TS EAMCET 2025 Physics chapter-wise Questions with Solutions PDF

Thermodynamics and Heat

1. What amount of heat should be supplied to 2.0 × 〖10〗^(-2) kg of nitrogen (at room temperature) to raise its temperature by 55 °C at constant pressure? (Molecular mass of N2 = 28; R = 8.3 J mol^–1 K^–1.)

Ans:

a)1140.79 J

b) 1130.49

c)1020.79

d)1410.79

Solutions: Mass of Nitrogen, m = 2.0 × 10^{-2}kg = 20 g

- Rise in temperature, ΔT = 55 °C
- Molecular mass of N_2 M = 28
- Universal gas constant, R = 8.3 J mol^{-1} K^{-1}
- Number of moles, n = m/M = 20/28 = 0.714
- Molar specific heat at constant pressure for nitrogen, C_P = 7/2R = 29.05 J/mol/K
- The total amount of heat to be supplied is given by the relation ΔQ = $nC_P\Delta T$ = 0.714 X 29.05 X 55 = 1140.79 J

2. A steam engine delivers 5.4×10^8J of work per minute and services 3.6 × 10^9J of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?

Ans: a) 0.15, 3.08 X 10^9 J

b) 0.15, 0.3.06 X 10^9 J

c) 0.20, 3.10 X 10^9 J

d) 0.51, 3.07 X 10^9 J

Solutions-

Work done by the steam engine per minute, W = 5.4 X 10^8 J

Heat supplied by the boiler , H = 3.6 X 10^9 J

- Efficiency of the engine, η = output energy/input energy = (5.4 X 10^8) / (3.6 X 10^9)= 0.15
- Amount of heat wasted = Input energy – Output energy = 3.6 X 10^9 - 5.4 X 10^8 J = 3.06 X 10^9 J

3. A refrigerator is to maintain eatables kept inside at 9°C. If room temperature is 36°C, calculate the coefficient of performance.

Ans: a) 10.55

b)10.66

c)10.44

d) 10.45

Solution: Temperature inside the refrigerator, T_1 = 9°C= 9 + 273 K = 282 K

Room temperature, T2 = 36°C = 36 + 273 = 309 K

Coefficient of performance = T_1 / (T2 - T_1)= 282/(309-282) = 10.44

Therefore, the coefficient of performance is 10.44

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Work, Power and Energy

1. A body of mass 0.5 kg travels in a straight line with velocity v =a x^3/2 where a = 5 m^–1/2 s^–1. What is the work done by the net force during its displacement from x = 0 to x = 2 m?

Ans:

A. 50 J

B. 70J

C. 60 J

D. 40 J

Solution:

Mass of the body = 0.5 kg

Velocity, v = $a\ x^{3/2}$

a = 5 $m^{-1/2}\ s^{-1}$

At x =0, the initial velocity, u = 0

At x = 2, the final velocity, v = 5 X $2^{3/2}$ = 14.142 m/s

Work done by the system = increase in K.E. of the body = (1/2)m(v^2 - u^2) = (1/2) X 0.5 X 14.142 X 14.142 = 50 J

2. A family uses 8 kW of power. (a) Direct solar energy is incident on the horizontal surface at an average rate of 200 W per square meter. If 20% of this energy can be converted to useful electrical energy, how large an area is needed to supply 8 kW? (b) Compare this area to that of the roof of a typical house.

Ans:

A. **A = 100 m^2 , 16.14 X 14.24 m**

B. **A = 300 m^2 , 14.41 X 14.14 m**

C. **A = 200 m^2 , 14.14 X 14.14 m**

D. **A = 150 m^2 , 14.14 X 14.41 m**

Solutions:

A.6.23 Power used by the family = 8 kW = 8000 W

(a) Solar energy received = 200 W/m^2

Percentage conversion of Solar energy to Electrical energy = 20%

If the area required is A then 0.2 X A X 200 = 8000

A = 200 m^2 . The comparable roof size is 14.14 X 14.14 m

3. The bob of a pendulum is released from a horizontal position. If the length of the pendulum is 1.5 m, what is the speed with which the bob arrives at the lowermost point, given that it dissipated 5% of its initial energy against air resistance?

Ans: A) 4.95 m/s

B) 5.29 m/s

C) 5.75 m/s

D) 6.10 m/s

Solution: Using g=9.8 m/s2g = 9.8 \text{ m/s}^2g=9.8 m/s2 and L=1.5 mL = 1.5 \text{ m}L=1.5 m: v=2×0.95×9.8×1.5v = \sqrt{2 \times 0.95 \times 9.8 \times 1.5}v=2×0.95×9.8×1.5 v=2×0.95×14.7v = \sqrt{2 \times 0.95 \times 14.7}v=2×0.95×14.7 v=27.99v = \sqrt{27.99}v=27.99 v≈5.29 m/sv \approx 5.29 \text{ m/s}v≈5.29 m/s

So, the speed of the pendulum bob at the lowermost point is approximately 5.29 m/s5.29 \text{ m/s}5.29 m/s.

Laws of Motion

1. A rocket with a lift-off mass 30,000 kg is blasted upwards with an initial acceleration of 5.0 m s^-2. Calculate the initial thrust (force) of the blast.

Answer:

A. **6.0 X 10^5 N**

B. **4.5 X 10^5 N**

C. **3.0 X 10^5 N**

D. $9 X 10^5$ N

Solution: The mass of the rocket, m = 30000 kg When the rocket is fired, gravitational acceleration tries to pull it down. Hence the effective acceleration on the rocket = rocket acceleration + gravitational acceleration. The acceleration, a = 5 m/s^2, gravitational acceleration = 10 m/s^2 Total acceleration = 5 +10 = 15 m/s^2 Thrust force = 30000 X 15 N = $4.5 X 10^5$ N

2. A nucleus is at rest in the laboratory frame of reference. Show that if it disintegrates into two smaller nuclei the products must move in opposite directions or same directions or indicate any other magnitude.

Ans:

A) The −ve-ve−ve sign indicates that the two velocities V1V_1V1 and V2V_2V2 are in opposite directions.

B) The −ve-ve−ve sign indicates that the two velocities V1V_1V1 and V2V_2V2 are in the same direction.

C) The −ve-ve−ve sign indicates that the magnitude of V1V_1V1 is greater than V2V_2V2.

D) The −ve-ve−ve sign indicates that the magnitude of V2V_2V2 is greater than V1V_1V1.

Solutions:

A 5.17 Let m_1 & m_2 be the masses of two nuclei and m be the mass of the main nuclei. $m = m_1 + m_2$

If V_1 and V_2 be the corresponding velocities of two nuclei then total linear momentum after disintegration = $m_1V_1 + m_2 V_2$ Since at the initial stage, mass nuclei was at rest, so the initial linear momentum = 0

From the law of conservation we know

Total linear momentum before disintegration = total momentum after disintegration

$0 = m_1V_1 + m_2 V_2$

$V_1= - m_2 V_2 /m_1$

-ve sign indicates that the two velocities V_1 and V_2 are in opposite directions.

3. An aircraft executes a horizontal loop at a speed of 650 km/h with its wings banked at 15°. What is the radius of the loop ?

Answer:

A) The radius of the loop is approximately 12,410.67 meters.

B) The radius of the loop is approximately 10,250.35 meters.

C) The radius of the loop is approximately 14,860.92 meters.

D) The radius of the loop is approximately 9,780.54 meters.

Solution: The speed of the aircraft, v = 650 km/h = 200 m/s The angle of banking = 15° From the relation tanθ = v^2 /rg we get r = v^2/ (g X tanθ) = 12410.67m

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Gravitation-

1. Which of the following symptoms is likely to afflict an astronaut in space: (a) swollen feet, (b) swollen face, (c) headache, (d) orientational problem.

A) Answer: (a), (b), and (c)

B) Answer: (b), (c), and (d)

C) Answer: (a), (c), and (d)

D) Answer: (a), (b), and (d)

Solutions: Legs hold the entire mass of a body in standing position due to gravitational pull. In space, an astronaut feels weightlessness because of the absence of gravity. Therefore swollen feet of an astronaut do not affect him/her in space. (b) A swollen face is caused generally because of apparent weightlessness in space. Sense organs such as eyes, ears, nose and mouth constitute a person's face. These symptoms can affect astronauts in space. (c) Headaches are caused because of mental strain. It can affect the working of an astronaut in space. (d) Space has different orientations. Therefore, orientational problems can affect an astronaut in space. Therefore option **B** is correct.

2. A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth?

A. **30 N**

B. **45N**

C. **28N**

D. **35N**

Solutions:. Weight of the body, W = 63 N Acceleration due to gravity at h from the Earth's surface is given by g' = gg (1+h $RRee$)2 where g = acceleration due to gravity on the Earth's surface, $RRee$ = Radius of the Earth. h = $RRee$ 2 g' = gg (1+$RRee$ /2 $RRee$)2 = gg (1+h 2h)2 = (4/9)g Weight of the body of mass m at a height h is given by W' = m X g' = (4/9) mg = (4/9) x w = (4/9) x 63 N = 28 N

3. A satellite orbits the earth at a height of 400 km above the surface. How much energy must be expended to rocket the satellite out of the earth's gravitational influence? (Mass of the satellite = 200 kg; mass of the earth = 6.0×1024 kg; radius of the earth = 6.4 × 106 m; G = 6.67 × 10–11 N m2 kg–2.)

A) 5.88×109 J

B) 4.75×109 J

C) 6.32×109 J

D) 5.25×109 J

Solution: Mass of the Earth, M = 6.0×1024 kg Mass of the satellite, m = 200 kg Radius of the Earth, *RRee* = 6.4 × 106 m Universal gravitational constant, G = 6.67 × x10–11 N m2 kg–2 Height of the satellite, h = 400 km = 0.4× 106 m Total energy of the satellite at height h = 1 2 *mmmm*2 + (−*GGMMeemm RRee*+*h*) Orbital velocity of the satellite, v = □ *GGMMee RRee*+*h* Total energy of the satellite at height h = *mm* 2 (*GGMMee RRee*+*h*) - (*GGMMeemm RRee*+*h*) =− 1 2 (*GGMMeemm RRee*+*h*) The negative sign indicates that the satellite is bound to the Earth. This is called the bound energy of the satellite. Energy required to send the satellite out of its orbit = - (bound energy) = 1 2 (*GGMMeemm RRee*+*h*) = 1 2 (6.67 *XX* 10−11 ×6×1024×200 6.4×106 +0.4×106) = 5.88× 109 J

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Oscillation and Waves-

1. Which of the following relationships between the acceleration a and the displacement x of a particle involve simple harmonic motion?

(a) a = 0.7x

(b) a = –200x^2

(c) a = –10x

(d) a = 100x^3

Solution: A motion represents simple harmonic motion if it is governed by the force of law: F = ma, where F is the force, m is the mass and a is the acceleration and F = kx, where k is a constant among given equations and x is the displacement. We can write a = (k/m)x Only equation a = -10x is written in this form. Hence this relation represents SHM. The answer is option (c).

2. The acceleration due to gravity on the surface of the moon is 1.7 m s^–2. What is the time period of a simple pendulum on the surface of moon if its time period on the surface of earth is 3.5 s ? (g on the surface of earth is 9.8 m s^–2)

A. 6.40 s

B. 7.40 s

C. 8.40 s

D. 9.40 s

Solution: Acceleration due to gravity on Moon surface, g' = 1.7 m/s^2

- Acceleration due to gravity on Earth surface, g = 9.8 m/s^2
- Time period on Earth, T = 3.5 s
- We know T = 2π √l/g where l = length of the pendulum
- l = $T^2/(2\pi^2)$X g= $3.5^2 / 2\pi^2$ X 9.8 = 3.041 m. On Moon surface, the length of the pendulum remained same = 3.041 m
- So time period on moon surface, T' = 2π√l/g' = 2π√3.041/1.7 = 8.40 s

3. A SONAR system fixed in a submarine operates at a frequency 40.0 kHz. An enemy submarine moves towards the SONAR with a speed of 360 km h^–1. What is the frequency of sound reflected by the submarine ? Take the speed of sound in water to be 1450 m s^–1.

A. **46.93 kHz**

B. **47.83 kHz**

C. **45.33 kHz**

D. **45.93 kHz**

Solution: A 15.25 Operating frequency of the SONAR system, v = 40 kHz Speed of enemy submarine, v_e = 360 km/h = 100 m/s Speed of sound in water, V = 1450 m/s The source is at rest and the observer (enemy submarine) is moving towards it. Hence, the apparent frequency (f’) received and reflected by the submarine is given by the relation: f = $(v+v_e/v)V$ = (1450 + 100)/1450 X 40 = 42.76 kHz The frequency (f’) received by the enemy submarine is given by the relation: f’ = $(v/v-v_e)f$ = (1450/(1450-100)) X 42.76 =45.93 kHz