※ 考生請注意：本試題 ☑可 □不可 使用計算機

1 Write down the three universal constants in the electromagnetic model with the unit in **SI** system, and their relations. (10%)

2. A solution containing sodium ions is confined in a region between two concentric spheres of radii 1 and 4 (cm). Assuming that it has a charge density of
$$(1 \times 10^{-8}/R^4) \cos^2 \phi \, (C/m^3)$$
Find the total charge contained in this region. (10%)

3. A constant voltage V_0 is applied to a partially filled parallel-plate capacitor shown in Fig. 1. The permittivity of the dielectric is ε, and the area of the plates is S. Find the force on the upper plate. (20%)
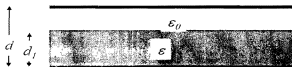

Fig. 1

4. Consider a metallic rectangular box with sides a and b and height c. The side walls and the bottom surface are grounded. The top surface is isolated and kept at a constant potential V_0. Determine the potential distribution inside the box. (20%)

5. A transparent dielectric coating is applied to glass ($\varepsilon_r = 4$, $\mu_r = 1$) to eliminate the reflection of red light ($\lambda_0 = 0.75 \, \mu m$). a) Determine the required dielectric constant and thickness of the coating. b) If violet light ($\lambda_0 = 0.42 \, \mu m$) is shone normally on the coated glass, what percentage of the incident power will be reflected? (20%)

(背面仍有題目,請繼續作答)

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6. An infinitely long solenoid with air core having a radius b and n closely wound turns per unit length as shown in Fig. 2. The windings are slanted at an angle α with respect to horizontal axis, and carry a current I. Determine the magnetic flux density both inside and outside the solenoid. (20%)

Fig. 2