

臺灣綜合大學系統 105 學年度學士班轉學生聯合招生考試試題

科目名稱	普通物理 B	類組代碼	E00
		科目碼	E0015

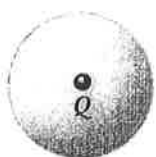
※本項考試依簡章規定各考科均「不可以」使用計算機

本科試題共計 3 頁

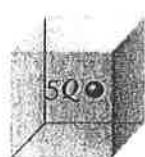
第一部分：簡答題（60 分）

共 12 題，每題 5 分，請於答案卷上標明題號並依序作答（中英文作答均可，無需詳列計算過程）。

- The work done by a force on a particle moving between any two points is independent of the force taken by the particle, the force is called conservation force. Please write down a **non-conservation force** you known that is NOT satisfied above property.
- A large tank is filled with the water to a height of h . The bottom of the tank has a hole. What is the speed of the water emerged out of the hole?
- Three objects of uniform density—a solid sphere, a solid cylinder, and a hollow cylinder, are placed at the top of an incline. They are all released from rest at the same elevation and **roll without slipping**. Which object reaches the bottom first?
- Please use a PV (pressure-volume) diagram, with the help of an isothermal curve, to describe the **isothermal expansion** of an ideal gas from an initial state to final state.
- Please give the **entropy statement** of the second law of thermodynamics.
- A water film ($n=1.33$) in air is 320-nm thick. If it is illuminated with white light at normal incident, what color will it appear to be in the reflected light?
- Use a plot of E versus r to describe the electric field magnitude versus distance r from the center of a **solid charged conducting sphere** of radius a .
- Rank the electric fluxes through each Gaussian surface shown in the following figure **from largest to smallest**.



(a)



(b)



(c)



(d)

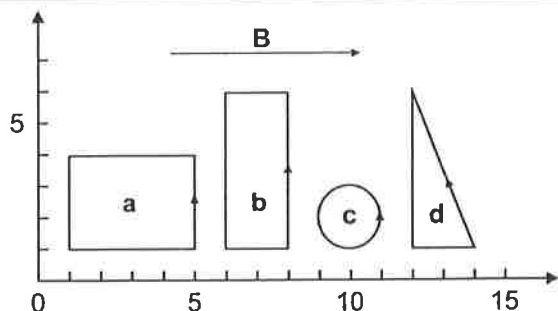
- A magnetic field exerts a torque on each of the current-carrying single loop of wire shown in the following figure. The loops lie in the xy plane, each carrying the **same magnitude current**, and the uniform magnetic field points in the positive x direction. Rank the loops by the magnitude of the torque exerted on them by the field **from largest to smallest**.

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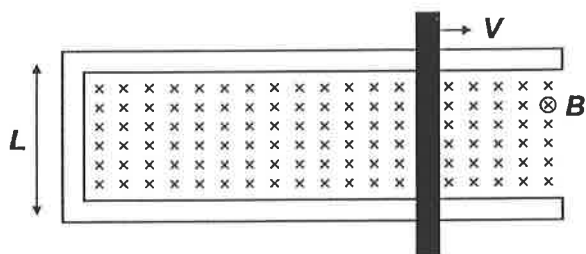
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10. A rod with resistance R lies across frictionless conducting rails in a uniform magnetic field B , as shown in the following figure. Assume the rails have negligible resistance. Calculate the force that must be applied by a person to pull the rod to the right at constant speed V .



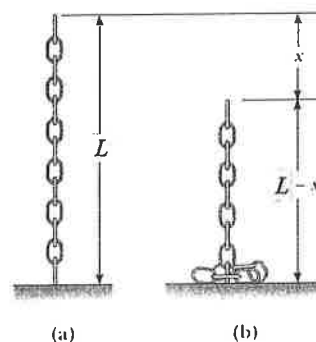
11. A crew on a spacecraft watches a movie that is two hours long. The spacecraft is moving at high speed through space. Does an **earth-based observer** watching the movie screen on the spacecraft through a powerful telescope measure the duration of the movie to be longer than, shorter than, or equal to two hours?
12. There are four stars shown in a telescope color photograph. Start A appears to glow red, start B appears to glow violet, start C appears to glow orange, whereas start D looks blue in color. Please rank the stars by their surface temperatures **from highest to lowest**.

第二部分：計算題（40 分）

共 3 題，請於答案卷上標明題號依序作答，並詳列計算過程（中英文作答均可）。

1. A chain of length L and total mass M is released from rest with its lower end just touching the top of a table, as in the right figure.

- (a) Find the force exerted by the table on the chain after the chain has fallen through a distance x , as in Figure. **(5 points)**



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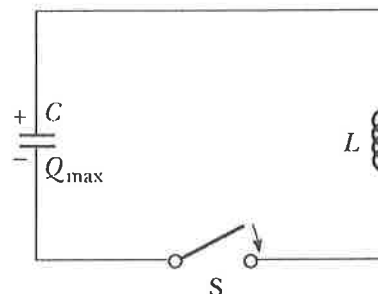
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(b) What is the maximum force? **(5 points)**

2. (a) Show a graphical and physical description of an LC circuit by using the mechanical analog of a block-spring system in one cycle oscillation. (Hint: Try to discuss the energies stored in the circuit and mechanical systems) **(5 points)**



- (b) Following above description, what are the time relations of charge in the capacitor and current in the circuit? (Hint: Use the rule of energy conservation in one cycle oscillation) **(5 points)**
- (c) If the resistance of the wires in an LC circuit were not zero, would the oscillation persist? Please explain. **(5 points)**

3. A conduction electron in a metal may be treated as a particle in a three-dimensional box of side L . The energy is determined by three quantum numbers n_1 , n_2 , and n_3 :

$$E = \frac{h^2}{8mL^2} (n_1^2 + n_2^2 + n_3^2)$$

- (a) What values of n_1 , n_2 , and n_3 correspond to the ground state and the first excited state? **(5 points)**
- (b) What is the energy difference between the ground state and the second excited state? **(5 points)**
- (c) What is the wavelength of a photon that will cause the transition between the ground state and the second excited state? **(5 points)**