DPP – 1 WORK, POWER & ENERGY

1. Define work. Is work a vector or scalar quantity? What is the SI unit of work?

2. Obtain the relation between SI unit and the CGS unit of work.

3. Write an expression for work W in terms of force F, displacement d and the angle between force and displacement θ.

4. State the condition when work is positive and maximum.

5. State the condition when work is negative and maximum.

6. State the condition when body is displaced but the work is zero.

7. Does a boy work while pushing the rigid wall?

8. Why the electrons in any atom don't work while revolving round the nucleus?

9. A satellite is revolving round the planet on circular path. What is the work done by the satellite? Explain.

10. A body of mass m climbs the height h against gravity. What is the work done by the body?

11. A cricket ball of mass 100 g is thrown vertically upwards such that it goes to the height of 12 m. What is the work done in this process? ($g = 10\ m\ s^{-2}$)

12. A constant force of 100 N displaces a particle

(i) 2 m in the direction of force,

(ii) 4 m at an angle of 30^0 from the direction of force and

(iii) 1.2 m at right angle to force. Calculate work done by the particle in each condition.

13. Define power and write its SI unit.

14. Is power a scalar quantity?

15. Show that power = force x speed.

DPP – 2 WORK, POWER & ENERGY

1. What is one horse power? How it is related to SI unit of power?

2. The power of a motor is 30 kW. What maximum load it can raise with speed 2 m s^{-1}?

3. A steamer boat of I O H.P. can move with maximum speed 7.46 m s^{-1}. What is the resistance (force) offered by the river on the boat?

4. The maximum frictional force on a motor bike of 2.5 H.P. is 1000 N. What is the maximum possible speed of the bike?

5. A machine does 1000 joules of work in 4 seconds. What is the power of the machine in
(i) watt and (ii) horse power?

6. Calculate the electric energy generated by an electric power station of 2 MW in a day.

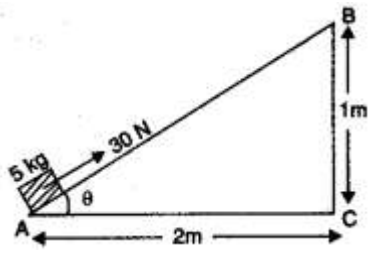
7. Raju and Aarti both climb 20 steps to reach the first floor of the school building. They take time 20 seconds and 30 seconds respectively to reach the floor. Who does more work? Who delivers more power?

8. An overhead water tank is fixed at the height of 10 m from the ground and has capacity of 500 litres. Calculate the time required to fill the tank from a pump of 0.5 H.P. whose efficiency is 90%.

9. Define one kilowatt-hour. Find its relation with joule.

10. A load of 1000 kgf is to be moved on an inclined plane of length 10 m. If the angle of inclination of the plane with horizontal is 300 calculate the work done against gravity.

11. A body of mass 5 kg is pulled from point A to B on an inclined plane ABC. A force of 30 N is applied along the surface AB. Calculate,



(i) the work done by the force in pulling the body.
(ii) the work done against the force due to gravity. ($g = 9.8\ ms^{-2}$)
(iii) explain the reason for difference in two works done.

12. A man runs 50 m on horizontal road, then 5 m on an inclined road (inclination 3 in 4). Weight of man is 60 kgf. Calculate total work done by him (Neglect friction).

13. An overhead water tank of capacity 1000 litres is 30 m above the ground. Calculate total work done in filling this tank. Calculate total time taken by a lift pump of power 5 kW to fill the tank.

14. A steamer boat of100 HP can move in sea with maximum velocity of 3.43 m/s. Calculate frictional force applied by water on boat.

15. A power lifter lifts a load of 180 kgf up to height of 2.2 m for 5s. Calculate
(i) the work done (ii) power developed by him.

DPP - 3 WORK, POWER & ENERGY

1. A girl of mass 50 kg, climbs a flight of 100 stairs each measuring 0.25 m in height, in 20 s. Find (a) Force acting on the girl (b) Work done by the girl (c) Gain in potential energy (d) Power in (i) Watts (ii) Horse power. Take g = 10 ms^{-2}; 1 HP = 750 W)

2. A load of 220 kg is vertically pulled up by a crane through a vertical height of 16 m in 40 s. Calculate (i) Force acting in the upward direction (ii) Total work done (iii) Horse power of the engine pulling the rope. (Take g = 9.8 ms^{-2}; 1 HP = 750 W)

3. A work of 1000 J is done on a body in 4 s, such that a displacement of 20 m is caused. Calculate (a) Force (b) Power.

4. What force must be applied to a body through a distance of 10 m, such that it does a work of 4000 J? If the mass of body is 20 kg, what is the acceleration of the body?

5. An engine of power 200 W, operates for 4 s. Find the work done by the engine. If the force developed by the engine is 100 N, calculate the maximum displacement caused.

6. Calculate the horse power of the motor of an elevator, which can carry 10 persons of average mass 60 kg through a vertical height of 20 m in 30 s. [Take g = 10 N / kg]

7. Calculate the power of an electric pump in horse power, which can lift 2000 m^3 of water from a depth of 20 m in 25 minutes. (Take g = 10 ms^{-2} and 1 m^3 of water = 10^3 kg)

8. Calculate the height through which a crane can lift a load of 4 t, when its motor of 4 HP operates for 10 s.[Take, g = 10 ms^{-2}]

9. For how long must an electric motor pump of 2 HP operate, so as to pump 5 m^3 of water from a depth of 15 m. [Take g = 10 N/kg, 1 m^3 of water = 10^3 kg]

10. An electric pump is 60 % efficient and is rated 2 HP. Calculate the maximum amount of water it can lift through a height of 5 m in 40 s. [Take g = 10 ms^{-2} and 1 HP = 750 W]

11. Calculate the time for which a motor pump of 10 HP and efficiency 80% must be switched on, so as to pump 20 m^3 of water through a vertical height of 20 m. [Density of water = 1000 kg m^{-3}; g = 10 ms^{-2}; 1 HP = 750 W]

12. In a hydroelectric power station, 1000 kg of water is allowed to drop through a height of 100 m in 1 s. If the conversion of potential energy to electric energy is 60%, calculate the power output. [Take g = 10 ms^{-2}]

13. A compressed spring is held near a small toy car of mass 0.15 kg. On the release of the spring, the toy car moves forward with a velocity of 10 ms^{-1}. Find the potential energy of the spring.

14. A catapult throws a stone of mass 0.10 kg with a velocity of 30 ms^{-1}. If 25 % of the P.E. of the elastic band is wasted during transmission, find the magnitude of the potential energy.

DPP - 4 WORK, POWER & ENERGY

1. A body A of mass 20 kg is moving with a velocity of 1 ms^{-1}. Another body B of mass 1 kg is moving with a velocity of 20 ms^{-1}. Find the ratio of kinetic energy of A and B.

2. A bullet of mass 0.2 kg, moving with a velocity of 200 ms^{-1}, strikes a stationary wooden target of mass 5 kg. If all the energy is transferred to the wooden target, calculate the velocity with which the target moves in the forward direction.

3. A body of mass m has a velocity v. If the mass of the body increases 81 times, but the kinetic energy remains same, calculate the new velocity.

4. A body P has KE energy E. Another body Q, whose mass is 9 times than P, also has kinetic energy E. Calculate the ratio of velocities of P and Q.

5. A scooter develops a power of 1 HP while running at 36 km/hr. Calculate the force generated by its engine. [Take 1 HP = 750 watts]

6. The engine of a car develops a power of 5 HP and force 500 N while running a uniform speed S. Calculate the value of S

7. The heart of a normal person beats 72 times in a minute and does a work of 1 joule per beat. What is power of the heart?

8. The heart of a deer chased by a tiger beats 200 times in a minute and does a work of 1.4 joules per beat. What is the power of heart?

9. A beam of electrons has an energy of 1 joule. How many electrons are m the beam? [6.25 x 10^{18} electrons]

10. An accelerated electron has energy of 9.6 x 10^{-18} J. Express the energy in electron volts (eV)

11. Calculate the kinetic energy of a body of mass 100 g and having a momentum of 20 kg ms^{-1}

12. Calculate the kinetic energy of a body of mass 5 kg momentum 50 kg ms^{-1}.

13. A spring is kept compressed by a toy car of mass 100 g. On releasing the pressure the car moves out with a speed of 0.5 ms^{-1}. Calculate the potential energy of the compressed spring.

14. A lead pallet of mass 10 g leaves an air gun with a velocity of 40 ms^{-1}. What is the magnitude of potential energy stored by its spring?