GP2-LQA4 學號:_____ 系級:_____姓名: _____ 得分:_____

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填充,計算題須寫出計算過程,並且將答案填入空格。

Problem 1

Work and energy in a capacitor. (03小題)

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01 (a)A capacitor with capacitance C is charged by an external source. What is The work required to bring the total capacitor charge up to a final value q? W=_____ [q,C,epsilon_0] 分數= 6

02 (b)A metal sphere of radius R is charged to a potential V. What is the electric potential energy stored in the sphere? U=_____ [R,V,epsilon_0] 分數= 6

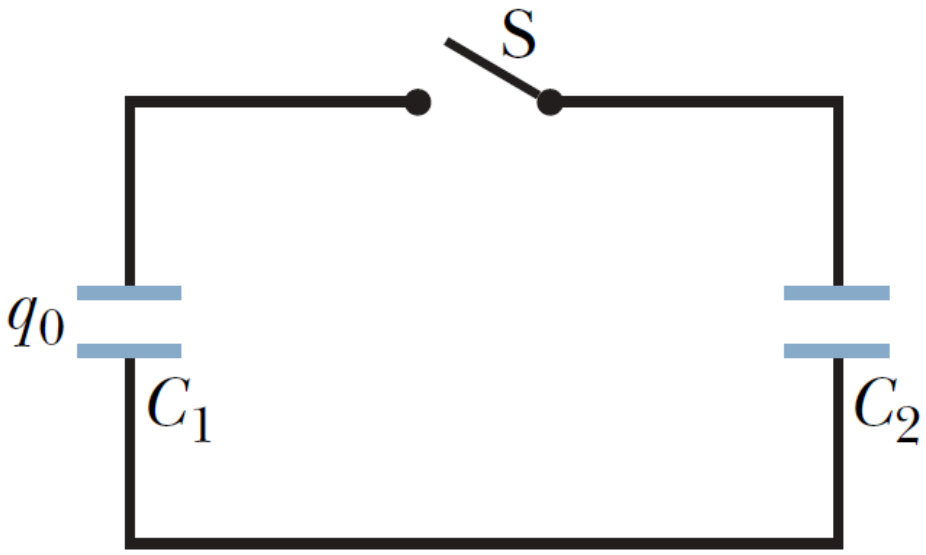
03 (c)If the electric field between 2 parallel plates is E, what is the electric energy density in the space of between? u=_____ [E,epsilon_0] 分數= 6

Problem 2

An isolated conducting sphere whose radius R is 5 cm has a charge q = 2.5 nC. (a) How much potential energy is stored in the electric field of this charged conductor? (b)What is the energy density at the point 10 cm from the center of the spere? (02小題) 04 (a)U=_____ J 分數= 8 05 (b)u=____ J/m^3 分數= 8

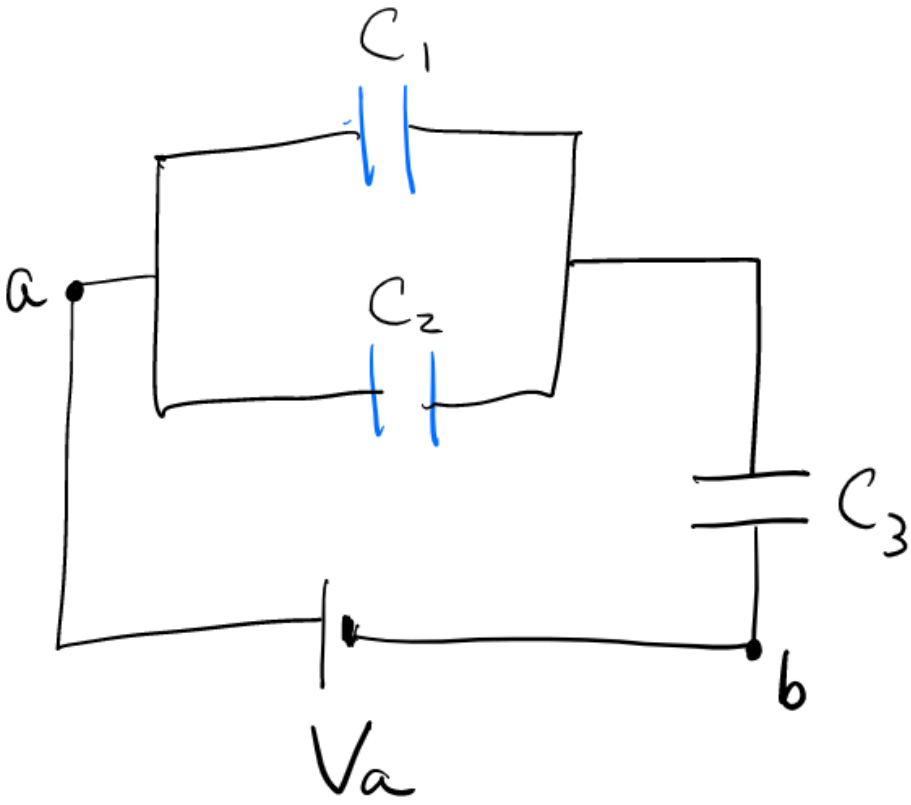
Problem 3

Capacitor 1, with $C_1 = 3.55\mu$ F, is charged to a potential difference $V_0 = 6.30$ V, using a 6.30 V battery. The battery is then removed, and the capacitor is connected to an uncharged capacitor 2, with $C_2 = 8.95\mu$F. When switch S is closed(see figure), charge flows between the capacitors. Find the charge on each capacitor when equilibrium is reached. (02小題) 06 (a)charge on C_1=_____ C 分數= 8 07 (b)charge on C_2=_____ C 分數= 8



Problem 4

For the capacitor network shown in the figure, the potential difference of the battery is V_a(=V_a) and $C_1 = C_2 = C, C_3 = 2C$. Find (a)the equivalent capacitance between a and b; (b) the potential difference on C_3; (c) the total energy stored on C_3; (d)the total energy stored on C_1. (04小題)



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08 (a)the equivalent capacitance between a and b, C_{eq}=_____ [C] 分數= 4

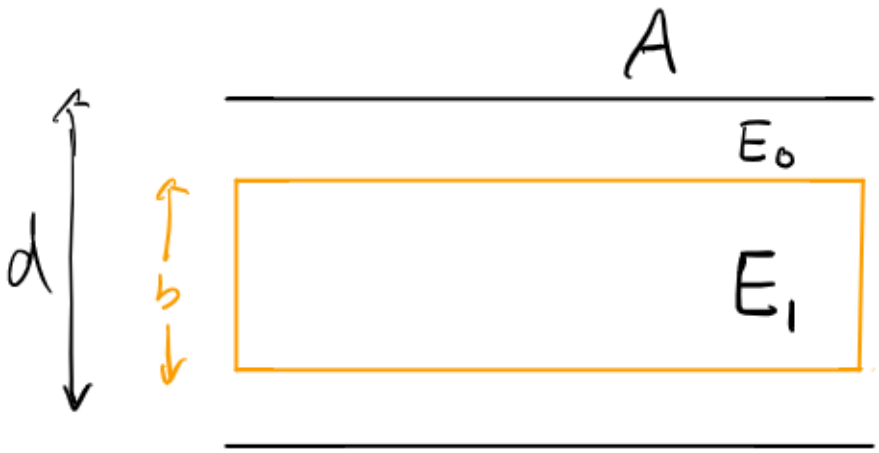
09 (b)the potential difference on C_3=____ [Va,C] 分數= 3

10 (c)the total energy stored on C_3=_____ [Va,C] 分數= 3

11 (d)the total energy stored on C_1=_____ [Va,C] 分數= 3

Problem 5

The figure shows a parallel-plate capacitor of plate area A and plate separation d. A potential difference V_0 is applied between the plates.The battery is then disconnected, and a dielectric slab of thickness $b(< d)$ and dielectric constant κ is placed between the plates as shown. (a) What is the capacitance C0 before the dielectric slab is inserted? (07 小題)



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12 Stage 1: before the dielectric slab is inserted:
(a)the capacitance C_0=_____ [d,A,epsilon_0,V_0] 分數= 6

13 (b)the charge appears on the plates=_____ [b,d,A,epsilon_0,V_0] 分數= 6

14 Stage 2: after the dielectric slab is inserted:
(c)the charge appears on the plates=_____ [kappa,b,d,A,epsilon_0,V_0] 分數= 6

15 (d)the electric field E_0 in the gaps between the plates and the dielectric slab=_____
[kappa,b,d,A,epsilon_0,V_0] 分數= 6

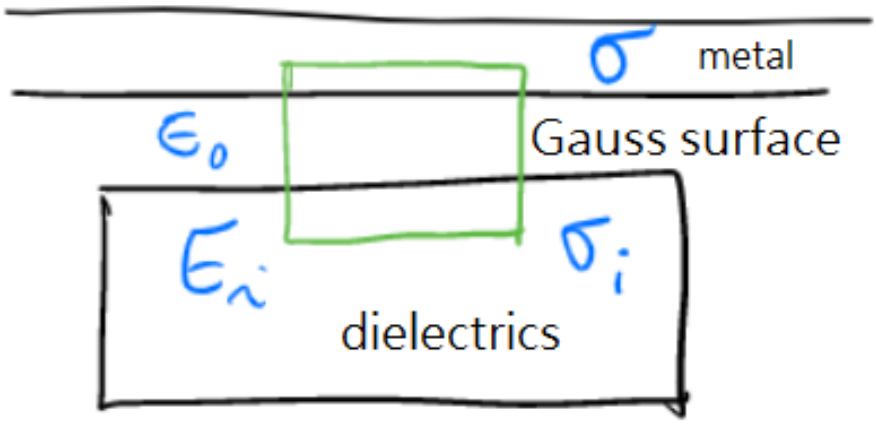
16 (e)the electric field E_1 inside the dielectric slab=_____ [kappa,b,d,A,epsilon_0,V_0] 分數= 6

17 (f)the potential difference V between the plates=_____ [kappa,b,d,A,epsilon_0,V_0] 分數= 6

18 (g)the capacitance C=_____ [kappa,d,A,epsilon_0] 分數= 6

Problem 6

Two parallel plates have equal and opposite charges. When the space between the plates is evacuated, the electric field is $E = 3.2 \times 10^5$ V/m. When the space is filled with dielectric, the electric field is $E = 2.5 \times 10^5$ V/m. (a) What is the dielectric constant? (b) What is the charge density on each surface of the dielectric? (02小題)



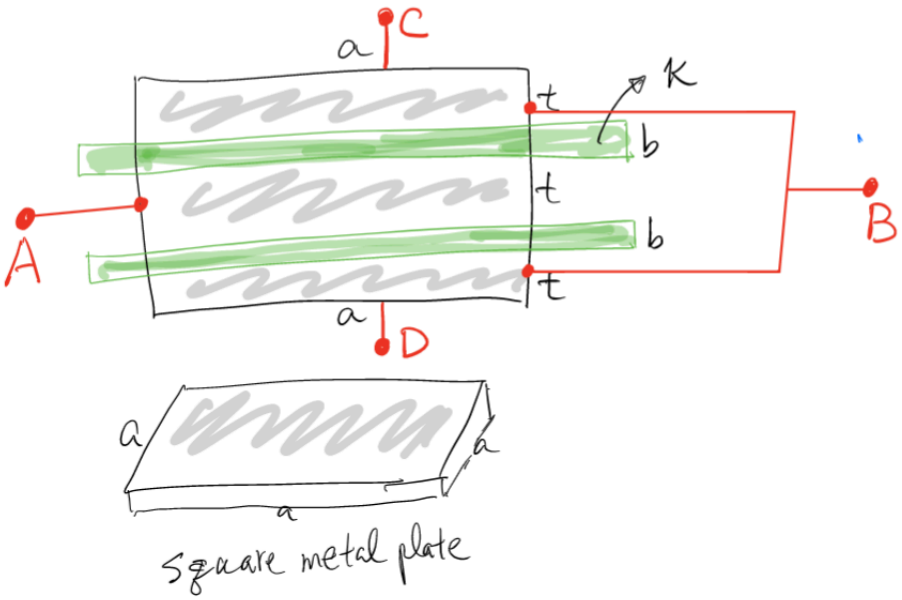
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19 (a)κ=_____ 分數= 6

20 (b)the surface charge density on each surface of the dielectric, σ_i=_____ C/m^2 分數= 6

Problem 7

Three square metal plates each has side of length a and thick t, are arranged as in the figure. The plates are separated by sheets of paper b thickness and with dielectric constant κ. (a)If the outer plates are connected together and connected to point B. The inner plate is connected to point A. What is the capacitance between points A and B? (b)If instead, the upper plate is connected to C and bottom one to D. Find the capacitance between C and D. (02小題)



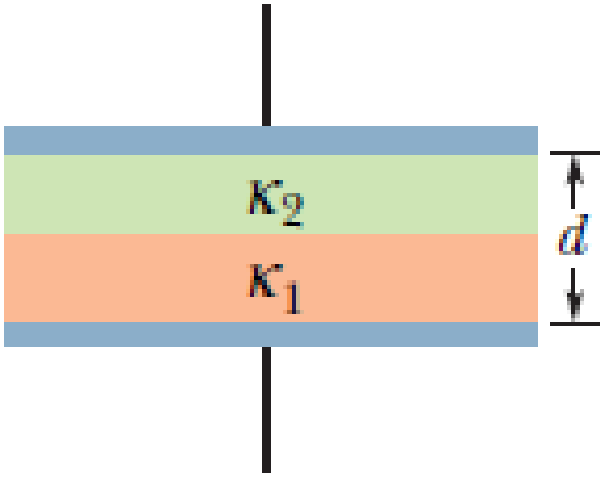
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21 (a) the capacitance between A and B=_____ [a,t,b,kappa,epsilon_0] 分數= 6

22 (b) the capacitance between C and D=_____ [a,t,b,kappa,epsilon_0] 分數= 6

Problem 8

The figure shows a parallel plate capacitor with a plate area A and plate separation d. The top half of the gap is filled with material of dielectric constant k1; the bottom half is filled with material of dielectric constant k2. What is the capacitance? (01小題)



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23 the capacitance=_____ [epsilon_0,A,d,k1,k2]

分數= 10