Physics 11
Chapter 11 Quiz Solutions

1.	a. ☐	b. ☒	c. ☐	d. ☐
2.	a. ☐	b. ☐	c. ☐	d. ☒
3.	a. ☐	b. ☐	c. ☒	d. ☐
4.	a. ☒	b. ☐	c. ☐	d. ☐
5.	a. ☐	b. ☒	c. ☐	d. ☐
6.	a. ☐	b. ☐	c. ☒	d. ☐
7.	a. ☐	b. ☒	c. ☐	d. ☐
8.	a. ☐	b. ☐	c. ☒	d. ☐
9.	a. ☐	b. ☒	c. ☐	d. ☐
10.	a. ☒	b. ☐	c. ☐	d. ☐

1. **Problem**
An object of mass 20.0 kg is moving with speed 7.00 m/s. What is its kinetic energy?

   a. 374 J
   b. 490 J
   c. 248 J
   d. 314 J

   Solution
   The kinetic energy is
   $$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(20\,\text{kg})(7\,\text{m/s})^2 = 490\,\text{J}$$

2. **Problem**
An object of mass 52.0 kg is 9.00 m above the ground. What is its gravitational potential energy relative to the ground?

   a. 5920 J
   b. 6570 J
   c. 5310 J
   d. 4590 J

   Solution
   The gravitational potential energy is
   $$E_p = mgh = (52\,\text{kg})(9.80\,\text{m/s}^2)(9\,\text{m}) = 4590\,\text{J}$$

3. **Problem**
A ball drops some distance and loses 54 J of gravitational potential energy. Do **NOT** ignore air resistance. How much kinetic energy did the ball gain?

   a. More than 54 J.
   b. Exactly 54 J.
   c. Less than 54 J.
   d. Cannot be determined.

   Solution
   Some of the potential energy was transformed into kinetic energy and some into non-mechanical energy (heat, sound, vibrations, etc.) because of the air resistance. Therefore, the kinetic energy gained is less than the potential energy lost.

4. **Problem**
A ball drops some distance and gains 31 J of kinetic energy. Do **NOT** ignore air resistance. How much gravitational potential energy did the ball lose?

   a. More than 31 J.
   b. Exactly 31 J.
   c. Less than 31 J.
   d. Cannot be determined.

   Solution
   Some of the potential energy was transformed into kinetic energy and some into non-mechanical

energy (heat, sound, vibrations, etc.) because of the air resistance. Therefore, the potential energy lost is more than the kinetic energy gained.

5. **Problem**
The transfer of energy by mechanical means is

   a. force
   b. work
   c. momentum
   d. acceleration

   Solution
   The transfer of energy by mechanical means (applying a force over a distance) is work.

6. **Problem**
A 1619-kg car is traveling at 26 m/s. The brakes are suddenly applied and the car slides to a stop. The average braking force between the tires and the road is 1464 N. How far will the car slide once the brakes are applied?

   a. 294.0 m
   b. 336.0 m
   c. 374.0 m
   d. 248.0 m

   Solution
   The work done by the brakes equals the kinetic energy of the car.

$$W = Fd = \frac{1}{2}mv^2$$

   Therefore, solving for d,

$$d = \frac{m}{2Fv^2} = 374\,\text{m}$$

7. **Problem**
A car moving at 88 km/h comes to a stop in 30 m after the driver applies the brakes. How far would the same car take to stop if it were moving at 59 km/h? Assume identical road conditions and braking force.

   a. $14.9\,\text{m}$
   b. $13.5\,\text{m}$
   c. $17.8\,\text{m}$
   d. $20.0\,\text{m}$

   Solution
   The braking force does work to remove the kinetic energy of the car. Since kinetic energy depends on velocity squared, the car has $(59/88)^2 = 0.4495093$ times the kinetic energy when it is traveling at 59 km/h than when it is traveling at 88 km/h. The work done by the brakes must also be multiplied by $(59/88)^2$.

Since $W = Fd$ and we are assuming the same braking force, the distance must be multiplied by $(59/88)^2$.

$$d = (59/88)^2(30\,\text{m}) = 13.5\,\text{m}$$

8. **Problem**
The net work done on an object is equal to its

   a. change in velocity.
   b. change in total mechanical energy.
   c. change in kinetic energy.
   d. change in potential energy.

Solution
According to the work-energy theorem, the net work done on an object is equal to its change in kinetic energy. Note that the net work could include *negative* work done by gravity or friction so that an applied force could do work on an object without increasing its kinetic energy.

9. **Problem**
A test rocket of mass 58 kg is fired straight up. Its fuel gives it a kinetic energy of 9292 J by the time the rocket engine burns all the fuel. What additional height will the rocket rise?

   a. 8.38 m
   b. 16.3 m
   c. 10.1 m
   d. 13.9 m

Solution
The rocket will rise an additional height such that all of its kinetic energy is transformed into gravitational potential energy, $E_p = mgh$.

$$h = \frac{E_p}{mg} = \frac{(9292\,\text{J})}{(58\,\text{kg})(9.80\,\text{m/s}^2)} = 16.3\,\text{m}$$

10. **Problem**
Yuki's mass is 92.0 kg. He climbs the 8.9-m ladder of a slide, and reaches a velocity of 11.0 m/s at the bottom. How much work was done by friction on Yuki?

   a. 2460 J
   b. 3500 J
   c. 1340 J
   d. 3170 J

Solution
The work done by friction is the difference between the initial potential energy and the final kinetic energy.

$$W = mgh - \frac{1}{2}mv^2 = m(gh - \frac{1}{2}v^2)$$

$$W = (92\,\text{kg})[(9.80\,\text{m/s}^2)(8.9\,\text{m}) - \frac{1}{2}(11\text{m/s})^2] = 2460\,\text{J}$$