Physics important topic

- **Thermodynamics**
- **Electrical circuit**
- **Force magnetics**
- **Angular momentum**
- **Angular acceleration**
- **Work power energy**
- **Projectile motion**
- **Law of falling bodies**
- **Kinetic energy**
- **Potential energy.**
- **Centripetal force**
- **Centrifugal force**

Thermodynamics

1.**A Carnot engine whose sink is at 300 K has an efficiency of 40%. By how much should the temperature of the source be increased so as to increase its efficiency by 50% of original efficiency?**
1) 380 K
2) 275 K
3) 325 K
4) 250 K

Answer – 4) 250 K.

Efficiency = 1 - (T_sink / T_source)
Given that the initial efficiency is 40%, we can write:
0.40 = 1 - (300 / T_source)
Solving for T_source:
0.40 = 1 - (300 / T_source)
0.60 = 300 / T_source
T_source = 300 / 0.60
T_source = 500 K

To increase the efficiency by 50% of the original efficiency, we need to find the new temperature of the source, let's say T_source_new:

Efficiency_new = 0.40 + (0.50 * 0.40) = 0.40 + 0.20 = 0.60
0.60 = 1 - (300 / T_source_new)
Solving for T_source_new:
0.60 = 1 - (300 / T_source_new)
0.40 = 300 / T_source_new
T_source_new = 300 / 0.40
T_source_new = 750 K

To find the increase in temperature, we subtract the initial temperature from the new temperature:
Temperature increase = T_source_new - T_source
Temperature increase = 750 K - 500 K
Temperature increase = 250 K

2. **If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then**

1) Q = 0
2) W = 0
3) Q = W = 0
4) E = 0

Solve

In a closed cycle process, the system returns to its initial state, so the change in internal energy (ΔU) is zero. Based on the first law of thermodynamics, we have the equation:

$\Delta U = Q - W$

Since ΔU is zero, we can conclude that Q = W.
Therefore, the correct answer is 3) Q = W = 0.

Q3. In thermodynamic processes which of the following statements is not true?

1) In an adiabatic process PV^{γ} = constant
2) In an adiabatic process the system is insulated from the surroundings
3) In an isochoric process pressure remains constant
4) In an isothermal process the temperature remains constant.

Solve :

In an isochoric process, pressure remains constant.
In an isochoric process, also known as an isochoric or constant-volume process, the volume remains constant, not the pressure.

Therefore, the correct answer is 3) In an isochoric process, pressure remains constant.

Q4. The internal energy change in a system that has absorbed 2 Kcal of heat and done 500 J of work is:
1) 7900 J
2) 8900 J
3) 6400 J
4) 5400 J

Solve-

The internal energy change (ΔU) can be calculated using the first law of thermodynamics:

ΔU = Q - W
Given that Q = 2 Kcal = 2 * 4184 J (1 Kcal = 4184 J) and W = 500 J, we have:
ΔU = 2 * 4184 J - 500 J
ΔU = 8368 J - 500 J
ΔU = 7868 J

Therefore, the correct answer is 1) 7900 J.

Q5**. If ΔU and ΔV represent the increase in internal energy and work done by the system respectively in a thermodynamic process, which of the following is true?**
1) ΔU = -ΔW, in an isothermal process
2) ΔU = -ΔW, in an adiabatic process
3) ΔU = ΔW, in an isothermal process
4) ΔU = ΔW, in an adiabatic process

Solve-

ΔU = -ΔW in an isothermal process.
In an isothermal process, the temperature remains constant, so the change in internal energy (ΔU) is zero. According to the first law of thermodynamics, we have:

ΔU = Q - W
Since ΔU is zero, we can conclude that Q = W. However, since the work is being done by the system (negative), we have ΔU = -ΔW.

Therefore, the correct answer is 1) ΔU = -ΔW in an isothermal process.

Q6. During an isothermal expansion, a confined gas does –150 J of work against its surroundings. This implies that

1) 150 J of heat has been added to the gas
2) 150 J of heat has been removed from the gas
3) 300 J has been added to the gas
4) no heat is transferred because the process is isothermal

Solve -

During an isothermal expansion, the temperature of the gas remains constant. According to the first law of thermodynamics, we have:

$\Delta U = Q - W$

Since it is an isothermal process, ΔU is zero, and the work done by the gas is negative (-150 J). Therefore, to balance the equation, the heat (Q) must be positive and equal to +150 J.

Hence, 150 J of heat has been removed from the gas.

Q9. Pick the only reversible process among the following processes:

1) Movement of a particle on a frictionless track
2) Passage of current through a resistor
3) Passage of heat from water at 40 °C to water at 20 °C
4) Expansion of a gas coming out of a nozzle

Answer-

Movement of a particle on a frictionless track.

A reversible process is one that can be reversed without leaving any trace on the system or the surroundings. In the case of the movement of a particle on a frictionless track, there is no dissipation of energy or irreversibility involved. The process can be reversed without any loss or generation of heat or energy.

Q10. Pick the one that is not a state variable of a thermodynamic system:

1) Temperature
2) **Heat**
3) Volume
4) Internal energy

Answer-

Temperature, volume, and internal energy are state variables because they depend only on the current state of the system and not on how the system reached that state. Heat, on the other hand, is not a state variable because it represents energy transfer and depends on the specific process or path taken by the system.

Q11. The second law of thermodynamics is concerned essentially with

1) nature of heat flow
2) amount of heat flow
3) direction of heat flow
4) speed of heat flow

Answer -

Direction of heat flow.

The second law of thermodynamics states that heat flows spontaneously from an object at a higher temperature to an object at a lower temperature. It establishes the direction of heat transfer and introduces the concept of entropy, which characterizes the irreversibility and the tendency towards disorder in natural processes.

Q12. Consider the following two statements:
A: A system is in steady state if its properties are independent of space. B: A system is in steady state if its properties are independent of time.
Which of the following statements is true?
1) Both A and B are true
2) A is false but B is true
3) A is true but B is false
4) Both A and B are false

A is false, but B is true.
A steady state refers to a system where its properties are independent of time, meaning they do not change over time. However, the properties of a system can vary in space, so statement A is false. On the other hand, statement B is true as a steady state implies independence from time.

Q13. **Consider a refrigerator in a kitchen. Take the refrigerator and everything in it to be our system. Which best describes the system's surroundings?**
1) All of the air in the kitchen
2) Pans and gas stove in the kitchen
3) The air inside the refrigerator
4) Everything in the universe external to the system

Everything in the universe external to the system.
In the context of the refrigerator and everything in it being considered the system, the surroundings refer to everything outside the system. This includes the entire universe beyond the refrigerator, the kitchen, and any other objects or entities not included in the defined system.

Q14: Two moles of a gas undergo expansion from volume V to 10V at a temperature of 27°C. The work done in the process in J is

1) 4.5 × 102
2) 1.0 × 103
3) 5.0 × 103
4) 1.1 × 104

The work done (W) during the expansion of a gas can be calculated using the equation:

$W = -\Delta U = -nRT \ln(V_f/V_i)$

Given that n = 2 moles, R = 8.314 J/(mol·K), T = 27°C = 300 K, Vi = V, and Vf = 10V, we have:

$W = -2 * 8.314 * 300 \ln(10)$

$W \approx -4988$ J

Since the work is negative, the absolute value of the work is:

$|W| \approx 4988$ J

Therefore, the closest option is 3) 5.0 × 10^3 J.

Electrical circuit

1. **If 1 A current flows in a circuit, the number of electrons flowing through this circuit is**
   a. 0.625 × 1019
   b.1.6 × 1019
   c. 1.6 × 10 - 19
   d. 0.625 × 10 - 19

Solve -
The charge of one electron is 1.6 × 10 - 19 coulomb. Again 1 A current means transferring of 1 coulomb charge per one second.

$$1\ A = \frac{1}{1.6 \times 10^{-19}} = 0.625 \times 10^{19}$$

2. **How many coulombs of charge flow through a circuit carrying a current of 10 A in 1 minute?**
   a.10
   b.60
   c. 600
   d.1200
   Solve -
   1 Ampere current means flowing of 1 Coulomb charge per second. That means 10 A current in 1 minute or 60 seconds implies 10 × 60 = 600 coulombs.

3. A capacitor carries a charge of 0.1 C at 5 V. Its capacitance is
   a. 0.02 F
   b.0.5 F
   c. 0.05 F
   d. 0.2 F

   The capacitance of a capacitor is expressed by Q/V. Where Q is the charge of the capacitor and V is the voltage across the capacitor.

$$C = \frac{Q}{V} = \frac{0.1}{5} = 0.02\ C$$

4. Four capacitors each of 40 µF are connected in parallel, the equivalent capacitance of the system will be

a. 160 µF
b.10 µF
c. 40 µF
d. 5 µF

The impedance of a capacitor is inversely proportional to its capacitance value. Reciprocal of equivalent impedance of parallel connected circuit elements is sum of reciprocal of impedance of each of the elements.

$$C_{eq} = C_1 + C_2 + C_3 + C_4 + C_5$$
$$C_{eq} = 40\ \mu F + 40\ \mu F + 40\ \mu F + 40\ \mu F + 40\ \mu F$$
$$C_{eq} = 160\ \mu F$$

05. Five capacitors each of 5 µF are connected in series, the equivalent capacitance of the system will be

5 µF
25 µF
10 µF
1 µF

When numbers of circuit elements are connected in series, the impedance of equivalent combination is sum of impedance of all elements in series. Again, capacitance is inversely proportional to impedance. Hence, when capacitors are connected in series

$$\frac{1}{C_{eq}} = \frac{1}{c_1} + \frac{1}{c_2} + \frac{1}{c_3} + \frac{1}{c_4} + \frac{1}{c_5}$$
$$\frac{1}{C_{eq}} = \frac{1}{5\ \mu F} + \frac{1}{5\ \mu F} + \frac{1}{5\ \mu F} + \frac{1}{5\ \mu F} + \frac{1}{5\ \mu F}$$
$$C_{eq} = 1\ \mu F$$

06. 1 F is theoretically equal to

a. 1 ohm of resistance
b. ratio of 1 V to 1 C
c. ratio of 1 C to 1 V
d. none of these

1 Farad capacitance is defined as the capacity of dielectric medium to store 1 Coulomb charge when 1 Volt potential difference is applied across it. Thus, capacitance is expressed as the ratio of charge to voltage (Q = CV).

7. The unit of resistivity is

a. Ω.
b. Ω - metre.
c. Ω / metre.
d. Ω / m^2.

8. What is the order of magnitude of the resistance of a dry human body?

a. 10 Ω
b. 10^4 Ω
c. 10 MΩ
d. 10 μΩ

Answer: (b) 10^4 Ω

Explanation: It is known that the resistance of a dry human body is 10 kΩ = 10^4 Ω.

9. **A silver wire has a resistance of 2.1 Ω at 27.5 °C, and a resistance of 2.7 Ω at 100 °C. What is the temperature coefficient of resistivity of silver?**

a. 0.0059
b. 0.0039
c. 0.0129
d. 0.0159

Answer: (b) 0.0039

$\alpha = (R_2 - R_1) / (R_1 * (T_2 - T_1))$

where:

α is the temperature coefficient of resistivity,

R_2 is the resistance at the higher temperature,

R_1 is the resistance at the lower temperature,

T_2 is the higher temperature in Kelvin,

T_1 is the lower temperature in Kelvin.

First, let's convert the temperatures from Celsius to Kelvin:

$T_1 = 27.5\ °C + 273.15 = 300.65\ K$

$T_2 = 100\ °C + 273.15 = 373.15\ K$

Now, we can substitute the values into the formula:

$\alpha = (2.7\ \Omega - 2.1\ \Omega) / (2.1\ \Omega * (373.15\ K - 300.65\ K))$

Simplifying the equation further:

$\alpha = 0.6\ \Omega / (2.1\ \Omega * 72.5\ K)$

$\alpha \approx 0.0038\ K^{-1}$

Therefore, the temperature coefficient of resistivity of silver is approximately $0.0038\ K^{-1}$.

10. The rate of flow of electric charge through any cross-section of a conductor is known as _____.

a. Electric flux
b. Electric potential
c. Electric current
d. Electric field

Answer: (c) Electric current

Explanation: The rate of flow of electric charge through any cross-section of a conductor is known as electric current.

11 . Which of the following is non-ohmic resistance?

a. Lamp filament
b. Copper wire
c. Carbon resistor
d. Diode

Answer: (d) Diode is non-ohmic resistance.

Explanation: A non-ohmic resistance is a resistance that does not obey ohm's law. Among the given options, a diode is a non-ohmic resistance.

12. Unit of conductance is _____.

a. Dyne
b. Siemen
c. Ohm
d. Volts

Answer: (b) Siemen

Explanation: Unit of conductance is siemen.

13. Current density is a _____.

a. scalar quantity.
b. vector quantity.
c. dimensionless quantity.
d. none of these options

Answer: (b) vector quantity.

Explanation: Current density is a vector quantity.

14. The resistivity of certain metals or alloys drops to zero when they are cooled below a certain temperature, this phenomenon is known as _____.

a. Conductivity
b. Partial conductivity
c. Superconductivity
d. Non-conductivity

Answer: (c) Superconductivity

Explanation: The resistivity of certain metals or alloys drops to zero when they are cooled below a certain temperature, this phenomenon is known as superconductivity.

15. The opposition offered by the electrolyte of the cell to the flow of current through itself is known as _____.

a. External resistance
b. Internal resistance
c. Non-resistance
d. None of these options

Answer: (b) Internal resistance

Explanation: The opposition offered by the electrolyte of the cell to the flow of current through itself is known as internal resistance.

Force magnetics

1. **What is the space around a current-carrying conductor, in which its magnetic effect can be experienced called?**
   a) Electric field
   b) Magnetic pole
   c) Magnetic field
   d) Charge distribution

   Answer: c
   Explanation: The space around a current-carrying conductor, in which its magnetic effect can be experienced is called the magnetic field. When a current is passed through a conductor, it modifies the space around the conductor and forms a magnetic field.

   2. Give the SI unit of the magnetic field.
   a) Ampere
   b) Tesla
   c) Oersted
   d) Weber

   Answer: b
   Explanation: The SI unit of the magnetic field is tesla, named after the great scientist Nikola tesla. 1 tesla is 107 times the magnetic field produced by a conducting wire of length one metre and carrying a current of one ampere at a distance of one metre from it and perpendicular to it.

   3. What is the force exerted by a stationary charge when it is placed in a magnetic field?
   a) Zero
   b) Maximum
   c) Minimum
   d) Depends on the strength of the magnetic field

   Answer: a
   Explanation: A stationary charge does not produce any magnetic field and it does not suffer any interaction against the external magnetic field. Hence the force exerted is zero.

5. **What is the work done by the magnetic field on a moving charged particle?**
   a) Maximum
   b) Minimum
   c) Depends on the strength of the magnetic field
   d) Zero

   Answer: d
   Explanation: As the magnetic force acts in a direction perpendicular to the direction of the velocity or the direction of motion of the charged particle, so the work done is zero.
   $W = F \times dl \times \cos 90°$
   $W = 0$.

   5. The north pole of a magnet is brought near a stationary negatively charged conductor. What is the force experienced by it at the poles?
   a) Maximum
   b) Minimum
   c) Zero
   d) Depend on the nature of the conductor
   Answer: c
   Explanation: The north pole of a magnet will not experience any force. This is because a stationary charge does not produce any magnetic field. Therefore, the force experienced by the magnet at the poles is zero.

   6. When a charge moves parallel or antiparallel to the direction of the magnetic field, it experiences a maximum force. State true or false.
   a) True
   b) False

Answer: b
Explanation: When a charge moves parallel or antiparallel to the direction of the magnetic field, it experiences a minimum (zero) force.
When $\theta = 0o$ or $180o$,
$Fm = qvB\sin\theta = qvB\ (0) = 0$.

6.

7.Identify the condition under which the force acting on a charge moving through a uniform magnetic field is minimum.

a) θ = 90o
b) θ = 180o
c) θ = 270o
d) θ = 340o

Answer: b

Explanation: When θ = 0o or 180o,
Fm = qvBsinθ = qvB (0) = 0.
So when a charge moves parallel or antiparallel to the direction of the magnetic field, it experiences a minimum force.

8. Identify the condition under which the force acting on a charge moving through a uniform magnetic field is maximum.

a) θ = 90o
b) θ = 180o
c) θ = 0o
d) θ = 360o

Answer: a

Explanation: When θ = 90o → Fm is maximum.
Thus a charge experiences a maximum force when it moves perpendicular to the direction of the magnetic field. So, this is the condition when the force experienced is maximum.

Angular momentum, Angular acceleration

1. The relation between angular momentum and angular velocity is

a. $\bar{J}=\bar{r}\times\bar{\omega}$
b. $\bar{J}=\bar{\omega}\times\bar{r}$
c. $\bar{J}=\bar{\omega}I$
d. $\bar{J}=I\bar{\omega}$

Correct option is D)
By definition the angular momentum J is defined as the product of moment of inertia I and the angular velocity ω.

Work power energy

1.The rate of doing work is called ————————-
a. Force
b. Acceleration
c. Power
d. Displacement
Answer: (c) Power

Explanation: Power is defined as the rate of doing work.

2. Which is the type of collision in which both the linear momentum and the kinetic energy of the system remain conserved?

a. Inelastic Collision
b. Elastic Collision
c. Destructive collision
d. None of the options
Answer: (b) Elastic Collision

Explanation: In an elastic collision, the linear momentum and the kinetic energy of the system remain conserved.

3. Collision between marble balls is which type of collision?

a. Inelastic Collision
b. Elastic Collision
c. Destructive collision
d. None of the options
Answer: (b) Elastic Collision

Explanation: Collision between marble balls is an example of elastic collision.

4.. Find the potential energy stored in a ball of mass 5 kg placed at a height of 3 m above the ground.

a. 121.20 J
b. 147.15 J
c. 227.31 J
d. 182.21 J
Answer: (b) 147.15 J

Explanation: m = 5 kg, h = 3 m, g = 9.81 m/s-2
We know that, Potential energy = mgh
= 5 * 9.81 * 3 = 147.15 J

6. **What is the power utilised when work of 1000 J is done in 2 seconds?**

a. 100 W
b. 200 W
c. 20 W
d. 500 W
Answer: (d) 500 W

Explanation: W=1000J, t=2 seconds
Power=work/time = 1000/2 = 500 W

9**. An electric heater of rating 1000 W is used for 5 hrs per day for 20 days. What is the electrical energy utilized?**

100 kWh
200 kWh
120 kWh
500 kWh
Answer: (a) 100 kWh

Explanation: The power of the electric heater is 1000 W, and the time period is 20×5 = 100 hr.
Electrical energy = Power × Time
Electrical energy = 1000 × 100 = 100000 Wh
Electrical energy = 100 kWh

10. **A ball moves in a frictionless inclined table without slipping. The work done by the table surface on the ball is**

Negative
Zero
Positive
None of the options
Answer: (b) Zero

Explanation: **The work done by a ball when it moves on a frictionless inclined table without slipping is zero.**

Easy learning notes

Projectile motion

1. A body of mass m, projected at an angle of θ from the ground with an initial velocity of v, acceleration due to gravity is g, what is the maximum horizontal range covered?
a) R = v2 (sin 2θ)/g
b) R = v2 (sin θ)/2g
c) R = v2 (sin 2θ)/2g
d) R = v2 (sin θ)/g
View Answer

Range = (v^2 * sin(2θ)) / g

where:
Range is the horizontal range,
v is the initial velocity of the projectile,
θ is the angle of projection,
g is the acceleration due to gravity.

2**. A body of mass 5 kg, projected at an angle of 60° from the ground with an initial velocity of 25 m/s, acceleration due to gravity is g = 10 m/s2, what is the maximum horizontal range covered?**
a) 54.13 m
b) 49 m
c) 49.16 m
d) 60 m

Answer: a
Explanation: The formula for horizontal range is R = v2 (sin 2θ)/g. Here, v = 25, θ = 60°, g = 10. Hence, on solving we will get range as 54.13 m.

3. **A body of mass 10 kg, projected at an angle of 30° from the ground with an initial velocity of 5 m/s, acceleration due to gravity is g = 10 m/s2, what is the time of flight?**
a) 0.866s
b) 1.86 s
c) 1.96 s
d) 1.862 s
Answer: a
Explanation: The formula for time of flight is t = 2(v sinθ/g). Here, v = 5, θ = 30°, g = 10. Hence, on solving we will get the time of flight as 0.866 s.

4. On calculating which of the following quantities, the mass of the body has an effect in simple projectile motion?
a) Velocity
b) Force
c) Time of flight
d) Range
Answer: b
Explanation: All mentioned quantities except force are kinematic quantities. Force is a kinetic quantity. Force = m x a. Hence, the mass of the body has an effect on force calculation.

5. **A ball of mass 100 g, projected at an angle of 30° from the ground with an initial velocity of 11 m/s, acceleration due to gravity is g = 10 m/s2, what is the maximum height attained?**
a) 1.5 m
b) 3.0 m
c) 1.0 m
d) 2.0 m

Answer: a
Explanation: The formula for maximum height is h = (v sinθ)2/2g. Here, v = 11, θ = 30°, g = 10. Hence, on solving we will get the maximum height attained as 1.5125 m. The value can be rounded off to 1.5.

6. When do we get maximum range in a simple projectile motion?
a) When θ = 45°
b) When θ = 60°
c) When θ = 90°
d) When θ = 0°

Answer: a
Explanation: The formula for horizontal range is R = v2(sin 2θ)/g. This will be maximum when sin 2θ = 1, which implies that 2θ = 90°, which in turn implies that θ = 45°. Hence the correct answer is when θ = 45°.

7. When do we get maximum height in a simple projectile motion?
a) When θ = 45°
b) When θ = 60°
c) When θ = 90°
d) When θ = 0°
Answer: c
Explanation: The formula for horizontal range is h = (v sinθ)2/2g. This will be maximum when sin θ = 1, which implies that θ = 90°. Hence the correct answer is when θ = 90°.

8. A football is projected at an angle of 45° from the ground with an initial velocity of 10 m/s, take acceleration due to gravity is g = 10 m/s2.What is the time of flight?
a) 1.4142 s
b) 1.5361 s
c) 1.8987 s
d) 1.5651 s

Answer: a
Explanation: The formula for time of flight is t = 2(v sinθ/g). Here, v = 10, θ = 45°, g = 10. Hence, on solving we will get the time of flight as 1.4142 s.

9. A bag of mass 1000 g, projected at an angle of 90° from the ground with an initial velocity of 5 m/s, acceleration due to gravity is g = 10 m/s2, what is the maximum height attained?
a) 1.25 m
b) 3.0 m
c) 1.5 m
d) 2.0 m

10. A body of mass 55 kg, projected at an angle of 45° from the ground with an initial velocity of 15 m/s, acceleration due to gravity is g = 10 m/s2, what is the maximum horizontal range covered?

a) 22.5 m
b) 25 m
c) 16 m
d) 15 m

Answer: a
Explanation: The formula for horizontal range is R = v2 (sin 2θ)/g. Here, v = 15, θ = 45°, g = 10. Hence, on solving we will get range as 22.5 m.

11. At what angle of projectile (θ) is the horizontal range minimum?
a) θ = 45°
b) θ = 60°
c) θ = 90°
d) θ = 75°
View Answer

Answer: c
Explanation: The formula for horizontal range is R = v2 (sin 2θ)/g. When θ = 90°, sin 2θ = sin 180° = 0. Hence, the range covered becomes 0. Since range cannot be negative, 0 is the minimum value it can attain.

12. A body of mass 5 kg, projected at an angle of 45° from the ground covers a horizontal range of 45 m, acceleration due to gravity is g = 10 m/s2, what is the velocity with which it was projected covered?
a) 21.21 m/s
b) 20 m/s
c) 22 m/s
d) 21.1 m/s

Answer: a
Explanation: The formula for horizontal range is R = v2 (sin 2θ)/g. Here, R = 45, θ = 45°, g = 10. Hence, on solving we will get velocity as 21.21 m/s.

13. A big stone of mass 1000 g, projected at an angle of 30° from the ground it covers a maximum vertical distance of 5 m, acceleration due to gravity is g = 10 m/s2, what is the velocity with which it was thrown?
a) 11.55 m/s
b) 11.5 m/s
c) 1.155 m/s
d) 12.0 m/s

Answer: a
Explanation: The maximum vertical distance is the maximum height. The formula for maximum height is h = (v sinθ) 2/2g. Here, h = 5, θ = 30°, g = 10. Hence, on solving we will get the initial velocity as 11.55 m/s.

14**. A soccer ball is projected at an angle of 60° from the ground.It attains its maximum height in 10s. Considering acceleration due to gravity as g = 10 m/s2. What is the velocity with which it was projected?**

a) 115.5 m/s
b) 117 m/s
c) 120 m/s
d) 11.55 m/s
View Answer

Answer: a
Explanation: The time for achieving the maximum height is equal to half of the time of flight. Therefore, the time of flight is 20s. The formula for time of flight is t = 2(v sinθ/g). Here, t = 20, θ = 60°, g = 10. Hence, on solving we will get the initial velocity as 115.5m/s.

Kinetic Energy, Potential Energy

1. **Energy a system possesses because of its velocity relative to the surrounding is**
   a) Kinetic Energy
   b) Potential Energy
   c) Work
   d) None of the mentioned

   Answer: a
   Explanation: Energy a system possesses because of its velocity relative to the surrounding is Kinetic Energy.

   2. A system is at rest, the kinetic energy of the system is
   a) Infinite
   b) Greater than zero
   c) Less than zero
   d) Zero

   Answer: a
   Explanation: A resting body have no velocity and kinetic energy.

   3. A 5 Kg body is having a Kinetic energy of 250 J. What is the velocity of the body?
   a) 10 m/s
   b) 15 m/s
   c) 20 m/s
   d) 40 m/s

   Answer: a
   Explanation: K.E. = mv2/2 .

   4. What is the specific kinetic energy of a particle, having a velocity 5 m/s?
   a) 12.5 J
   b) 25 J
   c) 50 J
   d) 100 J

   Answer: a
   Explanation: Specific Kinetic Energy = v2/2.

5. What is the unit of Specific kinetic energy?
a) J
b) J/kg
c) Pa
d) N

Answer: b
Explanation: Specific kinetic energy is kinetic energy unit mass, Unit is J/Kg.

6. Water is pumped from a storage tank through a tube of 4 cm inner diameter at the rate of 0.002 m3/sec. What is the specific kinetic energy of the water in the tube?
a) 0.26 J/Kg
b) 1.26 J/Kg
c) 2.26 J/Kg
d) None of the mentioned

Answer: b
Explanation: Specific Kinetic Energy = v2/2, v = Flow rate*Area of the tube.

9. A mass is at 30 m of height from its reference point. What is the specific potential energy of the mass?
a) 294
b) 394
c) 495
d) 594

Answer: a
Explanation: Specific potential is the potential energy of the unit mass.

10. What is the potential energy of a 2 kg mass having a height of 40 m from its reference point.
a) 287
b) 784
c) 487
d) 847

Answer: b
Explanation: PE = mgh.

11. The decrease in potential energy of a ball of mass 20kg, which falls from a height of 50cm, is?
a) 968J
b) 98J
c) 1980J
d) 450J

Answer: b
Explanation: U = mgh
U = 20×9.8×0.50 = 98J.

12. If the water falls from a dam into a turbine wheel 19.6m below, then the velocity of water at the turbine is? (g=9.8m/s)
a) 9.8m/s
b) 19.6m/s
c) 39.2m/s
d) 98m/s

Answer: b
Explanation: Loss in potential energy = Gain in kinetic energy
mgh = 1/2mv2
v = √2gh = √(2×9.8×19.6)=19.6m/s.

Centripetal force, Centrifugal force

1. A wheel of mass 8kg and radius of gyration 25cm is rotating at 300rpm. What is its moment of inertia?
a) 0.5 kgm2
b) 10 kgm2
c) 5 kgm2
d) 0.25 kgm2
Answer: a
Explanation: M = 8kg, K = 25cm = 0.25m
Therefore, l = MK2 = 8×0.252 = 0.5 kgm2.

2. The moment of inertia of a uniform circular disc about its diameter is 100gcm2. What is its moment of inertia about its tangent?
a) 200 gcm2
b) 100 gcm2
c) 900 gcm2
d) 500 gcm2

Answer: d
Explanation: By the theorem of parallel axes, moment of inertia about a tangent parallel to the diameter,
I = Id+MR2 = 1/4 MR2+MR2=5/4 MR2
I = 5×100 = 500 gcm2.

3. The moment of inertia of a uniform circular disc about its diameter is 100 gcm2. What is its moment of inertia about an axis perpendicular to its plane.
a) 500 gcm2
b) 100 gcm2
c) 200 gcm2
d) 700 gcm2

Answer: c
Explanation: By theorem of perpendicular axes, moment of inertia of the disc about an axis perpendicular to its plane,
I = Sum of the moments of inertia about two perpendicular diameters
I = Id+Id=2×1/4×MR2=2×1000= 200 gcm2.

4**. Calculate the moment of inertia of the earth about its diameter, taking it to be a sphere of 1025kg and diameter 12800km**.
a) 1.64 kgm2
b) 16.4×1038 kgm2
c) 1.64×1038 kgm2
d) 0

Answer: c
Explanation: M = 1025kg, R = 6400km = 6.4×106 m
Moment of inertia of the earth about its diameter I = 2/5 MR2 = 2/5×1025×(6.4×106)2
I = 1.64×1038 kgm2.

5. A torque of 2×10-4 Nm is applied to produce an angular acceleration of 4rad/s2 in a rotating body. What is the moment of inertia of the body?
a) 0.5 kgm2
b) 5×104 kgm2
c) 0.5×10-4 kgm2
d) 0.5×104 kgm2

Answer: c
Explanation: Torque = Iα
I = Torque/α = (2×10-4)/4=0.5×10-4 kgm2.