國立成功大學103學年度轉學生招生考試試題

系所組別：全校

考試科目：普通物理

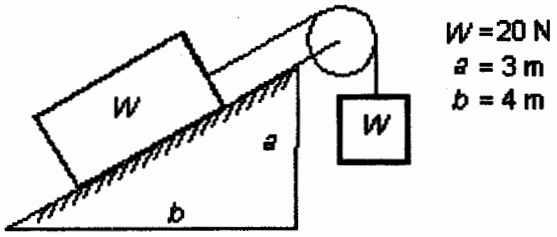
考試日期：0713，節次：4

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

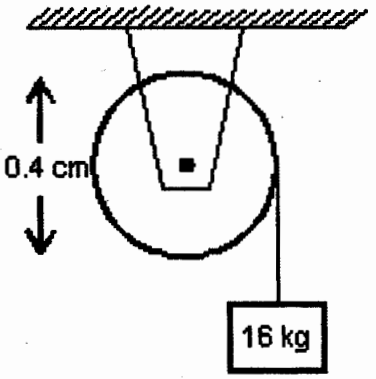
第一部份選擇題請於答案卷上標明題號依順序作答（無須寫計算過程）。

Part I: (60 points)

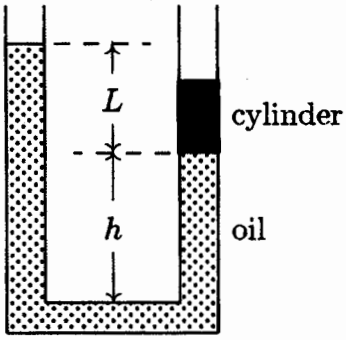
1. The system shown remains at rest. The force of friction on the upper block is:
(A) 4 N (B) 8 N (C) 12 N (D) 16 N (E) 20 N



2. A 16 kg block is attached to a cord that is wrapped around the rim of a flywheel of diameter 0.4 m and hangs vertically, as shown. The rotational inertia of the flywheel is 0.5 kg· m^2. When the block is released and the cord unwinds, the acceleration of the block is:
(A) 0.15 g (B)0.3 g (C) 0.56 g (D) 0.84 g (E) g



3. The diagram shows a U-tube with cross-sectional area A and partially filled with oil of density ρ. A solid cylinder, which fits the tube tightly but can slide without friction, is placed in the right arm. The system is in equilibrium. The weight of the cylinder is:
(A) $L^2\rho g$ (B) $L^3\rho g$ (C) $A\rho(L+h)g$ (D) $A\rho(L-h)g$ (E) none of these



4. The p-V diagram in Fig. 4 shows two paths along which a sample of gas can be taken from state a to state b, where $V_b=3V_1$. Path 1 requires that energy equal to $5\,p_1V_1$ be transferred to the gas as heat. Path 2 requires that energy equal to $5.5\,p_1V_1$ be transferred to the gas as heat. The ratio p_2/p_1 should be
(A) 1.5. (B) 2 (C) 2.5 (D) 3 (E) 4

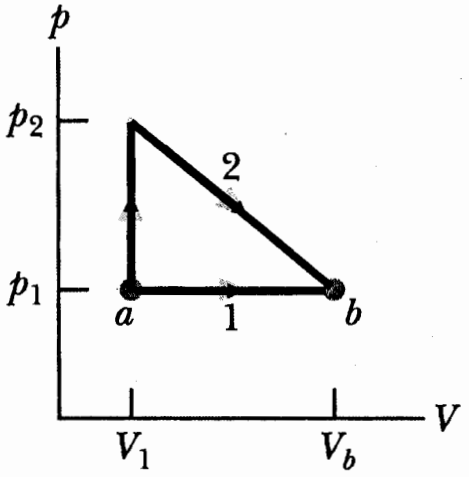


Fig 4

5. The coefficient of linear expansion of steel is 11×10^{-6} per C°. A steel ball has a volume of exactly 100 cm^3 at 0°C. When heated to 100°C, its volume becomes:
(A)100.33 cm^3 (B)100.0011 cm^3 (C)100.0033 cm^3 (D)100.000011 cm^3 (E) none of these

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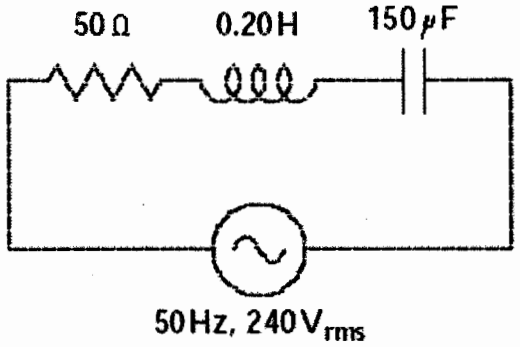
6. The impedance of the circuit shown as 

is:

(A) 21Ω (B) 50Ω (C) 63Ω (D) 65Ω (E) 98Ω

7. In Fig. 7, two tiny conducting balls of identical mass m and identical charge q hang from nonconducting threads of length L. Assume that θ is small, then the equilibrium separation x is approximately

(A) $q^2L/(4\pi\epsilon_0 mg)$ (B) $[q^2L/(4\pi\epsilon_0 mg)]^{1/2}$ (C) $2[q^2L/(\pi\epsilon_0 mg)]^{1/2}$

(D) $[q^2L/(2\pi\epsilon_0 mg)]^{1/3}$ (E) $3[q^2L/(\pi\epsilon_0 mg)]^{1/3}$

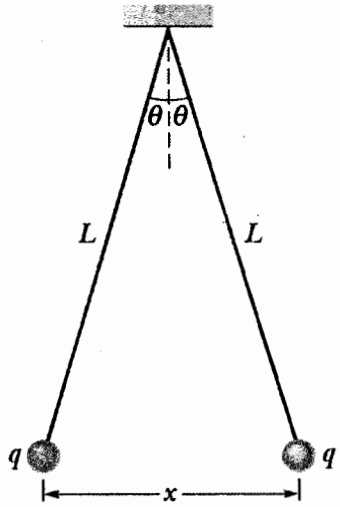
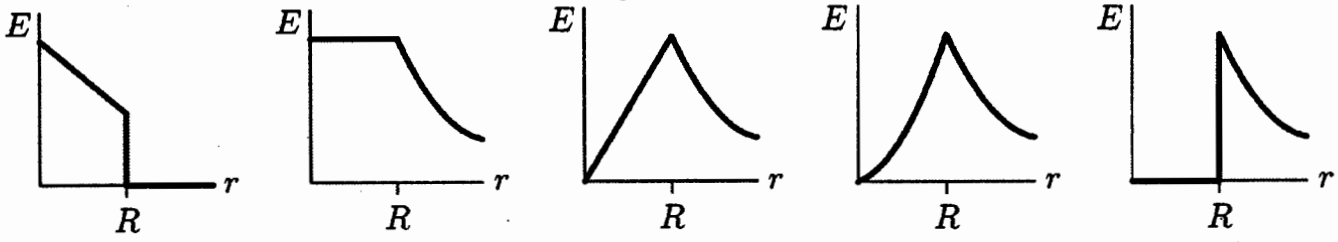


Fig 7

8. Which of the following graphs represents the magnitude of the electric field as a function of the distance from the center of a solid charged conducting sphere of radius R?



9. According to Einstein's Special Relativity, a fixed observer will find that a moving object appears to have

(A) time contraction, length dilation (B) time dilation, length dilation
(C) time unchanged, length contraction (D) time contraction, length contraction
(E) time dilation, length contraction

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10. Which of the following is NOT true for electromagnetic waves?
(A) they consist of changing electric and magnetic fields
(B) they travel at different speeds in vacuum, depending on their frequency
(C) they transport energy
(D) they transport momentum
(E) they can be reflected

Part II (40 points)

1. In Fig. A, a small 50g block slides down a frictionless surface through height h=20 cm and then sticks to a uniform rod of mass 100 g and length 40 cm. The rod pivots about point O through angle θ before momentarily stopping. Find θ.

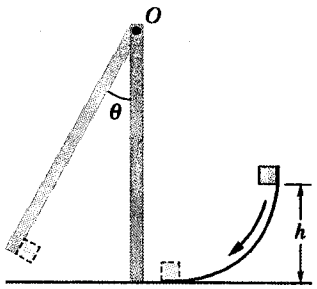

Fig A

2. The cycle in Fig. B represents the operation of a gasoline internal combustion engine. Volume V_3=4V_1. Assume the gasoline–air intake mixture is an ideal gas with γ=1.3. What are the ratios (a) T_2/T_1, (b) T_3/T_1, (c) T_4/T_1, and (d) p_3/p_1 ? (e) What is the engine efficiency? (10 pts)

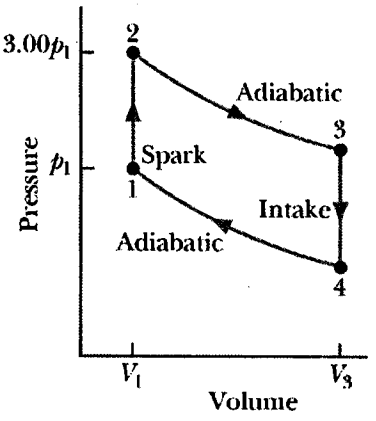

Fig B

3. Figure C shows a rod of length L=10 cm that is forced to move at constant speed v=5 m/s along horizontal rails. The rod, rails, and connecting strip at the right form a conducting loop. The rod has resistance 0.4Ω; the rest of the loop has negligible resistance. A current i=100A through the long straight wire at distance a=10mm from the loop sets up a (nonuniform) magnetic field through the loop. Find the
(a) emf and (b) current induced in the loop.
(c) At what rate is thermal energy generated in the rod?
(d) What is the magnitude of the force that must be applied to the rod to make it move at constant speed?
(e) At what rate does this force do work on the rod? (10 pts)

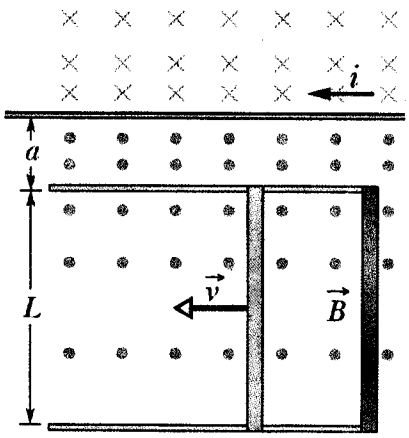

Fig C

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4. In Fig. D, light is incident at angle θ_1=40.1° on a boundary between two transparent materials. Some of the light travels down through the next three layers of transparent materials, while some of it reflects upward and then escapes into the air. If n_1=1.3, n_2=1.4, n_3=1.32, and n_3=1.45, what is the value of (a) θ_5 and (b) θ_4? [10 pts]

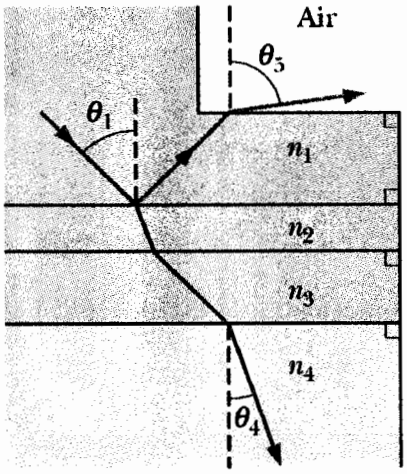

Fig D