Unit P4 Review (Energy)

1. Define the following terms
   (a) work

   Solution: the product of force and distance

   (b) energy

   Solution: the ability to do work

   (c) kinetic energy

   Solution: energy due to motion

   (d) potential energy

   Solution: energy that is stored

2. What are the units for energy?

   Solution: Joules (J)

3. What are the four types of **potential energy**?

   Solution: elastic, gravitational, nuclear, chemical

4. Calculate the work done if 5 N of force is used to push a grocery cart 3 m.

   Solution:

   $$\begin{aligned} F &= 5\,\text{N} & W &= Fd \\ d &= 3\,\text{m} & W &= (5)(3) \\ W &= ? & W &= 15\,\text{J} \end{aligned}$$

5. What is the kinetic energy of the wrecking ball with a mass of 200 kg if it swings with a velocity of 15 m/s?

Solution:

$$m = 200\,\text{kg} \qquad KE = \frac{1}{2}mv^2$$
$$v = 15\,\text{m/s} \qquad KE = \frac{1}{2}(200)(15)^2$$
$$KE = ? \qquad KE = (0.5)(200)(225)$$
$$KE = 22\,500\,\text{J}$$

6. What two things are needed in order for work to be done?

Solution: force and distance

7. Decide if work is being done in each of the following situations. Explain.
   (a) You push very hard against a stationary wall.

   Solution: no, there is no distance

   (b) When the light turns green, a car accelerates forward for three blocks.

   Solution: yes, there is a force, and the car is moving a distance.

   (c) A woman holds a child on her shoulders to watch a parade.

   Solution: no, the child is not moving a distance

   (d) A woman lifts a child to her shoulders.

   Solution: yes, there is a force, and the car is moving a distance.

8. Explain what the term "energy is conserved" means.

Solution: the total energy of a system does not change.

9. When does an object have zero kinetic energy?

Solution: when it is not moving

10. When does an object have zero gravitational potential energy?

Solution: when it is on the ground

11. You drop a ball. Explain what kinds of energy it has in each of the following cases:
    (a) Before it falls (while it's still in your hand)

    Solution: all energy is PE

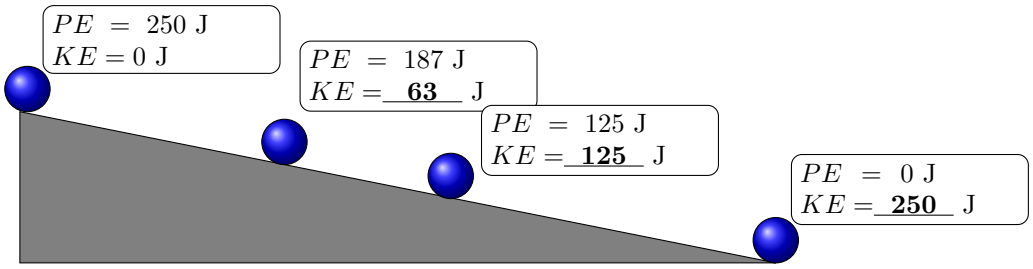
    (b) While it is falling

    Solution: PE is decreasing; KE is increasing

    (c) Just before it hits the ground

    Solution: all energy is KE

12. Fill in the missing kinetic energy values for the following marble rolling down a ramp:



13. What is the gravitational potential energy of a wrecking ball that is hung 20 meters above ground if it has a mass of 200 kg?

Solution:

$$m = 200\,\text{kg} \qquad PE = mgh$$
$$g = 9.8\,\text{m/s}^2 \qquad PE = (200)(9.8)(20)$$
$$h = 20\,\text{m}$$
$$PE = ? \qquad PE = 39\,200\,\text{J}$$

14. A force of 13 N is applied on a cart. If 125 J of work is done, how far did you push the cart?

Solution:

$$F = 13\,\text{N} \qquad W = Fd$$
$$W = 125\,\text{J} \qquad 125 = (13)d$$
$$d = ? \qquad 9.62\,\text{m} = d$$