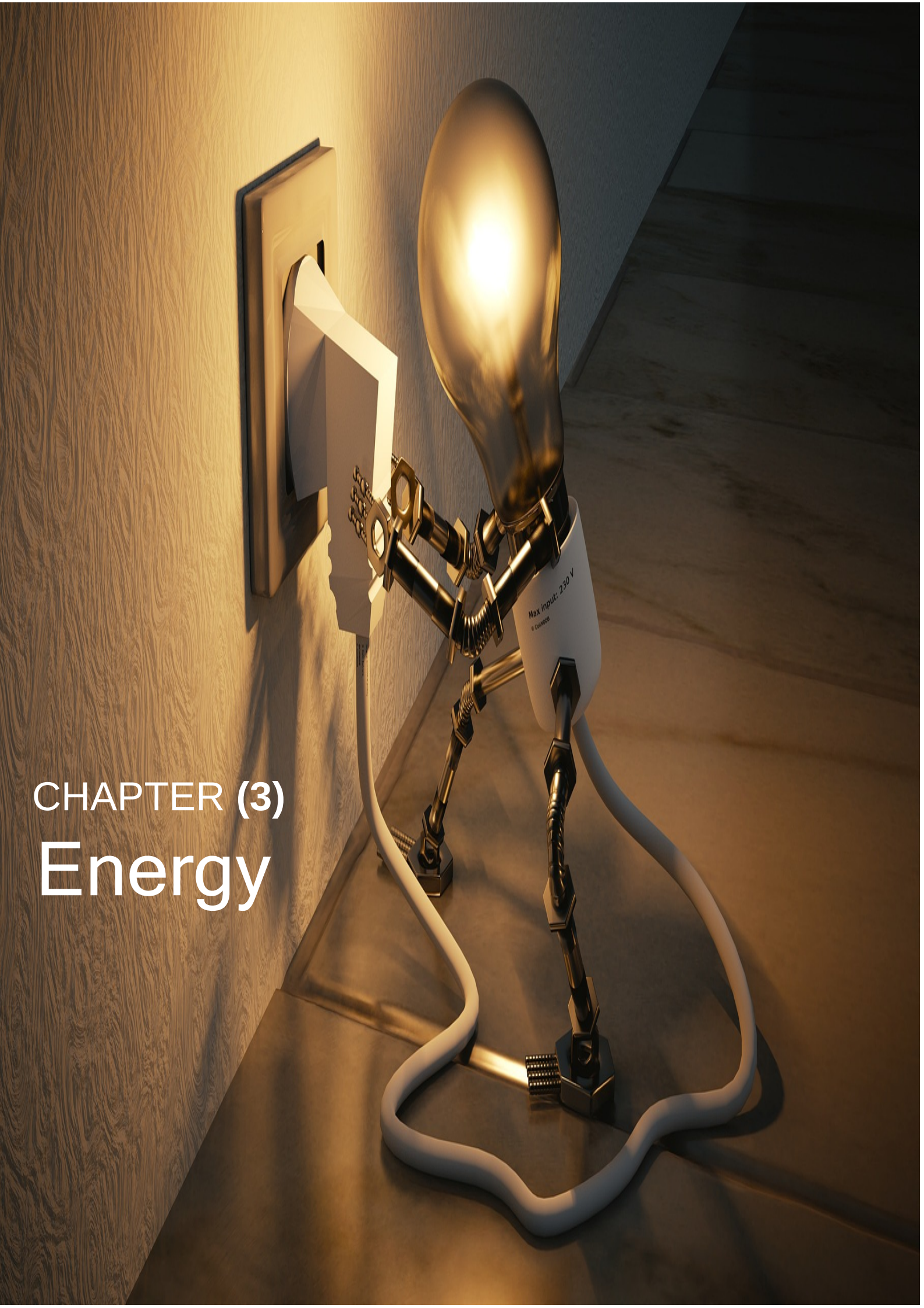


CHAPTER **(3)**

Energy

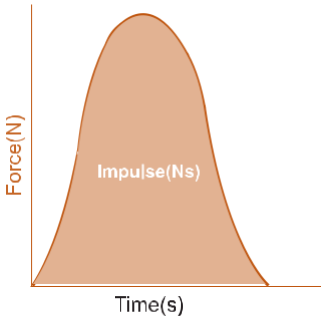
Energy systems and collisions

Types of systems:

- Closed System: is system that doesn't gain mass neither lose it.
- Isolated System: A system that does not have a net external force and does not exchange matter or energy with its surroundings

. **Types of Collisions:**

- Superealistic collisions : the kinetic energy after the collision is greater than before .
- Elastic collision : the kinetic energy after the collision equals to the energy before .
- Inelastic collision: the kinetic energy after the collision is less than before.
- The kinetic energy becomes less when the colloid's objects stick together



. **Momentum and Impulse:**

- Impulse: is the quantity that calculated by multiplying the exerted force and time. Impulse = F Δt

F is the force [N], and Δt is the time [s]

- The unit of impulse is N.s = kg.m/s
- The area under the curve of (Force vs Time) graph equals the impulse as shown below
- Example: The impulse that exerted on the ball by the player equals to the impulse that is exerted on the player by the ball and in opposite direction.
- Momentum: is the product of the mass and velocity of an object.
- P = mv P is the momentum [kg.m/s], m is the mass [kg], and v is the velocity [m/s].
- Momentum is directly proportional to both mass and velocity.
- Conservation of momentum: the total momentum of any isolated and closed system is conserved (constant)

1. The system that doesn't gain mass neither lose it is a

A open B closed
C elastic D inelastic

2. Two cars has the same mass and moving in the same direction , but one of them is slow and the other is fast, if they stick together, so their speed together will be.

A Equal B Same speed of the fast car
C Zero D Same speed of the slow car

3. The impulse unit is:

A N.s B N.m C Hz D rad

4. The area under the curve in Force – Time graph represents:

A Velocity B Acceleration
C Momentum D Impulse

5. Which of the following statements false when using to complete the phrase: (When a player hits the football then .

A The impulse on the football by the player equals to the impulse on the player by the football.
B The impulse on the football is greater than the impulse on the player.
C The two impulses in part B are opposite in direction.
D The force exerted on the ball is equivalent to the force exerted on the player.

6. The product of mass and velocity is:

A Acceleration B Momentum
C Kinetic energy D Potential energy

7. The momentum of a system consists of two balls can be described as conserved when the system:

A Closed and opened B Closed and isolated
C Opened and isolated D Opened

Work: is the translation of energy in mechanical ways. (Ability to do energy)

$W = F.d.\cos\theta$

Where W is the work [J], F is the force [N], d is the displacement [m], and Θ is the angle between the force and the displacement.

- To determine the work done by gravity force use this relation:

$$W = mgd$$

W is the work [J], m is the mass [kg], g is the gravitational acceleration [m/s²], and d is the displacement [m]

- The area under the curve in (force – displacement) equals the work done by the force.
- The work done by the friction force is negative sign because the friction force opposite to the motion and reduces the energy (Lost of energy).
- The work done by the friction force on horizontal surface is given as:

$$W = -f_k d \quad W = -\mu_k mgd$$

W is the friction work [J], f_k is the kinetic friction force [N], d is the displacement [m], μk is the coefficient of kinetic friction [unit less], m is the mass [kg], g is the gravitational force [m/s²].

- Work =0 , when the applied force is perpendicular to the displacement. Θ = 90o

8. Momentum equals to the product of the mass by:

A Angular velocity B Velocity
C Angular acceleration D Angular displacement

9. A bicycle has mass of 50 kg and its momentum 250 kg.m/s, so its velocity is:

A 0.25 m/s B 25 m/s
C 5 m/s D 50 m/s

Solution

P = mv 250 = 50v
V = 250/50 =5 m/s , so the right answer is C

10. If the velocity of an object is doubled, then its momentum will:

A Doubled B Multiple 4 times
C Decreased by half D Multiple by one fourth

11. Which of the following represents a mechanical energy transformation

A Momentum B Kinetic energy
C Work D Impulse

12. If you lift a book over a table and put it back, then you don't make work because:

A Displacement equals zero B Exerted energy equals zero
C Expended energy equals zero D Impulse equals zero

13. A machine lift a box 10 m up and makes work 5 kilo Joule on it, calculate the mass of the box in kg. $(g = 9.8 m/s^2)$

A 15 B 16 C 48 D 51

Solution

W = Fd
5 x 1000 = F x 10
5000 = 10F
F = 5000/10 = 500 N , that is the weight of the object
500 = mg
500 = m (9.8)
M=500/9.8 = 51 kg , so the right answer is D

14. An object slides to the east, the direction of the friction force will be to the: $(g = 9.8 m/s^2)$

A West B North C East D South

15. A person pushes a box with mass 40 kg a distance 10 m, with constant speed on horizontal surface , it's kinetic coefficient μ =0.1, determine the work done by the friction force (g = 10 m/s²)

A -4 B -40 C -400 D -4000

Kinetic energy and (work – energy) theorem:

Kinetic energy: is the energy of motion

$$K.E = \frac{1}{2}mv^2$$

- K.E is the kinetic energy [J], m is the mass [kg], v is the velocity [m/s].
- Kinetic energy is directly proportional to the mass and the squared of velocity.
- Work- Energy theorem: The work equals to the change in kinetic energy.

$W = \Delta K.E = K.E_f - K.E_i$

Kinetic energy and (work – energy) theorem:

Kinetic energy: is the energy of motion

W is the work [J], ΔK.E is change in kinetic energy [J] The translation of energy can take place between the sys-tem and the surrounding during the work done in both directions.

- If the work done on the system then W is (+), Total energy increased.
- If the work done by the system then W is (-), Total energy decreased.

16. The kinetic energy is:

A Inversely proportional to mass

B Directly proportional to the squared of mass

C Directly proportional to the squared of velocity

D Inversely proportional to the squared velocity

17. An object mass is 2kg and speed is 1m/s, how much is its kinetic energy in J unit?

A 0.25 B 0.5 C 0.75 D 1

Solution

$$K.E = \frac{1}{2}mv^2 = \frac{1}{2} \times 2 \times 1^2 = 1\,J$$

so the right answer is D

18. The kinetic energy for an object is 100J and its speed is 5m/s, how much is its mass?

A 8 B 10 C 20 D 500

19. An energy of a pendulum is 10 J at furthest displacement from balance, if the mass of pendu-lum ball is 5kg, how much is the highest speed?

A 0 m/s B 2 m/s C 4 m/s D 10 m/s

Solution

$$KE = \frac{1}{2}mv^2 \qquad V^2 = 4, v = \sqrt{4}$$

$$10 = \frac{1}{2} \times 5 \times v^2 \qquad V = 2\ m/s$$

so, the right answer is B

20. Two objects have the same kinetic energy, the mass of the second object is double the mass of the first object, if the speed of the first object is v, how much is the speed of second object?

A v^2 B C $\frac{v}{2}$ D $\frac{v}{\sqrt{2}}$

21. If 125J work is done on an object moves in horizontal path, which statement is correct?

A Its high increases 125 m

B Its speed increases 125 m/s

C Its potential energy changes 125 J

D Its kinetic energy changes 125 J

22. An object moves from rest on a rough horizontal surface by a force made 50J work on the object, if the friction force work is 20J, how much is the change in kinetic energy (J)?

A 120 B 90 C 80 D 30

23. If the work done on the system, so the work is.

A (+), system's energy increases

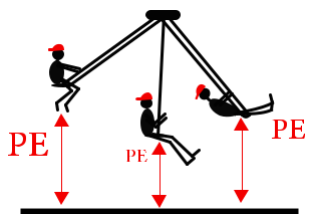
B (+), system's energy decreases

C (-) , system's energy decreases

D (-), system's energy increases

Potential energy:

- Gravitational potential energy: The energy is stored as the result of the gravitational attraction of the Earth for the object. $P.E = mgh$
- P.E is the gravitational potential energy [J], m is the mass [kg], g is the gravitational acceleration [m/s²], h is the height [m].
- The gravitational potential energy increases as the height increased.
- **The elastic potential energy:** is the energy stored in elastic materials as the result of their stretching or compressing. Elastic potential energy can be stored in rubber bands, bungee cords, trampolines, springs, an arrow drawn into a bow, etc.



24. What is the energy stored in objects?

A Potential B Kinetic
C Optical D Electric

25. If $g = 10m/s^2$, so we need ……. J to raise up a 2kg ball to 3 m height.

A 200 B 60 C 15 D 6

Solution

PE = mgh =2x3x10 = 60 J ,
so the right answer is B

26. A player lifts a 10kg weight to 10m height, how much is the potential energy that the weight has? If $(g = 9\ 8m/s^2)$

A 10 B 20 C 196 D 980

27. Which object is the most stored for potential

A 1 B 2 C 3 D 4

Object	Mass(kg)	Height(m)
1	3	2
2	5	4
3	20	0
4	1	9

28. How much is the mass of an object (kg) put on a 10 m height building, knowing that the potential energy of the object 196J ? $(= 9\ 8m/s^2)$

A 1 B 2 C 4 D 8

29. A 5kg mass object put on a table, its potential energy is 98J, how height is the table?
$(g = 9.8m/s^2)$

A 1 m B 2 m C 3 m D 4 m

30. In the diagram, if the pendulum moves from B to C, the potential energy.

A Doesn't change B Increases
C decreases D Equals zero

31. The stored energy in tight cord is.

A Kinetic energy B Static energy
C Elastic potential energy D Chemical potential energy

Power: is the work done divided by time. [J/s]

$$P = \frac{W}{t} \qquad P = \frac{Fd}{t} \qquad P = F.v$$

Where P is the power [Watt, W], W is the work [J], t is the time [s], F is the force [N], d is the distance [m], v is the speed [m/s].

- The unit op power is Watt , W = J/s = kg.m/s²
- The power is inversely proportional with time as the dissipated energy is constant.
- Example: What is the unit of power? Answer is Watt (A).

32. The done work divided on the time is.

A Momentum B energy
C push D power

33. Calculate the power of a machine makes 70J work in 3.5 s.

A 0.05 W B 20 W
C 73.5 W D 245 W

Solution

Power = W/t =70 /3.5 = 20 W,
so the right answer is B

34. Power unit is.

A $kg{\cdot}m^2/s^2$ B $kg{\cdot}m/s^2$
C $kg{\cdot}m^2/s^3$ D $kg{\cdot}m^2/s^3$

35. An engine lifts up aweighted 3×10^3 for 9m distance vertically in 10s, calculate the power of the engine (W).

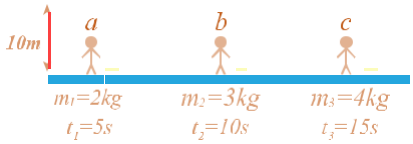
A 27 B 7×10^3
C 27×10^2 D 27×10^4

36. **An electric engine lifts an elevator for 5 m in 10s in 20000 N vertical force up, how much is the power that the engine do? (kW)**

A 200 B 100 C 20 D 10

37. **In the diagram three men, each man lift a box to 10m height, under each box; its mass and time, Which man has the most power?**

A C B A C B D Same ability



38. **Machine A does work in 130min, machine B does the same work in 65min,....**

A Power of A = Power of B

B Power of A < Power of B

C Power of A is double Power of B

D Power of B is double Power of A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B	A	A	D	B	B	B	B	C	A	C	A	D	A	C	C	D	A	B	D

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
D	D	A	A	B	D	B	B	B	B	C	D	B	C	C	D	B	D