Unit 5 · Work, Energy and Power

WORKSHEET

Full marks 31

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 31

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

coefficient of restitution	conservative	elastic	horsepower	joules	kinetic energy	momentum	potential energy	power	watt

Work is measured in _____. The rate of doing work is _____, and one _____ is 746 W. The energy a body has because it moves is its _____, and the energy stored in it because of its position or shape is its _____. A force whose work on a body moving round a closed path is zero is a _____ force. In an _____ collision the total kinetic energy is the same before and after. The relative speed of separation divided by the relative speed of approach is the _____.

2 Multiple choice [5]

Choose the correct option for each of the following questions.

i. One kilowatt hour (1 kWh) is: [1]

a. a unit of power, 1000 W
b. 3.6×10^6 J of energy
c. 3.6×10^3 J of energy
d. 746 W

ii. A stone tied to a string is whirled in a horizontal circle at a steady speed. The work done by the string's pull in one turn is: [1]

a. zero
b. the pull × the circumference
c. the pull × the radius
d. negative

iii. The kinetic energy of a 2 kg ball moving at 3 m/s is: [1]

a. 3 J
b. 6 J
c. 9 J
d. 18 J

iv. A car's speed is doubled. Its kinetic energy becomes: [1]

a. the same
b. twice as large
c. four times as large
d. half as large

v. In a perfectly inelastic collision: [1]

a. both momentum and kinetic energy are conserved
b. the bodies stick together, momentum is conserved, and kinetic energy is lost
c. momentum is lost but kinetic energy is conserved
d. the coefficient of restitution is 1

3 Short answers [7]

Write short answers to the following questions.

a. Write any two differences between conservative and non-conservative forces. **[2]**

b. A ball dropped on a floor never bounces back to the height it was dropped from. Where does its energy go? **[2]**

c. A lift carries 10 people, of 60 kg on average, up 15 m in 20 s. Find the least power its motor must give, in watts and in horsepower. ($g = 9.8\ m/s^2$) **[3]**

4 Long answer [4]

Write a long answer to the following question.

A body of mass m_1 moving at u hits a body of mass m_2 at rest, and they stick together. Find their common velocity, and show that the fraction of the kinetic energy lost is $\frac{m_2}{m_1 + m_2}$.

5 Numerical problems [8]

Solve the following problems. Show your working. Take $g = 9.8\ m/s^2$.

a. A 0.5 kg ball is dropped from a height of 5.0 m and bounces back up to 3.2 m. Find i. its speed just before and just after the bounce, ii. the coefficient of restitution between the ball and the floor, and iii. the energy lost in the bounce. [4]

Answer: _____

b. A force on a 2 kg body, starting from rest on a smooth floor, grows steadily from 0 to 20 N over the first 4 m, then stays at 20 N for the next 2 m. Sketch the force–displacement graph, find the work done over the 6 m, and find the body's speed at the end. [4]

Answer: _____

6 Think [3]

In a Newton's cradle of equal steel balls, one ball swung in hits the row, and one ball flies out at the other end at the same speed. Why don't two balls fly out together at half the speed? (Treat the collisions as elastic.)

7 Activity: Your power on the stairs

(not marked)

Find your mass on a scale. Count the steps of a staircase and measure the height of one step to find the height climbed. Time yourself walking up, then running up.

	Mass m (kg)	Height h (m)	Time t (s)	Work mgh (J)	Power mgh/t (W)
Walking					
Running					

Is the work done the same both ways? Which is different, and why?