

Grade 12 Physics

Energy Test

Energy Unit Test



First Name: _____

Last Name: _____

Directions:

- Show all work for full marks
- Test duration: 75 minutes
- For calculations, round final answers to 2 decimal places

For grading use only

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|---------|---|---|----|----|-------|
| Page: | 2 | 3 | 4 | 5 | Total |
| Points: | 6 | 7 | 31 | 30 | 74 |
| Score: | | | | | |

Multiple Choice (10 marks)

1. (1 point) What is the kinetic energy of a 2 kg object moving at 5 m/s?
 - A. 5 J
 - B. 25 J
 - C. 50 J
 - D. 10 J

2. (1 point) How much gravitational potential energy does a 5 kg object have at 10 m height?
 - A. 50 J
 - B. 490 J
 - C. 980 J
 - D. 245 J

3. (1 point) Which energy transformation occurs in a photovoltaic cell?
 - A. Thermal to electrical
 - B. Light to electrical
 - C. Chemical to electrical
 - D. Mechanical to electrical

4. (1 point) What is the work done by a 20 N force pushing an object 5 m?
 - A. 4 J
 - B. 100 J
 - C. 25 J
 - D. 200 J

5. (1 point) What power is developed by doing 600 J of work in 10 seconds?
 - A. 6 W
 - B. 60 W
 - C. 6000 W
 - D. 10 W

6. (1 point) Which statement best describes energy conservation?
 - A. Energy can be destroyed
 - B. Energy changes form but total remains constant
 - C. Energy becomes less useful over time
 - D. Energy creation is possible in closed systems

7. (1 point) What is the efficiency of a device that outputs 150 J from 200 J input?
- A. 133%
 - B. 50%
 - C. 75%
 - D. 25%
8. (1 point) How much energy is stored in a spring ($k=400 \text{ N/m}$) compressed 0.2 m?
- A. 8 J
 - B. 8 J
 - C. 16 J
 - D. 80 J
9. (1 point) A 5 kg object has a kinetic energy of 50 J. What is its speed?
- A. 2 m/s
 - B. 4.47 m/s
 - C. 10 m/s
 - D. 20 m/s
10. (1 point) A spring with a spring constant of 150 N/m is stretched by 0.2 m. What is the elastic potential energy stored in the spring?
- A. 1 J
 - B. 3 J
 - C. 3 J
 - D. 6 J
11. (1 point) A 2 kg block slides down a frictionless ramp from a height of 10 m. What is its speed at the bottom?
- A. 10 m/s
 - B. 14.14 m/s
 - C. 20 m/s
 - D. 30 m/s
12. (1 point) A car of mass 800 kg is moving at 20 m/s. What is its kinetic energy?
- A. 80,000 J
 - B. 160,000 J
 - C. 240,000 J
 - D. 320,000 J
13. (1 point) Work is defined as:
- A. Force divided by distance
 - B. Force times distance times the cosine of the angle between them
 - C. Change in momentum

D. Change in kinetic energy

14. (1 point) A pendulum's potential energy is maximum at:

A. Its lowest point

B. Its highest point

C. The midpoint of its swing

D. None of the above

Long Answer (40 marks)

15. A 50 kg roller coaster car starts from rest at 60 m height.

(a) (4 points) Calculate initial potential energy

(b) (6 points) Find speed at 20 m height (no friction)

(c) (6 points) Calculate actual speed at 20 m height if 10% energy is lost to friction

(d) (4 points) Determine average frictional force

16. A spring with a spring constant of 200 N/m is compressed by 0.3 m and used to launch a 2 kg block horizontally on a frictionless surface.

(a) (5 points) Calculate the elastic potential energy stored in the spring.

(b) (5 points) Determine the speed of the block as it leaves the spring.

17. A 15.0 kg branch falls from a tree onto a trampoline 8.0 m below.
- (a) (5 points) Calculate the total mechanical energy of the branch at the top of the tree just before it falls, assuming it starts from rest and air resistance is negligible.
 - (b) (5 points) Determine the velocity of the branch just before it hits the trampoline.
 - (c) (5 points) If the trampoline compresses by 0.25 m to bring the branch to a stop, calculate the spring constant of the trampoline.
18. A 0.020 kg bullet is fired at a wooden target with an initial velocity of 250 m/s. Upon hitting the target, the bullet becomes embedded and stops after penetrating 0.12 m into the wood.
- (a) (5 points) Calculate the initial kinetic energy of the bullet.
 - (b) (5 points) Determine the average force exerted by the target to stop the bullet.
 - (c) (5 points) If 20% of the bullet's kinetic energy is converted into heat, how much energy is absorbed as heat?

