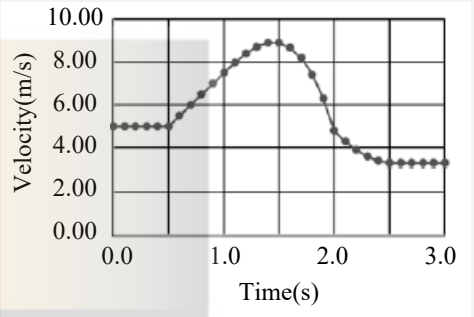
114年高醫物理試題精解

Choose one best answer for the following questions

【單選題】每題1分。

1. A particle moves in a track and its speed are recorded and plotted in the figure. Which statement is **correct**?



(A) It is stationary from $t = 0.0$ to $t = 0.5$ second

(B) It has maximum acceleration at $t = 1.5$ seconds

(C) No external force acting on the particle at $t > 2.5$ seconds

(D) The maximum force received by this particle is at $t = 1.5$ seconds

(E) This particle received a constant force against its motion during 1.0 to 2.0seconds.

Ans：(C)

⏭解析：

(A) It is *constant velocity* from $t = 0.0$ to $t = 0.5$ second.

(B) It has maximum *velocity* at $t = 1.5$ seconds.

(D) The *force is zero* at $t = 1.5$ seconds.

(E) This particle received a *variable force* against its motion during 1.0 to 2.0 seconds.

2. A particle moves in simple harmonic motion according to $x = 2\sin(15t)$, where x is in meters and t is in seconds. Its **maximum** velocity in m/s is _____.

(A) 30 sin(15t) (B) 2 cos(15t) (C) 15 (D) 30 (E) None of the above.

Ans：(D)

⏭解析：

$$v=\frac{dx}{dt}=2\times15\cos(15t)=30\cos(15t)=v_m\cos(\omega t)\Rightarrow v_m=30$$

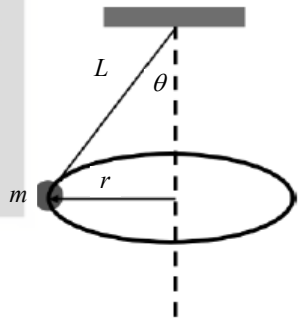
3. Consider a very small hole in the bottom of a tank 20 cm in diameter filled with water to a height of 50 cm. Find the speed at which the water exits the tank through the hole.
(A) 3.1 m/s (B) 9.8 m/s (C) 31.3 m/s (D) 34.9 m/s (E) 980 m/s.

Ans：(A)

⏭解析：

$$v=\sqrt{2gh}=\sqrt{2\times9.8\times0.5}=3.13[m/s]$$

4. A small object of mass m is suspended from a string of length L. The gravitational acceleration is g. The object revolves in a horizontal circle of radius r with constant speed. Find the period T of revolution.



(A) $\pi\sqrt{g\tan\theta/L}$ (B) $\pi\sqrt{L\sin\theta/g}$
(C) $2\pi\sqrt{L\cos\theta/g}$ (D) $2\pi\sqrt{g\sec\theta/L}$
(E) $\pi\sqrt{2g\cos\theta/L}$.

Ans：(C)

⏭解析：

由 $\vec{F}=m\vec{a}$

$$\begin{cases}T\sin\theta=m\dfrac{v^2}{r}\\ T\cos\theta=mg\end{cases}\Rightarrow v=\sqrt{rg\tan\theta}$$

$$T=\frac{2\pi r}{v}=\frac{2\pi(L\sin\theta)}{\sqrt{rg\tan\theta}}=\frac{2\pi(L\sin\theta)}{\sqrt{L\sin\theta g\tan\theta}}=2\pi\sqrt{\frac{L\cos\theta}{g}}$$

5. A carnival merry-go-round rotates about a vertical axis at a constant rate. A man standing on the edge has a constant speed of 3.7 m/s and a centripetal acceleration $\vec{a}$ of magnitude 1.8 m/s^2. Position vector $\vec{r}$ locates him relative to the rotation axis. What is the magnitude of $\vec{r}$?
(A) 3.5 m (B) 5.6 m (C) 6.4 m (D) 7.6 m (E) 12.4 m.

Ans：(D)

⏭解析：

$$a_r=\frac{v^2}{r}\Rightarrow 1.8=\frac{(3.7)^2}{r}\Rightarrow r=7.6[m]$$

6. A 2 kg object is subjected to three forces that give it an acceleration $\vec{a}$ = (–8m/s^2) $\hat{i}$ + (6 m/s^2) $\hat{j}$ .If two of the three forces are $\vec{F}_1=(30\ \text{N})\,\hat{i}+(16\ \text{N})\,\hat{j}$ and $\vec{F}_2=(-12\ \text{N})\,\hat{i}+(8\ \text{N})\,\hat{j}$, find the third force.
(A) (16 N) $\hat{i}$ – (12 N) $\hat{j}$ (B) (–34 N) $\hat{i}$ – (12 N) $\hat{j}$
(C) (20 N) $\hat{i}$ + (12 N) $\hat{j}$ (D) (–34 N) $\hat{i}$ + (12 N) $\hat{j}$
(E) (20 N) $\hat{i}$ + (18 N) $\hat{j}$.

Ans：(B)

⏭解析：

由 $\vec{F}=m\vec{a}$

$$\vec{F}_1+\vec{F}_2+\vec{F}_3=m\vec{a}$$

$$\Rightarrow(30\hat{i}+16\hat{j})+(-12\hat{i}+8\hat{j})+\vec{F}_3=2(-8\hat{i}+6\hat{j})$$

$$\Rightarrow\vec{F}_3=-34\hat{i}-12\hat{j}$$

7. n moles of gas in a container of volume V_i at temperature T expands rapidly into an evacuated region after a membrane is broken. The final volume of the gas-occupied space is V_f. What is the change in thermal

energy? (The universal gas constant is R.)

(A) $2nRT(V_f - V_i)/V_i$ (B) $nRT\ln(V_f/V_i)$

(C) $2nRT(V_f/V_i)$ (D) $2nRT\ln(2V_f/V_i)$

(E) $nRT(V_i+V_f)/V_f$.

Ans：(B)

⏭解析：

等溫過程熱的改變 $\Delta Q = nRT\ln\left|\frac{V_f}{V_i}\right|$

8. A medical defibrillator stores 320J in a 40.0μF capacitor. What is the voltage across the capacitor?

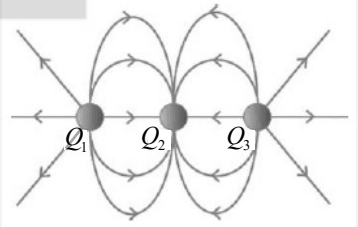
(A) 2.8 V (B) 4.0 V (C) 2.8 kV (D) 4.0 kV (E) 2.8 MV.

Ans：(D)

⏭解析：

$$U_c = \frac{1}{2}CV^2 \Rightarrow 320 = \frac{1}{2}(40\times10^{-6})V^2 \Rightarrow V = 4000$$

9. The figure shows three electric charges labeled Q_1, Q_2, Q_3, and some electric field lines in the region surrounding the charges. What are the signs of the three charges?



(A) Q_1 is negative, Q_2 is positive, Q_3 is negative

(B) Q_1 is positive, Q_2 is positive, Q_3 is negative

(C) Q_1 is positive, Q_2 is negative, Q_3 is positive

(D) Q_1 is positive, Q_2 is negative, Q_3 is negative

(E) Q_1 is negative, Q_2 is negative, Q_3 is negative.

Ans：(C)

⏭解析：

根據電力線分佈，可知 Q_1 is positive, Q_2 is negative, Q_3 is positive