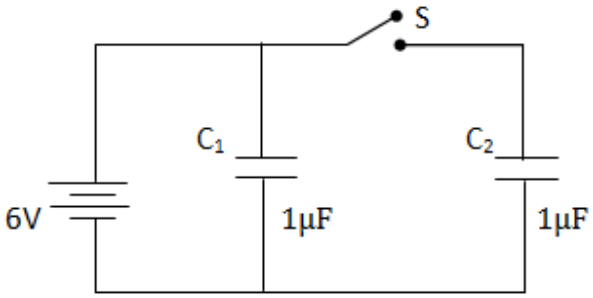
Q11. Figure shows two identical capacitors, C_1 and C_2, each of 1 μF capacitance connected to a battery of 6 V. Initially switch 'S' is closed. After sometime 'S' is left open and dielectric slabs of constant K=3 are inserted to fill completely the space between the plates of the two capacitors. How will the (I) charge and (II) potential difference between the plates of the capacitors be affected after the slabs are inserted?



Answer:

When S is closed	**When S is opened**
Charge on C_1 , $q_1=C_1V$ =1x6 =6 μC Charge on C_2 , $q_2=C_2V$=1x6=6 μC Both the capacitors have same charge 6 μC and same potential 6 Volt.	Since Dielectric constant 3 is inserted on both capacitors. Capacitance of C_1 increased to C_1' =3C_1=3μF Capacitance of C_2 increased to C_2' =3C_2=3μF Potential =6V therefore Charge on C_1 =q_1'=CV=3X6=18μC As C_2 is disconnected, charge on C_2=q_2'=6 μC Capacitance of C_2= C_2'=KX1=3 μF Potential at C_2=Charge/Capacitance=6/3=2 Volt.

Q12. Two convex lenses of same focal length but of aperture A_1 and A_2 ($A_1 < A_2$), are used as the objective lenses in two astronomical telescopes having identical eyepieces. What is the ratio of their resolving power? Which telescope will you prefer and why? Give reasons.

Answer: We know that resolving power is proportional to the aperture and is given by $\text{R. P.} = \frac{a}{1.22\lambda}$

$$\therefore \frac{(\text{Resolving Power of Lens})_1}{(\text{Resolving Power of Lens})_2} = \frac{A_1}{A_2}$$

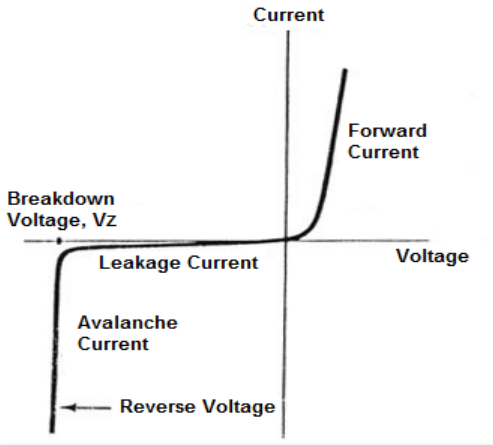
The telescope with objective of aperture A_2, should be preferred for viewing as this would

i. Give a better resolution.
ii. Have a higher light gathering power of telescope.

Q13. Repeat question

Q14. Name the semiconductor device that can be used to regulate an unregulated dc power supply. With the help of I – V characteristics of this device, explain its working principle.

Answer: Semiconductor device used to regulate unregulated dc power supply **is** Zener diode.



Working Principle:

V-I characteristics of zener diode indicates in forward bias region Zener diode is identical to that of Normal PN junction diode. In reverse bias zener diode acts as an open circuit and only small current in order of (1 μA) flows through the diode as shown in the figure. If the applied reverse voltage exceeds the breakdown voltage then break down occurs. In breakdown region zener diode provides almost constant voltage and the current through the zener increases rapidly.

A regulator is used to provide constant output voltage to the load connected in parallel with the regulator. Zener diode regulates the output voltage until the zener current falls below the minimum current in breakdown region.

Zener diodes are used to stabilize or regulate the voltage source against load or supply variations as it provides constant voltage in the reverse bias even though input voltage is varying after the breakdown.