Problems of Work, energy and power

1) A cellular telephone is pushed by a man with a force of 110 N. The work done on the cellular telephone is 14000 J. How far was the cellular telephone moved?
Answer: 127.3 m.

2) A box is pushed 72 m by a man. The amount of work done was 4500 J. How much force is exerted on the box?
Answer: 62.5 N.

3) Find the gain in kinetic energy of a cart that has an unbalanced force of 90 N acting through a distance of 98.5 m.
Answer: 8865 J.

4) A stone has a mass of 63 kg and it is moving with a speed of 78 m/s. If its height above ground is 44 m, calculate its mechanical energy.
Answer: 2.188×10^5 J.

5) Calculate the kinetic energy of an automobile with a mass of 695 kg traveling at 76 m/s.
Answer: 2.007×10^6 J.

6) An object with a kinetic energy of 15740 J has a mass of 23 kg. Find its velocity.
Answer: 37 m/s.

7) Calculate the mass of a car that is travelling at a speed of 5 m/s and has a kinetic energy of 25880 J.
Answer: 2070 kg.

8) Find the gravitational potential energy of a box with a mass of 125 kg and a height of 57 m above the ground.
Answer: 69830 J.

9) Find the mass of a rock if its gravitational potential energy is 6860 J and it's 10 m above ground.
Answer: 70 kg.

10) What distance is an object from the floor if the object contains 47330 J of gravitational potential energy and has a mass of 105 kg?
Answer: 46 m.

11) A stone is raised from 5 m above ground to a height of 35 m in 106 s. Assume that the stone has a mass of 2420 kg, and ignoring frictional losses, find the power to accomplish this task.
Answer: 6.712 kW.

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12) A box with a mass of 29 kg is lifted by a rope a distance of 67 m straight up at constant speed. How much power is required to complete this task in 77 s?
Answer: 247.3 W.

13) A 29 kg crate descends from a height of 11 m and reaches the ground with a speed of 11 m/s. Calculate the energy dissipated due to friction in the process.
Answer: 1370 J.

14) A 76 kg stone is thrown at 11 m/s from a height of 38 m. Find its speed when it contacts the ground.
*Answer*:   29.4 m/s.

15) A 27 kg roller coaster car is launched from ground level at 32.34 m/s. Find its speed when it reaches the top of a loop, which is 46 m above the ground.
Answer: 12 m/s.

16) A man and sled slide down a frictionless hill. The sled starts from rest and has a speed of 26 m/s at the bottom. Find the height of the hill.
*Answer*:   34.5 m.

17) A 7 kg crate moving at 5 m/s collides with a spring whose spring constant is 740 N/m. At the instant the crate is motionless, what is the largest amount that the spring could be compressed? Assume no friction.
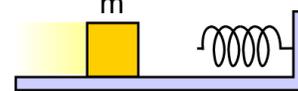
Answer: 48.6 cm.

18) A box rests on a vertical spring. The spring is compressed by 39 cm by the box and has 130 J of elastic potential energy.
    a) Calculate the spring constant.
    b) Calculate the mass of the box.
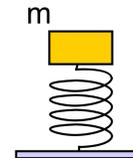
Answer: **a)** 1710 N/m   **b)** 68 kg.

19) A spring whose spring constant is 520 N/m is compressed 20 cm. What is the maximum speed it can give to a 9 kg block?
Answer: 1.52 m/s.

20) A spring has a spring constant of 320 N/m. How far must it be stretched for its elastic potential energy to be 40 J?
*Answer*:   50 cm.

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21) A 15 kg object slides on a horizontal, frictionless surface until it encounters a spring whose spring constant is 730 N/m. The object compresses the spring by 45 cm before turning around and sliding in the opposite direction. Calculate the initial velocity of the object.
Answer: 3.14 m/s.

22) A compression spring is sitting on the ground pointing upwards. Its spring constant is 1590 N/m. If we launch an 1.6 kg stone straight up using
the spring and we compress the spring 30 cm:
a) What is the potential energy of the spring?
b) How high will the stone go?
*Answer*:   **a)** 71.5 J   **b)** 4.56 m.
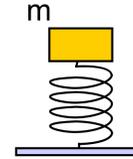
23) A spring with a spring constant of 560 N/m is pulled a distance of 57 cm from its relaxed position.
  a) Calculate the force in the spring.
  b) What is the potential energy of the spring?
Answer: **a)** 319 N   **b)** 91 J.

24) A horizontal spring whose spring constant is 1440 N/m is lying on a frictionless surface. One end of the spring is attached to a wall, and the other end is connected to an object of mass 11 kg. The spring is then compressed by 70 cm and released from rest.
What is the speed of the object at the instant when the spring
is stretched by 30 cm relative to its unstrained length?
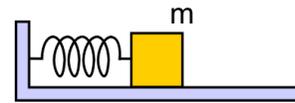
Answer: 7.24 m/s.

25) A 12.5 kg stone is attached to a vertical spring with a spring constant of 240 N/m. The stone is supported initially so that the spring is neither stretched nor compressed and then released from rest. How far does the stone fall before being brought to rest instantaneously by the spring?
Answer: 1.02 m.

26) A 6 kg object is attached to a spring and is oscillating horizontally on a frictionless table. The spring is initially stretched by 28 cm and then released from rest.
If the sprint constant is 1410 N/m, how fast is the object
moving when it reaches the equilibrium position of the spring?
Answer: 4.29 m/s.