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

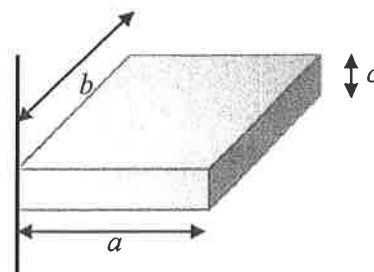| 科目名稱	普通物理 A	類組代碼	E00
		科目碼	E0014

※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）。

1. The uniform solid block in right figure has mass 0.2 kg and edge lengths a = 4.5 cm, b = 8.5 cm, and c = 1.8 cm. Calculate its rotational inertia about an axis through one corner and perpendicular to the large faces.

2. Water is filled to a height H behind a dam of width w. Calculate the resultant force exerted by the water on the dam.

3. An elevator (mass 5000 kg) is to be designed so that the maximum acceleration is 0.05 g. What is the **maximum force** the motor should exert on the supporting cable?

4. Please use a PV (pressure-volume) diagram to describe the **isobaric expansion** of an ideal gas from an initial state to final state.

5. Please give the statements of the **first law of thermodynamics**.

6. Calculate the **minimum thickness** of a soap-bubble film that results in constructive interference in the reflected light if the film is illuminated with light whose wavelength in free space is 600 nm. The index of refraction of the soap film is 1.33.

7. Use a plot of E versus r to describe the electric field magnitude versus distance r from the center of a **solid charged insulating sphere** of radius a.

8. Consider a uniformly wound solenoid having N turns and length l. Assume l is much longer than the radius of the windings and the core of the solenoid is air. Please calculate the inductance of the solenoid.

9. What is the physical meaning of **Gauss's law in magnetism**?

10. Please use the current-voltage difference curves to describe the **ohmic and nonohmic materials.**

11. Please write down **two forms** of Heisenberg uncertainty principle.

12. There are four starts shown in a telescope color photograph. Start A appears to glow red, start B appears to glow orange, start C appears to glow dark red, whereas start D looks blue in color. Please rank the starts by their surface temperatures **from lowest to highest**.

背面有題，請繼續作答。

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

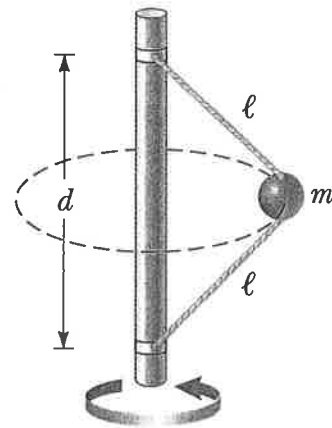| 科目名稱	普通物理 A	類組代碼	E00
		科目碼	E0014

※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. In right figure, a 1.5 kg ball is connected by means of two massless strings, each of length $L = 1.80$ m, to a vertical, rotating rod. The strings are tied to the rod with separation $d = 1.70$ m and are taut. The tension in the upper string is 35 N.

   (a) What are the tension in the lower string? **(5 points)**

   (b) What are the magnitude of the net force F_{net} on the ball? **(5 points)**

   (c) What are the speed of the ball? **(5 points)**

2. A nonconducting sphere has mass 60.0 g and radius 25.0 cm. A flat compact coil of wire with 6 turns is wrapped tightly around it, with each turn concentric with the sphere. As shown in the following figure, the sphere is placed on an inclined plane that slopes downward to the left, making an angle θ with the horizontal, so that the coil is parallel to the inclined plane. A uniform magnetic field of 0.350 T vertically upward exists in the region of the sphere.
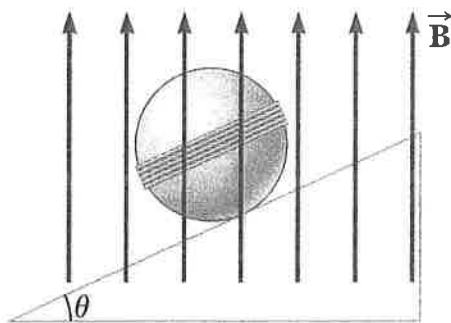
   (a) What current in the coil will enable the sphere to rest in equilibrium on the inclined plane? **(5 points)**

   (b) Show that the result does not depend on the value of θ. **(5 points)**

3. The radial part of the wavefunction for the 1s state in hydrogen is

   $$\Psi_{1s}(r) = \frac{1}{\sqrt{\pi a_0^3}} e^{-\frac{r}{a_0}}, \text{ where } a_0 \text{ is Bohr radius.}$$

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 A	類組代碼	E00
		科目碼	E0014

※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

(a) What is the radial probability density function for hydrogen atom in its ground state? **(5 points)**

(b) Show that the most probable value of r for electron in the ground state of the hydrogen atom. **(5 points)**

(c) Calculate the probability that the electron in the ground state of hydrogen will be found outside the first Bohr radius **(5 points)**

(hint: using the partial integration $\int x^2 e^{-x} dx = -(x^2 + 2x + 2)e^{-x}$)