UNIT VIIA TEST: V1

1. A 2 kg mass is held 4 m above the ground. What is the approximate potential energy due to gravity of the mass with respect to the ground?
   a. 20 J.
   b. 40 J.
   c. 60 J.
   d. 80 J.
   e. none of these.

2. It takes 40 J to push a large box 4 m across a floor. Assuming that the push is in the same direction as the displacement, what is the size of the force on the box?
   a. 4 N.
   b. 10 N.
   c. 40 N.
   d. 160 N.
   e. none of these.

3. Which requires more energy: lifting a 50 kg sack vertically 2 meters or lifting a 25 kg sack vertically 4 meters?
   a. lifting the 50 kg sack.
   b. lifting the 25 kg sack.
   c. both require the same amount of work.

4. A car moving at 15 m/s skids to a stop in 20m. If the car travels at 45 m/s, how far will it skid, assuming the same constant braking force?
   a. 20 m.
   b. 50 m.
   c. 90 m.
   d. 120 m.
   e. 180 m.

5. Suppose W is the energy transferred stretching a spring from 0 to 0.10 m. The amount of work done stretching the same spring from 0.10 m to 0.20 m is:
   a. W
   b. 2W
   c. 3W
   d. 4W

6. A crate is dragged across a floor at constant speed. The work done on the system can be accounted for by
   a. \( E_{el} \)
   b. \( E_k \)
   c. \( E_g \)
   d. \( E_{diss} \)
   e. both b and d
7. What does the following series of energy pie charts tell you about the behavior of the object? Explain.

For questions 8-9, make **quantitative** comparisons, by determining the **ratio** called for in the question. *Show work or provide some argument for your answer.*

8. Two spheres, A & B, of equal mass are released from rest at the heights indicated at left.
   a. Determine the value of the ratio $\frac{E_gB}{E_gA}$
   b. Determine the value of the ratio $\frac{V_B}{V_A}$ at impact.
   c. A remains on the shelf and B is pushed off. Draw the energy pie charts for A and B when B has dropped to A's level (10 m).

9. Consider the diagram at left which shows two spheres, A and B, which are dropped from the same height. Sphere B has **twice the mass** of sphere A.
   a. Determine the value of the ratio $\frac{E_gB}{E_gA}$
   b. Determine the value of the ratio $\frac{V_B}{V_A}$ at impact.
   c. How does the **acceleration** of B compare to that of A?
For questions 10-11 complete the energy bar graphs; be sure to define your system.

10. You pull a wagon, initially at rest, until it reaches constant velocity, along a level sidewalk.

For questions 12-14, consider the diagram representing a portion of an amusement park ride. A 100 kg car has 30,000 J of Potential Energy at point A. It moves down a frictionless track and comes to a stop as it compresses a huge spring at point D.

11. A dart gun fires a dart straight up which then sticks to the ceiling.

12. On the axes below, sketch the energy bar graphs when the car is at the indicated points.

13. How much kinetic energy does the car have at point C? Explain or calculate.

14. How fast is the car moving at point B? Show work.
15. Suppose the spring below has a spring constant of 50 N/m. The box has a mass of 8.0 kg and rests on a surface of negligible friction.

![Diagram](image1)

a. In the diagram at left, the spring was compressed 4.0 m. How much energy does the spring now store?

b. Suppose that all the elastic energy were transferred to the box when it was released (diagram at right). How fast would the box be moving?

16. Your battery has died and your friends push your vehicle so you can kick-start the engine. You and the vehicle have a combined mass of 1500 kg. If they do 6000 J of work and 2000 J of that is dissipated by friction, how fast is your vehicle traveling? Complete the energy bar graph below; specify the system.

![Energy Bar Graph](image2)

17. Hulky and Bulky, our two UPS workers, decide to race each other up a flight of stairs (Δh = 4.0 m) at the warehouse. Hulky, whose mass is 120 kg, makes the climb in 3.0 s; while Bulky, 150 kg, took 4.0 s to make the climb.

a. Who has more E_g at the top?

b. Who exerted more power?