**Class – 10 Concise Physics Solutions Part-II**

**Chapter-2 Work Energy and Power**

**Exercise 2(A)**

1. Force acting on the body = 10 kgf = 10 x 10 N = 100 N

Displacement, S=0.5 m

Work done= force x displacement in the direction of force

(i)W =F x S

W = 100 x 0.5= 50 J

(ii)Work = force x displacement in the direction of force

W = F x S costheta

W = 100 x 0.5 cos60o

W= 100 x0.5 x 0.5(cos60o=0.5)

W=25 J

(iii)Normal to the force:

Work = force x displacement in the direction of force

W = F x S costheta

W = 100 x 0.5 cos90o

W= 100 x 0.5 x 0 =0 J(cos90o =0)

1. Mass of boy=40 kg

Vertical height moved, h=8m

Time taken, t=5s.

(i) Force of gravity on the boy

F= mg =40 x 10 =400N

(ii)While climbing, the boy has to do work against the force of gravity.

Work done by the boy in climbing= Force x distance moved in the direction of force

Or, W = F x S= 400 x 8= 3200 J

(iii) Power spent = http://cdn.topperlearning.com/topper/bookquestions/188322_image005.gif

1. (i) The work done by persons A and B is independent of time. Hence both A and B will do the same amount of work. Hence,

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(ii) Power developed by the person A and B is calculated as follows:

A takes 20 s to climb the stairs while B takes 15 s, to do the same. Hence B does work at a much faster rate than A; more power is spent by B.

Power developed http://cdn.topperlearning.com/topper/bookquestions/188323_image009.gif (and amount of work done is same)

http://cdn.topperlearning.com/topper/bookquestions/188323_image011.gif

1. Total distance covered in 30 steps , S= 30 x 20 cm = 600 cm = 6 m

Work done by the boy in climbing= Force x distance moved in direction of force

Work, W= F x S= 350 x 6 =2100 J

Power developed= http://cdn.topperlearning.com/topper/bookquestions/188324_image013.gif

1. Work done by man= 6.4kJ

Distance moved, S=64m

(i) Work done by the man= Force x distance moved in direction of force

Work, W= F x S

6.4 x 103 =F x 64

http://cdn.topperlearning.com/topper/bookquestions/188325_image015.gif

(ii) Power spent= http://cdn.topperlearning.com/topper/bookquestions/188325_image017.gif

1 H.P= 746 W

1W = http://cdn.topperlearning.com/topper/bookquestions/188325_image019.gif

2560 W= http://cdn.topperlearning.com/topper/bookquestions/188325_image021.gif

1. Force= mg= 200 x 10=2000N

Distance, S= 2.5m

Time , t=5 s

(i) Work done, W= F S

W =2000 x 2.5m= 5000J

(ii) Power developed =http://cdn.topperlearning.com/topper/bookquestions/188326_image023.gif

1. (i) Energy spent by machine or work done= F S

Work, W =750 x 16= 12000J

(ii) Power spent= http://cdn.topperlearning.com/topper/bookquestions/188327_image025.gif

1. Energy consumed = power x time

(i) Energy = 3 kW x 10 h=30kWh

(ii) 1 kilowatt hour (kWh)= 3.6 x 106J

30kWh = 30 x 3.6 x 106J

= 1.08 x 108J

1. Force of gravity on boy

F= mg = 40 x 10=400N

Total distance covered in 15 steps ,

S= 15 x 15cm =225cm=2.25m

Work done by the boy in climbing= Force x distance moved in direction of force

Work, W= F x S= 400 x 2.25 =900J

Power developed= http://cdn.topperlearning.com/topper/bookquestions/188329_image027.gif

1. Volume of water= 50 L=50 x10-3 m3

Density of water= 1000kgm-3

Mass of water= Volume of water x density of water

= 50 x10-3 x1000= 50kg

Work done in raising 50kg water to a height of 25m against the force of gravity is:

W = mg x h= mgh

Power P= http://cdn.topperlearning.com/topper/bookquestions/188330_image029.gif

1. (i) Work done in raising a 50kg mass to a height 2m against the force of gravity is:

W = mg x h= mgh

Hence both men will do the same amount of work. Hence,

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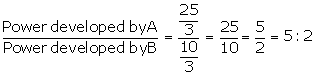
(ii) First man A takes 2 minutes to raise 50kg mass

Second man B takes 5 minutes to raise 50kg mass.

Power developed by man A=http://cdn.topperlearning.com/topper/bookquestions/188331_image033.gif

Power developed by man B=http://cdn.topperlearning.com/topper/bookquestions/188331_image035.gif

http://cdn.topperlearning.com/topper/bookquestions/188331_image037.gif



1. Work done in raising a 500kg mass to a height of 80m against the force of gravity is:

(a) W = mg x h= mgh

W= 500 x 10 x80 =4 x105J

(b) Power at which pump works =http://cdn.topperlearning.com/topper/bookquestions/188332_image041.gif

(c) Efficiency= http://cdn.topperlearning.com/topper/bookquestions/188332_image043.gif

Efficiency =40 % = 0.4

0.4 =http://cdn.topperlearning.com/topper/bookquestions/188332_image045.gif

Power input = http://cdn.topperlearning.com/topper/bookquestions/188332_image047.gif

1. Given, force = 1000N, velocity=30m/s

Power, P= force x velocity

P = 1000 x 30 = 30,000W = 30kW

1. Power =40kW

Force= 20,000N

Power = force x velocity

Velocity =http://cdn.topperlearning.com/topper/bookquestions/188334_image049.gif

**Exercise 2B.**

1. Height H1= h

Height H2= 2h

Mass of body 1= m

Mass of body 2= m

Gravitational potential energy of body 1 =mgH1= mgh

Gravitational potential energy of Body 2=mgH2= mg (2h)

Ratio of gravitational potential energies

= http://cdn.topperlearning.com/topper/bookquestions/188358_image057.gif

1. Mass , m=1kg

Height, h=5m

Gravitational potential energy= mgh

=1 x 10 x5=50J

1. Gravitational potential energy=14700 J

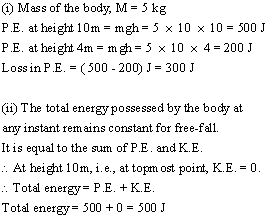
Force of gravity = mg= 150 x 9.8N/kg= 1470N

Gravitational potential energy= mgh

14700 =1470 x h

h=10m





1. Mass =0.5 kg

Energy= 1 J

Gravitational potential energy= mgh

1=0.5 x10 x h

1=5h

Height, h= 0.2 m

1. Force of gravity on boy=mg= 25 x 10 =250N

Increase in gravitational potential energy= Mg (h2-h1)

= 250 x (9-3)

=250 x6=1500 J

1. Mass of water, m= 50kg

Height, h=15m

Gravitational potential energy= mgh

=50 x10 x 15

=7500 J

1. Mass of man=50kg

Height of ladder, h2=10m

(i) Work done by man =mgh2

=50 x 9.8 x10= 4900J

(ii)increase in his potential energy:

Height,h2= 10m

Reference point is ground, h1=0m

Gravitational potential energy= Mg (h2-h1)

= 50 x9.8x (10-0)

= 50 x 9.8 x10= 4900J

1. F=150N

(a) Work done by the force in moving the block 5m along the slope = Force x displacement in the direction of force =150 x 5=750 J

(b) The potential energy gained by the block

U =mgh where h =3m

=200 x 3=600 J

(c ) The difference i.e., 150 J energy is used in doing work against friction between the block and the slope, which will appear as heat energy.

1. Mass, m =1kg

Velocity, v=10m/s

Kinetic energy=http://cdn.topperlearning.com/topper/bookquestions/188367_image061.gif

http://cdn.topperlearning.com/topper/bookquestions/188367_image063.gif

1. If the speed is halved (keeping the mass same), the kinetic energy decreases, it becomes one-fourth (since kinetic energy is proportional to the square of velocity).
2. ?
3. Given, velocity of first body v1=v

And velocity of second body, v2 =2v

Since masses are same, kinetic energy is directly proportional to the square of the velocity (http://cdn.topperlearning.com/topper/bookquestions/188369_image065.gif)

Hence, ratio of their kinetic energies is:

http://cdn.topperlearning.com/topper/bookquestions/188369_image067.gif

1. Given, velocity of first car, v1=15 km/h

And velocity of second car, v2 =30 km/h

Since masses are same, kinetic energy is directly proportional to the square of the velocity (http://cdn.topperlearning.com/topper/bookquestions/188370_image065.gif)

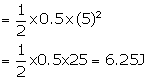
Hence, ratio of their kinetic energies is:

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1. Mass of ball= 0.5kg

Initial velocity=5m/s

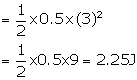
Initial kinetic energy= http://cdn.topperlearning.com/topper/bookquestions/188371_image061.gif



Final velocity of the ball =3m/s

Final kinetic energy of the ball =

http://cdn.topperlearning.com/topper/bookquestions/188371_image061.gif



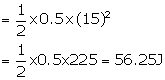
Change in the kinetic energy of the ball = 2.25 J - 6.25J = -4J

There is a decrease in the kinetic energy of the ball .

1. Mass of canon ball= 500g=0.5 kg

Speed, v=15m/s

(a)Kinetic energy of ball =http://cdn.topperlearning.com/topper/bookquestions/188372_image061.gif



(b)Momentum of the ball = mass x velocity

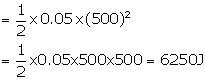
=0.5 x15=7.5kgm/s

1. Mass of bullet =50g = 0.05kg

Velocity=500m/s

Distance penetrated by the bullet=10cm=0.1m

(a)Kinetic energy of the bullet=http://cdn.topperlearning.com/topper/bookquestions/188373_image061.gif



(b)Work done by the bullet against the material of the target= resistive force x distance

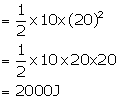
6250= resistive force x 0.1m

Resistive force=62500N

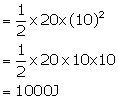
1. Let initial Mass, m1= 10kg and velocity, v1=20 m/s

Final mass, m2=2 x10=20 kg and velocity, v2=20/2= 10m/s

Initial kinetic energy, K1=http://cdn.topperlearning.com/topper/bookquestions/188374_image061.gif



Final kinetic energy, K2=http://cdn.topperlearning.com/topper/bookquestions/188374_image061.gif



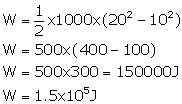
http://cdn.topperlearning.com/topper/bookquestions/188374_image083.gif

1. u=36 km/h=http://cdn.topperlearning.com/topper/bookquestions/188375_image085.gif

and v=72km/h=http://cdn.topperlearning.com/topper/bookquestions/188375_image087.gif

mass of the truck =1000 kg

(i)



(ii) Power http://cdn.topperlearning.com/topper/bookquestions/188375_image093.gif

1. Mass of body = 60kg

Momentum, p=3000kgm/s

(a)Kinetic energy http://cdn.topperlearning.com/topper/bookquestions/188376_image095.gif

http://cdn.topperlearning.com/topper/bookquestions/188376_image097.gif

=7.5 x 104J

(b)Momentum = mass x velocity

3000 = 60 x velocity

Velocity =50m/s

1. Momentum , p=500gcm/s=0.005kgm/s

Mass of ball =50 g=0.05kg

(a)Kinetic energy of the ballhttp://cdn.topperlearning.com/topper/bookquestions/188377_image095.gif

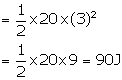
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1. Mass of box=20 kg

(a)Zero work is done as there is no displacement of the man.

(b)Work done, Kinetic energy of man

= http://cdn.topperlearning.com/topper/bookquestions/188378_image061.gif



(c) Work done in raising the box, Potential energy = mgh

     U= 20 x 10 x0.5=100J

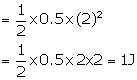
1. Mass of trolley = 0.5 kg

Velocity = 2 m/s

When the compressed spring is released, its potential energy is converted into kinetic energy completely.

Potential energy of compressed spring = kinetic energy of moving trolley

Kinetic energy of trolley =http://cdn.topperlearning.com/topper/bookquestions/188379_image061.gif



Hence, potential energy of compressed spring=1.0J

**Exercise 2C.**

No Numerical.

**Exercise 2D.**

1. Potential energy at the maximum height= initial kinetic energy

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http://cdn.topperlearning.com/topper/bookquestions/188407_image117.gif

1. (a) Potential energy at the greatest height = initial kinetic energy

or, mgh http://cdn.topperlearning.com/topper/bookquestions/188408_image115.gif

http://cdn.topperlearning.com/topper/bookquestions/188408_image119.gif

(b) Kinetic energy on reaching the ground= potential energy at the greatest height=56.25 J

(c) Total energy at its half way point=http://cdn.topperlearning.com/topper/bookquestions/188408_image121.gif=56.25J

1. (a) Potential energy of the ball =mgh

=2 x 10 x 5=100J

(b) Kinetic energy of the ball just before hitting the ground = Initial potential energy= mgh=2x10x5=100J

(c) Mechanical energy converts into heat and sound energy.

1. (a)Mass of skier= 60kg

Loss in potential energy = mg(h1 –h2)

=60 x 10 x(75-15)

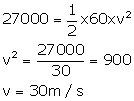
= 60 x 10 x60=3.6x104J

(b)Kinetic energy at B http://cdn.topperlearning.com/topper/bookquestions/188410_image125.gif

=2.7x 104J

Kinetic energyhttp://cdn.topperlearning.com/topper/bookquestions/188410_image115.gif

27000 http://cdn.topperlearning.com/topper/bookquestions/188410_image115.gif

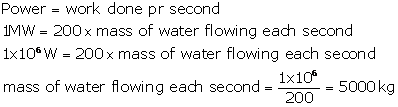


1. Potential energy = mgh

Efficiency = 40 %

Useful work done = 40 % of potential energy

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1. Potential energy at the extreme position= 40% of Kinetic energy at the resting position.

