Physics

Section A

1. A particle moves along the x-axis according to the equation $x(t)=5t^2-4t+1$. What is the acceleration of the particle at $t=3$ seconds?

A) 10 m/s²

B) 6 m/s²

C) 10 m/s²

D) 2 m/s²

2. A block of mass 2 kg is placed on a friction less inclined plane making an angle of 30° with the horizontal. What is the acceleration of the block down the plane? (Take $g=10$ m/s²)

A) 5 m/s²

B) 10 m/s²

C) 8.66 m/s²

D) 2.5 m/s²

3. Which of the following statements is true for an object in uniform circular motion?

A) The velocity is constant.

B) The acceleration is zero.

C) The speed is constant, but velocity changes.

D) Both speed and velocity are constant.

4. **A parallel plate capacitor is connected to a battery. If the plate separation is doubled while keeping the voltage constant, what happens to the capacitance?**

A) It doubles.

B) It halves.

C) It remains the same.

D) It quadruples.

5. **Light of wavelength 500 nm falls on a slit of width *1×10−61 ¥times 10^{-6}*1×10−6 m. What is the angular width of the central maximum in the diffraction pattern?**

A) 0.5 radians

B) 1 radian

C) 0.25 radians

D) 0.1 radians

6. **A current of 5 A flows through a conductor for 2 minutes. How much charge passes through the conductor?**

A) 600 C

B) 10 C

C) 150 C

D) 1000 C

7. **The dimensional formula for Planck's constant is:**

A) *[ML2T−1][ML^2T^{-1}]*[ML2T−1]

B) *[ML2T−2][ML^2T^{-2}]*[ML2T−2]

C) *[MLT−1][MLT^{-1}]*[MLT−1]

D) *[MT−2][MT^{-2}]*[MT−2]

8. Two waves of frequencies 250 Hz and 255 Hz superimpose. What is the beat frequency?

A) 5 Hz

B) 505 Hz

C) 2 Hz

D) 250 Hz

9. The escape velocity from the surface of Earth is approximately 11.2 km/s. What would be the escape velocity from a planet having twice the mass and twice the radius of Earth?

A) 11.2 km/s

B) 22.4 km/s

C) 15.8 km/s

D) 7.9 km/s

10. In a thermodynamic process, the pressure of an ideal gas is inversely proportional to the square of volume. The work done when the volume changes from V_1 to V_2 is proportional to:

A) $V_2 - V_1$

B) $\dfrac{1}{V_1} - \dfrac{1}{V_2}$

C) $V_1^2 - V_2^2$

D) $\ln\left(\dfrac{V_2}{V_1} \right)$

11. A wire of length L and cross-sectional area A has a resistance R. If the length is doubled and cross-sectional area is halved, the new resistance will be:

A) 2R

B) 4R

C) 8R

D) R