

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

- An ideal gas (1.0 mol) is the working substance in an engine that operates on the cycle shown in Fig. 1. Processes BC and DA are reversible and adiabatic. What is the type of the gas molecule? 7%
(a) monatomic (b) diatomic (c) polyatomic (d) methane (CH_4)
- Use parallel-axis theorem to find the **solid cylinder** rotational inertia I about the central axis. 7%
(a) MR^2 (b) $\frac{2}{5}MR^2$ (c) $\frac{1}{2}MR^2$ (d) $\frac{2}{3}MR^2$
- Fig. 2 show a box (mass $m_1 = 3.0$ kg) on a frictionless plane inclined at angle $\theta_1 = 30^\circ$. The box is connected via a cord of negligible mass to a box of laundered money (mass $m_2 = 2.0$ kg) on a frictionless plane inclined at angle $\theta_2 = 60^\circ$. The pulley is frictionless and has negligible mass. What is the tension in the cord? 7%
(a) 10 N (b) 16 N (c) 18 N (d) 20 N
- A 250g block is dropped onto a relaxed vertical spring that has a spring constant of $k = 2.5\text{N/m}$ (Fig. 3) The block becomes attached to the spring and compresses the spring 12cm before momentarily stopping. While the spring is being compressed, what is the speed of the block just before it hits the spring? (Assume that friction is negligible.) 7%
(a) 1.5m/s (b) 3.5m/s (c) 10m/s (d) 12.5m/s
- In Fig. 4 a block of mass $m = 12\text{kg}$ is released from rest on a frictionless incline of angle $\theta = 30^\circ$. Below the block is a spring that can be compressed 2.0cm by a force of 270N. The block momentarily stops when it compresses the spring by 5.5cm. How far does the block move down the incline from its rest position to this stopping point? 7%
(a) 0.15m (b) 0.25m (c) 0.35m (d) 12.5m
- In problem 5, what is the speed of the block just as it touches the spring? 7%
(a) 0.7m/s (b) 1.7 m/s (c) 2.7m/s (d) 3.7m/s
- Four point charges are at the corners of a square of side a as shown in Fig. 5. Determine the magnitude of the electric field $|\vec{E}|$ at the location of charge q . 7%
(a) $\frac{1}{4\pi\epsilon_0} \frac{q}{a^2}$ (b) $2.6 \frac{1}{4\pi\epsilon_0} \frac{q}{a^2}$ (c) $5.9 \frac{1}{4\pi\epsilon_0} \frac{q}{a^2}$ (d) $7.2 \frac{1}{4\pi\epsilon_0} \frac{q}{a^2}$

(背面仍有題目,請繼續作答)

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科目：普通物理

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8. In Fig. 6, a uniform sphere of mass $m=0.85$ kg and radius $r = 4.2$ cm is held in place by a massless rope attached to a frictionless wall a distance $L = 8.0$ cm above the center of the sphere. Find the tension in the rope? ($g=9.8\text{m/s}^2$) 7%
- (a) 6.4 N (b) 7.4 N (c) 8.4 N (d) 9.4 N
9. Charge is distributed uniformly throughout the volume of an infinitely long solid cylinder of radius R . Please find out the electric field E at a distance $r < R$ from the cylinder axis. Where ρ is the volume charge density. 7%
- (a) $\frac{\rho r}{2\epsilon_0}$ (b) $\frac{\rho r}{\epsilon_0}$ (c) $\frac{2\rho r}{3\epsilon_0}$ (d) $\frac{2\rho r}{\epsilon_0}$
10. A long coaxial cable (Fig.7) consist of two thin-walled concentric conducting cylinders with radii a and b . The inner cylinder carries a steady current i , and the outer cylinder provides the return path for that current. The current sets up a magnetic field between the two cylinders. Calculate the energy stored in the magnetic field for a length l of the cable. 7%
- (a) $\frac{\mu_0 i^2 l}{\pi}$ (b) $\frac{\mu_0 i^2 l}{2\pi} \ln b/a$ (c) $\frac{\mu_0 i^2 l}{4\pi} \ln b/a$ (d) $\frac{\mu_0 i^2 l}{\pi} \ln b/a$
11. The wire in Fig. 8 carries a current i and consists of a circular arc of radius R and central angle $\pi/2$ rad, and two straight sections whose extensions intersect the center C of the arc. What magnetic field \vec{B} does the current produce at C ? 7%
- (a) $\frac{\mu_0 i}{2\pi R}$ (b) $\frac{\mu_0 i}{2R}$ (c) $\frac{\mu_0 i}{8R}$ (d) $\frac{\mu_0 i}{10R}$
12. In Fig. 9, an x-ray beam of wavelengths from 95.0 to 140 pm is incident at $\theta=45.0^\circ$ to a family of reflecting planes with spacing $d = 275$ pm. What is the longest wavelength λ in the diffraction of the beam? 7%
- (a) 110 pm (b) 120 pm (c) 130 pm (d) 138 pm
13. In Fig. 10 displays a 12.0 battery and three uncharged capacitors of capacitances $C_1=4\mu\text{F}$, $C_2=6\mu\text{F}$ and $C_3=3\mu\text{F}$. The switch is thrown to the left side until capacitor 1 is fully charged. Then the switch is thrown to the right. What is the final charge (μC) on capacitor 1? 7%
- (a) 25 (b) 28 (c) 30 (d) 32

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14. In problem 13. the final charge (μC) on capacitor 2 ? 5%

- (a) 10 (b) 14 (c) 16 (d) 18

15. A wave traveling along a string is described by $y(x,t) = 0.00327 \sin(72.1x - 2.72t)$ in which the numerical constants are in SI units (0.00327 m, 72.1 rad/m, and 2.72 rad/s) what is the period of this wave? 4%

- (a) 1.31 s (b) 2.31 s (c) 3.31 s (d) 4.31 s

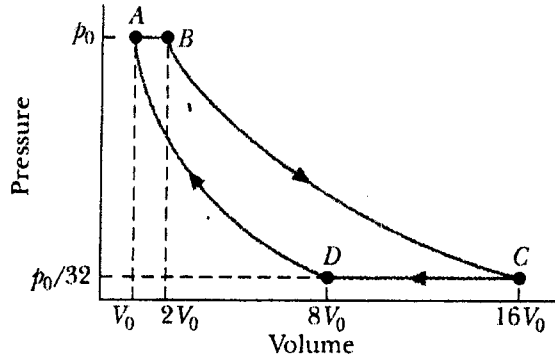


Fig. 1

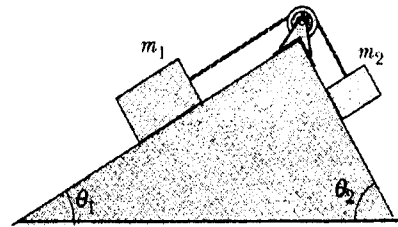


Fig. 2



Fig. 3

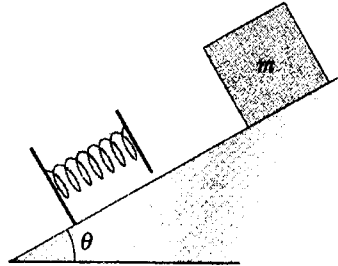


Fig. 4

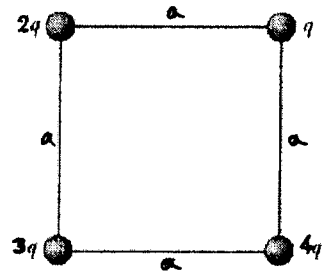


Fig. 5

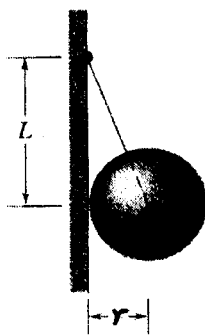


Fig. 6

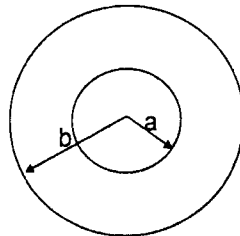


Fig. 7

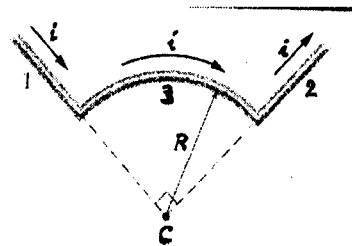


Fig. 8

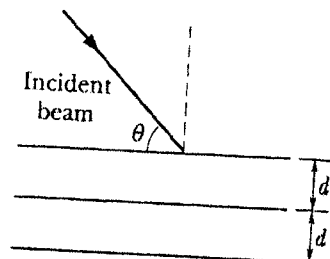


Fig. 9

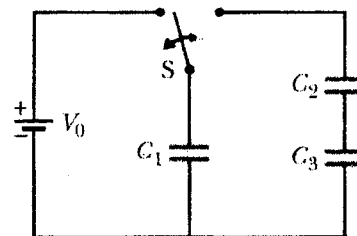


Fig. 10