1. (c)Electric field at a distance *R* is only due to sphere because electric field due to shell inside it is always zero. Hence electric field =
2. (d)  and  (given)

 and 

Potential at common centre



1. (a) For the given situation, diagram can be drawn as follows

*– q*

*+q*

*θ*

2*a*

*p*

→

*p*′

→

*P*

*r*

As shown in figure component of dipole moment along the line *OP* will be . Hence electric potential at point *P* will be 

1. (d) An imaginary cube can be made by considering charge *q* at the centre and given square is one of it's face.

*a*

*a/*2

*q*

So flux from given square (*i.e.* one face) 

1. (b) Force on *l* length of the wire 2 is

*R*

*λ*1

*λ*2

*Q*

*l*



⇒ 

Also 

1. (b) 

*R*

*R*

*Q*2

*R*

*Q*1

*O*1

*O*2

where 

and 

⇒ 

So, 

1. (a) Let an electron is projected towards the plate from the *r* distance as shown in fig.

*r*

*E­*

*KE* = 200 *eV*

*σ* = 2 × 10–6 *C/m*2

–

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–

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*e*

It will not strike the plate if and only if *KE* ≤ *e*(*E*⋅*r*) (where *E* = Electric field due to charge plate )

⇒ . Hence minimum value of *r* is given by



1. (b) ; where *n* = number of moles × 6.02 × 1023 × 10

⇒ 

1. (d) ****

****

At origin *x* = *y* = *z* = 0 so,and

⇒ .

Hence force 

1. (b) Flux linked with the given sphere 

where *Q* = Charge enclosed by the sphere.

Hence *Q* = *φε*­o = (*EA*)*ε*o

⇒ *Q* = 4*π* (*γ*o)2 × *Aγ*o*ε*o = 4*πε*o*Aγ*o3.

1. (a) From figure *dl* = *R dθ*;

Charge on *dl* = *λR dθ* 

Electric field at centre due to *dl* is .

*θ*

*dl*

*dl′*

*+*

*dθ*

*+*

*+*

*+*

*+*

*+*

*+*

*+*

*+*

*+*

*+*

*dE*

*dE* cos *θ*

*θ*

*R*

We need to consider only the component  as the component *dE* sin*θ* will cancel out because of the field at *C* due to the symmetrical element *dl*′.

Total field at centre 



**Alternate method** : As we know that electric field due to a finite length charged wire on it's perpendicular bisector is given by 

If it is bent in the form of a semicircle then *θ* = 90°

⇒ 

*λ*

*θ*

*θ*

*E*

= 

= 

1. (a)

*θ*

*x*

*T* sin*θ*

*T*

*θ*

*Fe*

*mg*

*T* cos*θ*

In equilibrium *Fe* = *T* sin*θ* ....... (i)

*mg* = *T* cos*θ* ....... (ii)

 also 

Hence 

⇒  ⇒ 

1. (c) 



 



*E* = 48 × 104 – 12 × 104 = 36 × 104 *N/C*

**

*QE*

*mg*

*–*

*+*

1. (c)

Net downward force 

⇒ Effect acceleration 

Hence time period 

*b*

*θ*

*θ*

*a*

*F*3cos *θ*

*F*3

*F*2

*+q*2

*– q*3

*F*3sin *θ*

*– q*1

1. (c)

*F*2 = Force applied by  on 

*F*3 = Force applied by  on –

*x-*component of Net force on  is

*F­x* = *F*2 + *F*3 sin*θ* 

⇒ 

⇒ ⇒ 

1. (c) The given circuit can be redrawn as follows. All capacitors are identical and each having capacitance 

*V*

*–*

*+*

5

4

3

4

3

2

1

2

|Charge on each capacitor| = |Charge on each plate|



Plate 1 is connected with positive terminal of battery so charge on it will be 

Plate 4 comes twice and it is connected with negative terminal of battery, so charge on plate 4 will be 

1. (b) Suppose *C* = 8 *μF* , *C*' = 16*μF*

*C,* *V*

*C,* *V*

*C,* *V*

*V*'

1

2

*m*

1

2

*n*

and *V* = 250 *V*, *V'* = 1000*V*

Suppose *m* rows of given capacitors are connected in parallel and each row contains *n* capacitors then potential difference across each capacitor  and equivalent capacitance of network  on putting the values we get *n* = 4 and *m* = 8

∴ Total capacitors = *n* × *m* = 4 × 8 = 32

**Short Trick :** For such type of problems number of capacitors = 

1. (b) This combination forms a G.P. 

Sum of infinite G.P. 

Here *a* = first term = 1 and *r* = common ratio 

⇒ ⇒ 

1. (a)  

Now condenser of capacity *C* is filled with dielectric *K*, therefore *C*2 = *KC*

As charge is conserved

∴  ⇒ 

1. (c) 

∴ 

*A*

*C*

100 *V*

1*μF*

6*μF*

2*μF*

*B*

Charge in  branch 

 and 

1. (c) Initially potential difference across both the capacitor is same hence energy of the system is

 ……(i)

In the second case when key *K* is opened and dielectric medium is filled between the plates, capacitance of both the capacitors becomes 3*C*, while potential difference across *A* is *V* and potential difference across *B* is  hence energy of the system now is

 ……(ii)

So, 

1. (c) Total charge 

∴ Common potential 

∴ Energy 

1. (b) Charge on capacitor *A* is given by 

Charge on capacitor *B* is given by 

Capacity of capacitor A after removing dielectric 

Now when both capacitors are connected in parallel their equivalent capacitance will be *Ceq* 

So common potential 

1. (d) The given circuit can be redrawn as follows

*a*

*b*

*C*

*C*

*C*

⇒ 

1. (c) The given circuit can be redrawn as follows

*A*

*C*

5*μF*

15*μF*

*B*

2000*V*

 ⇒ 

⇒  ⇒ 

1. (a) If the value of *C* is chosen as 4*μF*, the equivalent capacity across every part of the section will be 4*μF*.
2. (c) Plane conducting surfaces facing each other must have equal and opposite charge densities. Here as the plate areas are equal, .

The charge on a capacitor means the charge on the inner surface of the positive plate (here it is )

Potential difference between the plates 

1. (d) Charges on capacitors are  and  or 

The situation is situation is similar as the two capacitors in series are first charged with a battery of emf 50 *V* and then disconnected

2*pF*

*Q*

*Q*

2*pF*

50 *V*

+

–

+

–

+

–

+

–

+

–

*Q* = 60 *pC*

*Q* = 60 *pC*

*V*1 = 30 *V*

*V*2 = 30 *V*

⇒

∴ when *S*3 is closed  and 

1. (a) The  charges appearing on the inner surfaces of *A*, are bound charges. As *B* is uncharged initially, as it is isolated, the charges on *A* will not be affected on closing the switch *S*. No charge will flow in to *B*.
2. (c) As *Q* = *CV*, (*Q*1)max=10–6 × 6 × 103 = 6*mC*

While (*Q*2)max= 3 × 10–6 × 4 × 103 = 12*mC*

However in series charge is same so maximum charge on *C*2 will also be 6 *mC* (and not 12 *mC*) and potential difference across it *V*2 = 6*mC*/3 *μF* = 2*KV* and as in series *V* =*V*1 + *V*2 so *V*max= 6*KV* + 2*KV* = 8*KV*