.



Position	Height	Potential Energy	Velocity	Kinetic Energy	Total Energy
A	15 m				
B	10 m				
C	0 m				
D	5 m				

~~7. (II) Electric energy units are often expressed in the form of "kilowatt-hours." (a) Show that one kilowatt-hour (kWh) is equal to (b) If a typical family of four uses electric energy at an average rate of 520 W, how many kWh would their electric bill be for one month, and (c) how many joules would this be? (d) At a cost of $0.12 per kWh, what would their monthly bill be in dollars? Does the monthly bill depend on the rate at which they use the electric energy?~~

8. (II) A driver notices that her 1150-kg car slows down from 85 km/h to 65 km/hr in about 6.0 s on the level when it is in neutral. Approximately what power (watts and hp) is needed to keep the car traveling at a constant 75 km/hr?

9. (II) How much work can a 3.0-hp motor do in 1.0 h?

10. (II) A shot-putter accelerates a 7.3-kg shot from rest to 14 m/s. If this motion takes 1.5 s, what average power was developed?

11. (II) A pump is to lift 18.0 kg of water per minute through a height of 3.60 m. What output rating (watts) should the pump motor have?

Answers to Problems (see website for solutions)

1. 490J
2. -5.32×10^5J
3. 0.337m
4. 2509J

5a. 8.44m/s

5b. 3.64m

6.

73,500	0	0	73,500
49,000	9.9	24,500	73,500
0	19	73,500	73,500
24,500	14	49,000	73,500

7. Skip
8. 2,963W = 3.97hp
9. 8.06×10^6J
10. 477W
11. 10.6W