

## Sample paper 10

### Question 1

Which of the following is correct in respect to acceleration?

- A. Body does not require any force to accelerate
- B. Body's velocity should be zero
- C. Body should be at rest
- D. Acceleration of the body can be negative
- E. Frictional force increases acceleration

**Correct Answer: D**

**Explanation:**

To keep body moving with acceleration there must be some force applied from outside as frictional force tends to oppose the motion. Hence, A is incorrect. Velocity must be increasing all the time for acceleration or must be decreasing for deceleration. So, B is incorrect. Body at rest will experience no force so, no acceleration as well. Therefore, C is incorrect. Body thrown upwards experiences a negative acceleration since; motion of the body (upwards) is against acceleration due to gravity (acting downwards). Hence, D is the correct answer. Frictional force always tends to reduce the velocity of the body. Hence acceleration will reduce. Therefore, E is incorrect.

### Question 2

A car starts from a point A at 9 AM and reaches point B at 11 AM. If A and B are separated by 100 km and the car is moving with uniform speed, what is the speed of the car for the entire travel in m/s?

- A. 15.7 m/s
- B. 13.9 m/s
- C. 11.3 m/s
- D. 10.4 m/s
- E. 14.5 m/s

**Correct Answer: B**

**Explanation:**

$t = 11 \text{ AM} - 9 \text{ AM}$  Or  $t = 2 \text{ h}$

Speed  $v = d / t$

$v = 100 / 2$

Or  $v = 50 \text{ km/h}$

As the time is given in hours we need to convert it into seconds. Also, distance is given in km so we need to convert it into m.

$50 \text{ km/h} = 50 \times (1000/3600) \text{ m/s}$

$50 \text{ km/h} = 13.9 \text{ m/s}$

Hence, B is the correct answer option.

### Question 3

Which of the following is a unit of power?

- A. J
- B. Nm / s
- C. W/s
- D. N/s
- E. None of the above choices

**Correct Answer: B**

**Explanation:**

$$P = W/t$$

$$W = F \cdot d$$

SI unit of force (F) is N, displacement (d) is m. and time (t) is s. Therefore,

$$P = \text{Nm/s}$$

Hence, B is the correct answer option.

### Question 4

An elevator of mass 800 kg is moving upwards with a constant velocity of 3 m/s. What would be the resultant force acting on the elevator?

- A. 7840 N
- B. 2400 N
- C. 266.67 N
- D. 0 N
- E. None of the choices

**Correct Answer: D**

**Explanation:**

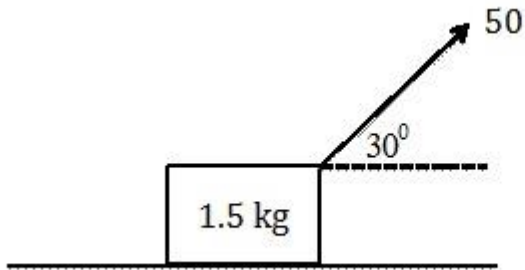
If the velocity of the object on which the forces are acting is zero, then it means that the object is in static equilibrium (no acceleration).

Force acting on a body is given as  $F = ma$

As the elevator is moving up with constant velocity, it experiences zero acceleration and from the equation we can say that the resultant force acting on it is zero. Hence, D is the correct answer option.

### Question 5

Consider that a force of 50 N, as shown in the figure, is dragging a block of ice of mass 1.5 kg along a frictionless horizontal surface. What is the acceleration experienced by the block of ice?



- A. 28.87 m/s<sup>2</sup>
- B. 25 m/s<sup>2</sup>
- C. 16.67 m/s<sup>2</sup>
- D. 19.24 m/s<sup>2</sup>
- E. 57.73 m/s<sup>2</sup>

**Correct Answer: A**

**Explanation:**

$$F = ma$$

$$50 \cos 30^\circ = ma$$

$$1.5 a = 50 \cos 30^\circ$$

$$a = 28.87 \text{ m/s}^2$$

Hence, A is the correct answer option.

### Question 6

What would be the Potential Energy stored in a spring of spring constant 20 N/m that is compressed by 2 cm?

- A.  $2 \times 10^{-3}$  J
- B.  $10^{-3}$  J
- C.  $4 \times 10^{-3}$  J
- D.  $7 \times 10^{-3}$  J
- E.  $8 \times 10^{-3}$  J

**Correct Answer: C**

**Explanation:**

$$PE = (1/2)kx^2$$

As the distance is given in cm we need to convert it into m.

$$PE = (1/2) * 20 * (0.02)^2$$

$$PE = 4 \times 10^{-3} \text{ Joule}$$

Hence, C is the correct answer option.

#### Question 7

**A rotor with uniform angular speed of 210rad/s needs a torque of 250 Nm from an engine. What would be the power of the engine required for the torque?**

- A. 54500 W
- B. 52500 W
- C. 34600 W
- D. 1.19 W
- E. None of the above choices

**Correct Answer: B**

**Explanation:**

$$P = \zeta \omega$$

$$P = 250 * 210$$

$$P = 52500 \text{ W}$$

Hence, B is the correct answer option.

#### Question 8

**A mass of 0.01 kg attached to a spring and the spring is compressed by 2 cm by a force of 45 N. If the force is removed, the system is set into oscillation, what would be the frequency of the oscillation?**

- A. 45.55 Hz
- B. 15.21 Hz
- C. 56.15 Hz
- D. 75.53 Hz
- E. 89.12 Hz

**Correct Answer: D**

**Explanation:**

$$f = \frac{1}{2\pi} \sqrt{k / m}$$

The restoring force that develops in the spring due to the external force applied is given as  $F = kx$ ; As the distance is given in cm we need to convert it into m.

$$45 = k \times 0.02 \text{ Or } k = 2250 \text{ N/m}$$

$$f = \frac{1}{2\pi} \sqrt{2250 / 0.01}$$

$$f = 75.53 \text{ Hz}$$

Hence, D is the correct answer option.

### Question 9

A tuning fork vibrates with a frequency of 500 Hz. If the speed of sound in air is 343 m/s, what is the distance the sound travels when the tuning fork makes 100 oscillations?

- A. 34.3 m
- B. 50.4 m
- C. 5 m
- D. 76.8 m
- E. 68.6 m

**Correct Answer: E**

**Explanation:**

$$v = f \lambda$$

$$343 = 500 \times \lambda \text{ Or } \lambda = 0.686 \text{ m}$$

This is the distance that the sound travels in one oscillation. The distance traveled in 100 oscillations is

$$d = 100 \times 0.686 \text{ m}$$

(d is the distance traveled in 100 vibrations)

$$d = 68.6 \text{ m}$$

Hence, E is the correct answer option.

### Question 10

What is the buoyant force exerted on a 20cm<sup>3</sup> block of iron submerged completely inside water?

- A. 0.234 N
- B. 0.111 N
- C. 2.289 N
- D. 1.34 N
- E. 0.196 N

**Correct Answer: E**

**Explanation:**

$$F_B = \rho gV$$

As the volume is given in cm<sup>3</sup> we need to convert it into m<sup>3</sup>.

$$F_B = 1000 \times 9.8 \times 2 \times 10^{-5}$$

$$F_B = 0.196 \text{ N}$$

Hence, E is the correct answer option.

**Question 11**

A given mass of gas exerts a pressure of 24 cm of mercury at  $-20^{\circ}\text{C}$ . What pressure the gas would exert at  $10^{\circ}\text{C}$  for an isochoric process?

25.11 cm

24.44 cm

34.45 cm

12.23 cm

26.88 cm

**Correct Answer: E**

**Explanation:**

Isochoric process is carried out at constant volume. As the pressure and temperature is changing, we have to apply Gay-Lussac law. It is given as

$$P_1 / T_1 = P_2 / T_2 \text{ ----- (1)}$$

As the temperature is given in  $^{\circ}\text{C}$  we need to convert it into Kelvin.

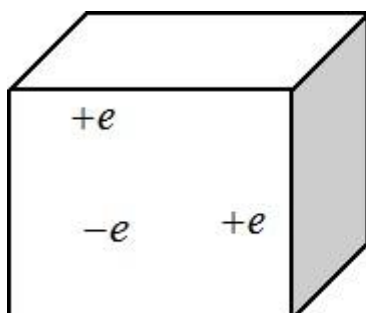
$$24 / 253 = P_2 / 283$$

$$P_2 = 26.88 \text{ cm}$$

Hence, E is the correct answer option.

**Question 12**

Consider the figure given below.



Two protons (+e) and one electron (-e) are inside a cube of side length 4 cm. What is the electric flux produced by the charges?

$$-e / \epsilon_0$$

Zero

$$e / \epsilon_0$$

$$1 / \epsilon_0$$

$$-(1 / \epsilon_0)$$

**Correct Answer: C**

**Explanation:**

$$\Phi = Q_{en} / \epsilon_0$$

$$Q_{en} = +e + e - e \text{ Or } Q_{en} = e$$

$$\Phi = e / \epsilon_0$$

Hence, C is the correct answer option.

### Question 13

What is the maximum value of Kinetic energy of the photoelectrons emitted, when a photon of frequency  $1.5 \times 10^{15}$  Hz is directed on a silver surface? Assume the threshold frequency for silver is  $1.1 \times 10^{15}$  Hz.

$$2.64 \times 10^{-9} \text{ J}$$

$$2.64 \times 10^{-19} \text{ J}$$

$$2.64 \times 10^{-18} \text{ J}$$

$$2.64 \times 10^{-15} \text{ J}$$

$$2.64 \times 10^{-11} \text{ J}$$

**Correct Answer: B**

**Explanation:**

$$K_{max} = h(f - f_0)$$

$$K_{max} = 6.6 \times 10^{-34} \times (1.5 \times 10^{15} - 1.1 \times 10^{15})$$

$$K_{max} = 2.64 \times 10^{-19} \text{ J}$$

Therefore, B is the correct answer option.

### Question 14

**At which angle does a ray of light reflect back to the same medium after being incident on another medium of a different refractive index?**

Less than critical angle

Greater than critical angle

0°

90°

Light will not reflect at any angle

**Correct Answer: B**

**Explanation:**

Critical angle is the angle above which total internal reflection will occur. That is, if a ray of light is incident on an interface separating two different mediums, making an angle greater than the critical angle, then the ray of light will reflect back. This will only take place at an angle greater than the critical angle. Hence, A is an incorrect answer option whereas B is the correct answer option. At 0° a ray of light is incident on a medium orthogonally. If both the mediums are of same refractive indices then only will the ray of light reflect back. Otherwise we will have refraction of light. Hence C is an incorrect option. At 90° a ray of light will travel along the interface separating the mediums. There will be no reflection or refraction. Hence, D is an incorrect answer option. Light will reflect at an angle greater than the critical angle. Hence, E is an incorrect answer option.

**Question 15**

**If a liquid of density of 810 Kg/m<sup>3</sup> and mass 0.950 Kg is kept in a vessel of negligible mass, what would be its volume in cm<sup>3</sup>?**

1.17 x 10<sup>-3</sup>

11.7

117

1.17

1170

**Correct Answer: E**

**Explanation:**

Volume = mass / density

Volume = 0.950 / 810 Or Volume = 1.17 x 10<sup>-3</sup> m<sup>3</sup>

We need to convert volume in m<sup>3</sup> to cm<sup>3</sup>

Volume = 1.17 x 10<sup>-3</sup> x 10<sup>6</sup> cm<sup>3</sup> Or Volume = 1170 cm<sup>3</sup>

Hence, E is the correct answer option.