Exercise

1) Define work.

A- Work is said to be done if the force applied on a body, moves it.

2) When does a force perform work?

A- When ~~an object moves, when a person~~ a body moves after applying force to it, force performs work there.

3) State 2 conditions when no work is done by a force.

A- ✱ If no motion takes place, no work is said to be done.

✱ If there is no change in the place / size / shape of the body, no work is said to be done.

4) A coolie is moving on a road with a luggage on his head. Does he perform work against the force of gravity? Give reason.

A- Yes, he is performing work against the force of gravity. ~~He is w~~ There is a change in his position, as he is walkin

5) The moon is revolving around the Earth in a circular path. How much work is done by the moon?

A- Work done by moon = Force x dist. moved by moon.

6) Write the expression for work done by a force.

A- Work = Force x Distance moved

$W = F \times d$

7) State the SI unit of work and define it.

A- SI unit of work is joule (J) where,
1 J = 1 newton (N) x 1 metre (m)

8) State 2 factors on which the work done on a body depends.

A- ☆ The magnitude of the force applied.
☆ The dist. moved by the body in the direction of force.

9) Define the term energy.

A- Energy is ~~the power of~~ of a body is its capacity to do work. ~~to do some act work.~~

10) State the SI unit of energy.

A- SI unit of energy is joule.

11) Define 1 joule of energy.

A- 1 J = 1 newton (N) x 1 metre (m)

12) How is work related to energy?

A- To do more amount of work, we need to spend more energy. Hence, we can say that there is a direct relationship between work and energy.

13) What are the 2 kinds of mechanical energy?

A- They are Potential energy and Kinetic energy.

14) What is potential energy? State its unit.

A- Potential energy of a body is the energy possessed by it due to ~~to~~ its ~~the~~ state of rest/position.

Unit of PE - Joule (J).

15) Give 1 example of a body that has potential energy, in each of the following:

a) due to its position at a height.

A- a falling stone.

b) due to its elongated stretched state.

A- a stretched rubber catapult.

16) State 2 factors on which the potential energy of a body at a certain height above the ground depends.

A- ★ Mass of the body.

★ It's height above the ground.

17) 2 bodies A and B of masses 10 kg and 20 kg respectively are at the same height above the ground. Which of the 2 has ~~gre a~~ greater potential energy?

A- Body B has greater potential energy than body A.

18) Write the expression for the gravitational potential energy explaining the meaning of the smybols used.

A- P.E. = mgh, where m = mass, g = gravity, h = height.

19) Define the term kinetic energy. Give one example of a body which possesses kinetic energy.

A- Kinetic energy of a body is the energy possessed by it due to its motion.

Ex- A fast moving stone breaks a window pane due to its kinetic energy.

20) State 2 factors on which the kinetic energy of a moving body depends.

A- ★ Mass of the body.
★ Speed of the body.

21) 2 toy-cars A and B of masses 200 and 500 g respectively are moving with the same speed. Which of the two has greater kinetic energy.

A- Toy-car B has greater kinetic energy than toy-car A.

22) A cyclist doubles his speed. How will his kinetic energy change? increase, decrease or remain the same?

A- His kinetic energy will increase.

23) Write the expression for the kinetic energy of a body explaining the meaning of the symbols used.

A- K.E = mv^2, where m = mass, ~~Spd~~ v = speed.

~~23) Can a body possess energy even when it is not in motion? Explain your answer with an example.~~

~~A- Yes,~~

24) Name the type of energy possessed by the following.

a) A moving cricket ball - Kinetic energy

b) A stone at rest on top of a building - Potential energy

c) A compressed spring - Potential energy

d) A moving bus - Kinetic energy

e) A bullet fired from a gun - Kinetic energy

f) Water flowing in a river - ~~Potential~~ Kinetic energy

g) A stretched rubber band - Potential energy

25) Give an example to show the conversion of potential energy to kinetic energy when put in use.

A- A wound up watch spring has potential energy because of its wound up state. As the spring ~~was~~ unwinds itself, the potential energy changes into kinetic energy. This kinetic energy does work in moving the arms of the watch.

26) State the energy changes that occur in a watch spring while it unwinds.

A- ~~Pot~~ Potential energy changes into kinetic energy.

NUMERICALS

1) A force of 20 N acts on a body and moves it through a distance of 5m in the direction of force. Calculate the work done by the force.

A) work done = force x Dist. in the direction of force

= 20 N x 5m

= 100 Nm = 100 J

2) A man lifts a mass of 20 kg to a height of 2.5 m. Assuming that the force of gravity on 1kg mass is 10 N. find the work done by the man.

A work done = force x dist. in the direction

(energy used)

work done = mass x Height x force of gravity

= 20 kg x 2.5m x 10 N

= 500 J

3) A body when acted upon by a force of 10 kgf moves to a distance 0.5 m in the direction of force. Find the work done by the force. Take 1 kgf = 10 N.

A (1 kgf = 10 N, then 10 kgf = 10 x 10 = 100 N)

Work done = Force x Dist. in the direction of force

= 100 N x 0.5m

= 50 Nm = 50 J

4) 2 bodies of same masses are placed at height h and 2h. Compare their gravitational potential energy.

A- U of 1st body = $mg \times h$

U of 2nd body = $mg \times 2h$

Ratio = $\frac{mgh}{mg2h} = \frac{1}{2} = 1:2$

5) Find the ~~gravitio~~ gravitational potential energy of 2.5 kg mass kept at a height of 15 m above the ground. The force of gravity on mass 1 kg is 10 N.

A- $U = m \times g \times h$

$= 2.5 \text{ kg} \times 10 \text{ N} \times 15 \text{ m}$

$= 25 \text{ N} \times 15 \text{ m}$

$= 375 \text{ J}$

6) The gravitational potential energy stored in a box of weight 150 kgf is 1.5×10^4 J. Find the height of the box. Take 1 kgf = 10 N.

A- $U = 1.5 \times 10^4 \text{ J}$

Weight = 150 kgf

Mass = 10 N

Height = $\frac{U}{g \times m} = \frac{1.5 \times 10^4}{150 \times 10} = \frac{1.5 \times 10 \times 10 \times 10 \times 10}{150 \times 10}$

$= \frac{150}{15} = 10 \text{ m}$

7) The potential energy of a body of mass 0.5 kg

increases by 100 J when it is taken to the top of a tower from the ground. If force of gravity on 1kg is 10 N, what is the height of the tower?

A- $h = \frac{U \text{ increased}}{mg} = \frac{100\ J}{0.5 \times 10\ N} = \frac{100\ J}{5\ N} = 20\ m$

8) A body of mass 60 kg is moving with a speed 50 ms^{-1} Find its kinetic energy.

A- $KE = \frac{1}{2} mv^2 = \frac{1}{2} \times 60\ kg \times 50\ m/s^2 = \frac{1}{2} \times 60 \times 50 \times 50 = 75000$

$= 7.5 \times 10^4\ J$

9) A truck of mass 1000 kg, increases its speed from 36 km h^{-1} to 72 km h^{-1}. Find the increase in its kinetic energy.

A- KE of actual speed $= \frac{1}{2} mv^2 = \frac{1}{2} \times 1000 \times 36\ km/h^2$

$= \frac{1}{2} \times 500 \times 36 \times 36 = 648000$

KE of increased speed $= \frac{1}{2} mv^2 = \frac{1}{2} \times 500 \times 72 \times 72 = 2592000$

Ratio $= \frac{648000}{2592000}$

0

A- $v_1 = 36 \frac{km}{h} = \frac{36 \times 1000}{3600} = 10 \ m/s$

$v_2 = 72 \frac{km}{h} = \frac{72 \times 1000}{3600} = 20 \ m/s$

$m = 1000 \ kg$

Increase in KE $= \frac{1}{2} m v_2^2 - \frac{1}{2} m v_1^2 = \frac{1}{2} m (v_2^2 - v_1^2)$

$= \frac{1}{2} \times 1000 (20^2 - 10^2) = 500 (400 - 100)$

$= 500 \times 300 = 150000 = 1.5 \times 10^4 \ J$

10) A car is moving with a speed of 15 km h^{-1} and another identical car is moving with a speed of 30 km h^{-1}. Compare their kinetic energy.

A- Let the mass be m

$v_1 = 15 \ km/h$

$v_2 = 30 \ km/h$

KE of 1st car $= \frac{1}{2} m v^2 = \frac{1}{2} \times m \times 15 \times 15$

KE of 2nd car $= \frac{1}{2} m v^2 = \frac{1}{2} \times m \times 30 \times 30$

$\text{Ratio} = \frac{\frac{1}{2} \times m \times 15 \times 15}{\frac{1}{2} \times m \times 30 \times 30} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} = 1:4$

11) A pump raises water by spending 4×10^5 J of energy in 10 s. Find the power of pump.

A:- Power = $\frac{W}{t} = \frac{4 \times 10^5 \text{ J}}{10s} = 4 \times 10^4 \text{ W}$

12) It takes 20 s for a girl A to climb up the stairs while girl B takes 15 s for the same job. Compare:

i) the work done.

A- No. of work done by girl A = 1

No. of work done by girl B = 1

Ratio = $\frac{1}{1} = 1:1$

ii) the power spent by them.

A- Girl A

$P = \frac{W}{t} = \frac{1}{20}$

Girl B

$P = \frac{W}{t} = \frac{1}{15}$

Ratio = $\frac{\frac{1}{15}}{\frac{1}{20}} = \frac{15}{20} = \frac{3}{4} = 3:4$

Ans: 22/9/21