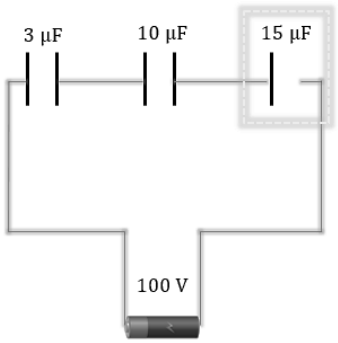
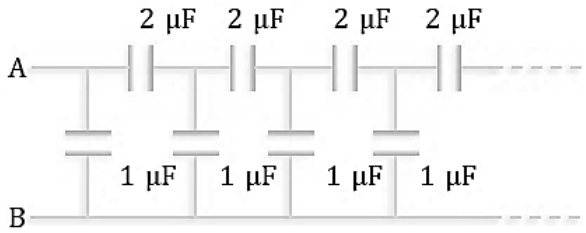
Q.1 Three capacitors of capacitance 3 μF, 10 μF and 15 μF are connected in series to a battery of 100 V. The charge on 15 μF is

(A) 50 μC **(B)** 100 μC **(C)** 200 μC **(D)** 280 μC



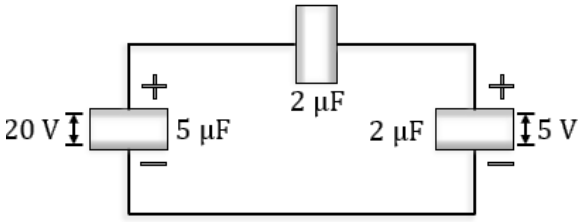
Q.2 The equivalent capacitance of the infinite ladder shown in the figure between points A&B will be

(A) 2 μF **(B)** 1 μF **(C)** 4 μF **(D)** $\frac{1}{2}$ μF



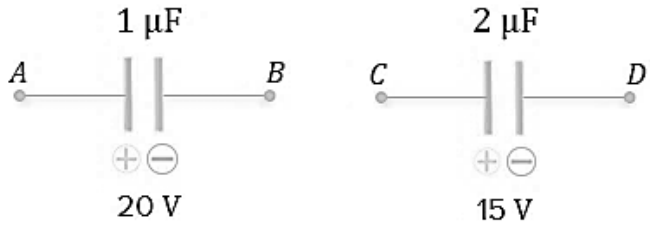
Q.3 An uncharged capacitor with capacitance 2 μF is connected to two charged capacitors as shown in figure. After connecting them, final charge appearing on the initially uncharged capacitor will be:

(A) $\frac{135}{6}$ μC **(B)** $\frac{40}{3}$ μC **(C)** $\frac{25}{2}$ μC **(D)** $\frac{125}{3}$ μC



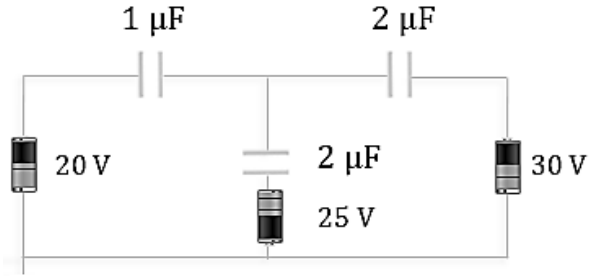
Q.4 Two capacitors of capacitance 1 μF and 2 μF are charged to potential difference 20 V and 15 V as shown in figure. If now terminal B and C are connected together while terminal A is connected with positive terminal of battery and terminal D of capacitor connected with negative terminal of battery with an emf 30 V.The final charges on 1 μF and 2 μF capacitors respectively will be;

(A) $\frac{20}{3}$ μC, $\frac{80}{3}$ μC **(B)** $\frac{50}{3}$ μC, $\frac{80}{3}$ μC **(C)** $\frac{120}{7}$ μC, $\frac{80}{7}$ μC **(D)** $\frac{50}{6}$ μC, $\frac{40}{3}$ μC



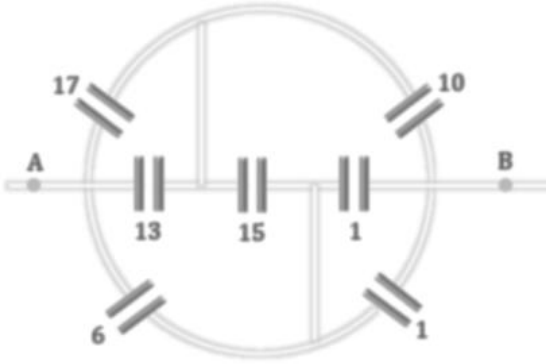
Q.5 In the given circuit, the charge on 2 μF capacitor (connected to −ve terminal of 25 V battery) will be (Initially, all capacitors are uncharged)

(A)58 μC **(B)**60 μC **(C)**48 μC **(D)**16 μC



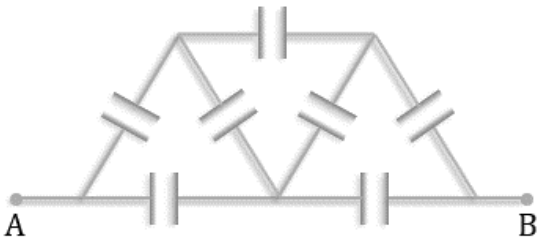
Q.6 Find equivalent capacitance across **AB** (all capacitances are in μF).

(A)$\frac{20}{3}$ μF **(B)**9 μF **(C)** 48 μF **(D)**36 μF



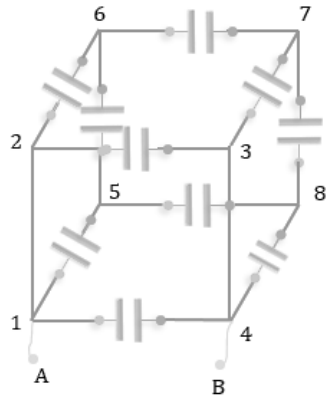
Q.7 What is the equivalent capacitance between $A$and$B$, if each capacitor is of 24 μF ?

(A)14 μF **(B)**21 μF **(C)** 28 μF **(D)**35 μF



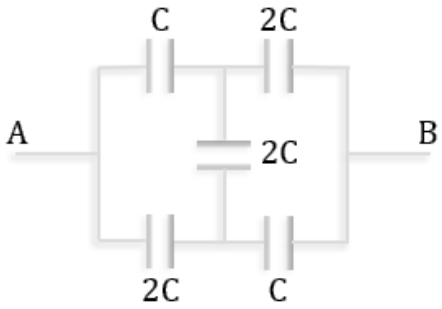
Q.8 Twelve capacitors each of capacitance C are connected together so that each lies along the edge of the cube as shown in figure. The equivalent capacitance between 1 and 4 will be:

(A)$\frac{5C}{7}$ **(B)**$\frac{4C}{3}$ **(C)** $\frac{12C}{7}$ **(D)**$\frac{7C}{4}$



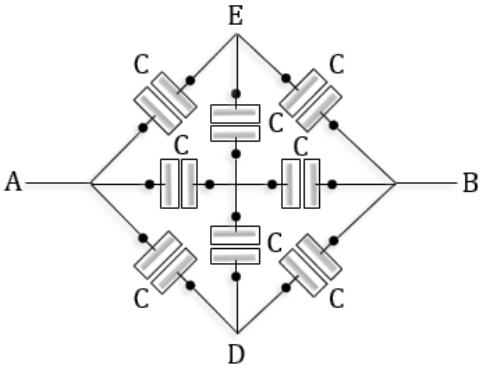
Q.9 Find the equivalent capacitance between AandB.

(A) $\frac{2C}{7}$ **(B)** $\frac{5C}{7}$ **(C)** $\frac{10C}{7}$ **(D)** $\frac{4C}{7}$



Q.10 Find the equivalent capacitance between AandB.

(A) $\frac{C}{2}$ **(B)** $\frac{3C}{2}$ **(C)** 2C **(D)** $\frac{5C}{2}$

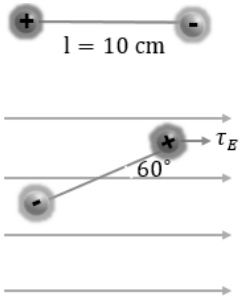


WORKSHEET

Dipole

Q.1 An electric dipole of length 10 cm having charges 6×10^{-3} C is placed at 60° with respect to a uniform electric field. If it experiences a torque of$3\sqrt{3}$ N − m, then the magnitude of the electric field is

(A)1×10^4 N/C **(B)**2×10^4 N/C **(C)** $\times 10^4$ N/C **(D)**4×10^4 N/C



Dipole

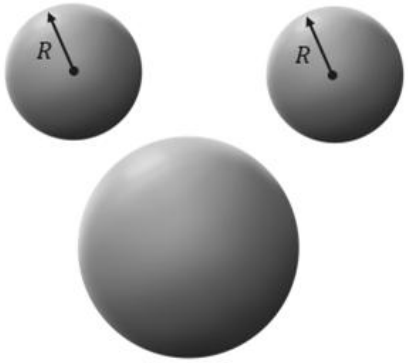
Q.2 An electric dipole is placed at a distance x from center O on the axis of a charged ring of radius R and charge Q uniformly distributed over it. What is the work done in rotating the dipole through180°?

(A)$\frac{aqQx}{2\pi\varepsilon_0(R^2+x^2)^{\frac{3}{2}}}$ **(B)**$\frac{aqQx}{\pi\varepsilon_0(R^2+x^2)^{\frac{3}{2}}}$ **(C)** $aqQx(R^2+x^2)$ **(D)**zero

Surface Energy

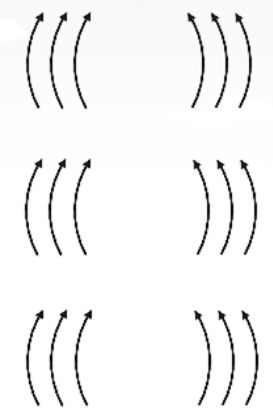
Q.3 Two drops of equal radius coalesce to form a bigger drop. What is the ratio of surface energy of the bigger drop to the smaller drop?

(A)$2^{1/3}:1$ **(B)**1: 1 **(C)** $2^{2/3}:1$ **(D)**1: 2



Q.4 A 50 kg skydiver falls through the air and attains terminal velocity after some time. The drag force is a function of velocity given as $F_{drag} = -bv^2$ where the negative sign denotes that the drag force is opposite to the direction of velocity. What is the terminal velocity of the skydiver (assuming the drag constant bis0.2 kg/m)?

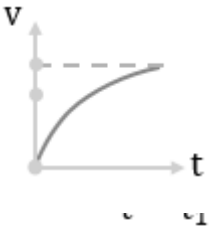
(A)5 m/s **(B)**50 m/s **(C)**100 m/s **(D)**100 m/s



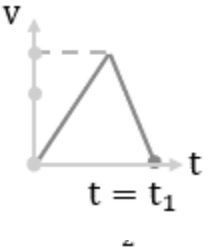
Newton's Laws of Motion

Q.5 A ball of mass m falls from rest under gravity in a resisting medium (Exerting drag during motion). The resistance force is given by f = kv, which can be considered as a friction force offered by the resisting medium. The correct velocity (v) versus time (t) graph for body is:

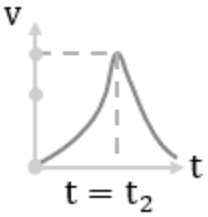
(A) $\frac{mg}{k}$



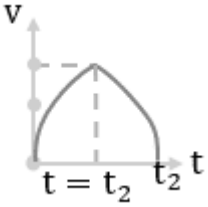
(B) $\frac{mg}{k}$

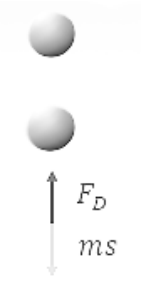


(C) $\frac{mg}{k}$



(D) $\frac{mg}{k}$

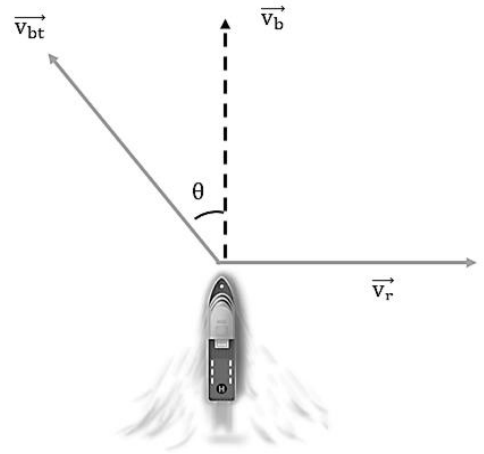




Relative Velocity

Q.6 A man wants to cross the river to an exactly opposite point on the other bank. If he can row his boat with $\frac{2}{\sqrt{3}}$ times the velocity of the current, then at what angle to the current he must keep the boat pointed?

(A) 60° **(B)** 90° **(C)** 120° **(D)** 150°

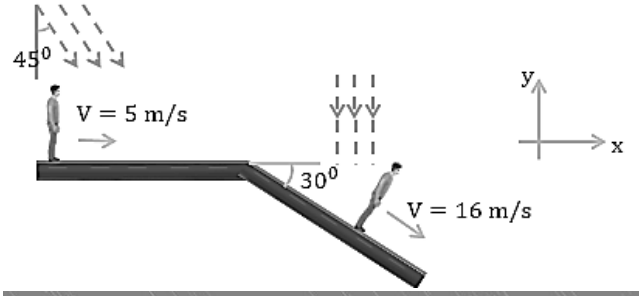


Relative Velocity

Q.7 A man moving with a velocity of 5 m/s on a horizontal road observes that raindrops fall at an angle of 45° with the vertical. When he moves with a velocity of 16 m/s along an inclined plane, which is inclined at 30° with the horizontal, he observes raindrops falling vertically downward as shown in the figure. Find the actual velocity $\vec{V}_r$ of the raindrops.

(A) $\overrightarrow{V_r} = 8\sqrt{3}\hat{i} - (8\sqrt{3} - 5)\hat{j}$ **(B)** $\overrightarrow{V_r} = 4\sqrt{3}\hat{i} - (4\sqrt{3} - 5)\hat{j}$

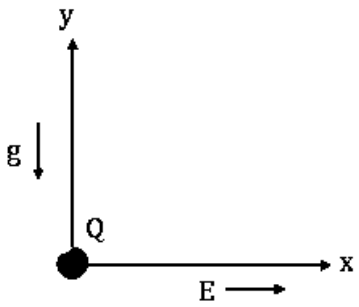
(C) $\overrightarrow{V_r} = 2\sqrt{3}\hat{i} - (2\sqrt{3} - 5)\hat{j}$ **(D)** $\overrightarrow{V_r} = \sqrt{3}\hat{i} - (\sqrt{3} - 5)\hat{j}$



Trajectory Motion under Gravitational and Electric Field

Q.8 A region consists of a uniform electric field E and a uniform gravitational field g as shown in figure. A particle of charge Q and mass m begins to move in this region. Deduce an equation for its trajectory.

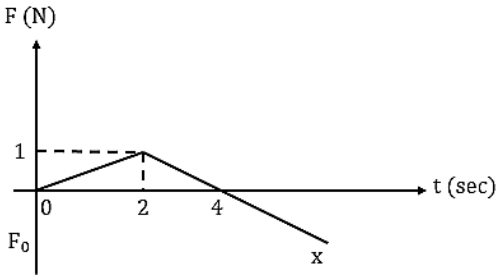
(A) $y = mgx^2$ **(B)** $y^2 = \frac{mg}{Q}x$ **(C)** $y = -\frac{mg}{QE}x$ **(D)** $y = \frac{2mg}{QE}x$



Newton's Laws of Motion

Q.9 Force acting on a body varies with time as shown in the graph given below. If initial momentum of the body is $\vec{P}$, then the time taken by the body to retain its momentum $\vec{P}$ again is:

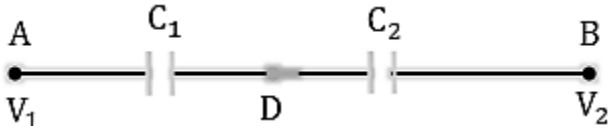
(A) 8 s **(B)** $(4+2\sqrt{2})$ s **(C)** 6 s **(D)** can never obtain



Parallel and Series Combination of Capacitors

Q.10 Two capacitors C_2 and C_2 are joined in a circuit as shown in figure. The potential at point A is V_1 and that at B is V_2. Then the potential of point D will be:

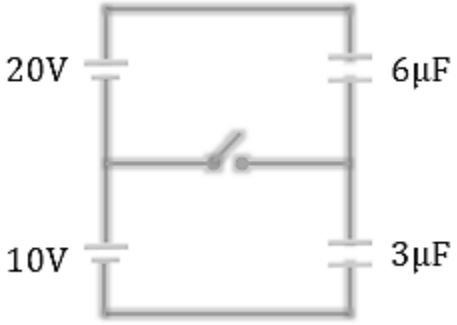
(A) $\frac{1}{2}(V_1+V_2)$ **(B)** $\frac{C_1V_2+C_2V_1}{C_1+C_2}$ **(C)** $\frac{C_1V_1+C_2V_2}{C_1+C_2}$ **(D)** $\frac{C_2V_1-C_1V_2}{C_1+C_2}$



Heat Generated in the Circuit

Q.11 Initially, the switch *S* is open in the circuit for a long time. After the switch is closed, the heat generated in the circuit will be:

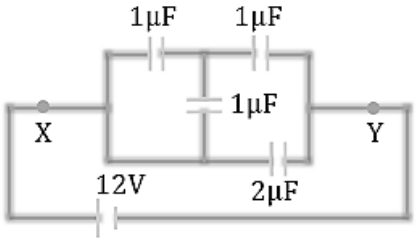
(A) 600 μJ **(B)** 750 μJ **(C)** 350 μ **(D)** 450 μ



Parallel and Series Combination of Capacitors

Q.12 In the circuit shown in the figure, a 12 volt battery has been connected across the points X and Y. The work done by battery will be:

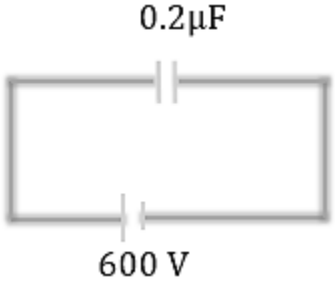
(A) 180 μJ **(B)** 384 μJ **(C)** 424 μJ **(D)** 212 μJ



Parallel and Series Combination of Capacitors

Q.13 A capacitor 0.2 μF is charged to 600 V. after removing the battery, it is connected to 1 μF capacitor in parallel. The voltage across 1 μF will become:

(A) 300 V **(B)** 600 V **(C)** 100 V **(D)** 120 V



Work Done by the Battery in Charging

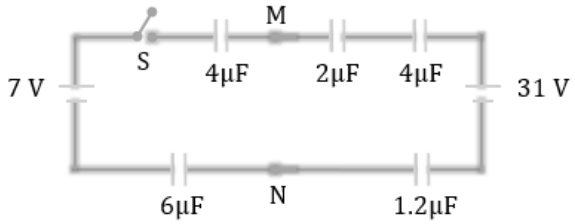
Q.14 Three capacitors having capacitance 20 μF, 30 μF and 40 μF are connected in series with a 12 V battery. The amount of work done by the battery in charging the combination will be:

(A) 1.5×10^{-3} J **(B)** 2.25×10^{-3} J **(C)** 1.33×10^{-3} J **(D)** $\times 10^{-3}$ J

Potential Difference between Points

Q.15 Five capacitors are connected as shown in the figure. Initially, all capacitors are uncharged and S is open. When S is closed, then the potential difference between points M and Nis:
[Assume steady state to be achieved after S closed]

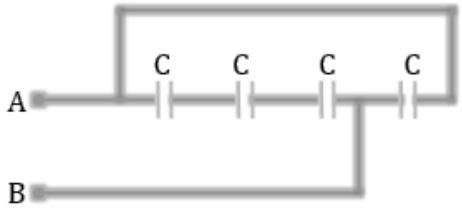
(A) 14 V **(B)** 12 V **(C)** 10 V **(D)** 15 V



Parallel and Series Combination of Capacitors

Q.16 The effective capacitance between A and B is

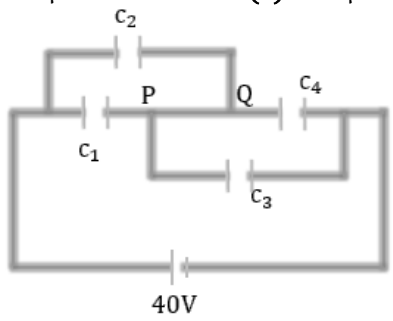
(A) $\frac{C}{4}$ **(B)** $\frac{3C}{4}$ **(C)** $\frac{C}{3}$ **(D)** $\frac{4C}{3}$



Parallel and Series Combination of Capacitors

Q.17 The figure shows a circuit where $C_1 = C_2 = C_3 = C_4 = 4\ \mu F$. What is the extra charge flown through the battery when a 12 μF capacitor is introduced between PandQ?

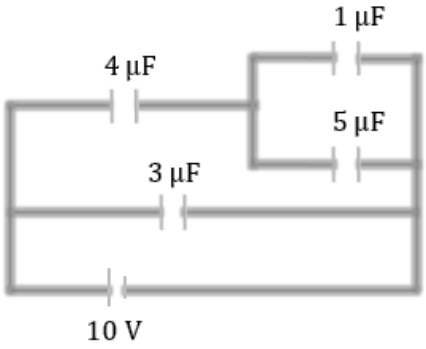
(A)0 **(B)**100 μC **(C)** 200 μC **(D)**80 μC



Parallel and Series Combination of Capacitors

Q.18 The charge on the 4 μF capacitor in the given circuit is ___ (inμC).

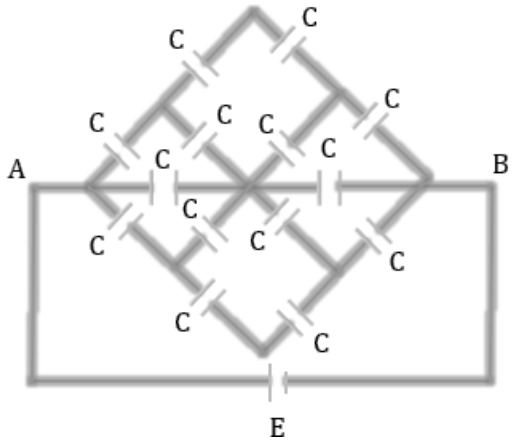
(A)12 **(B)**24 **(C)** 36 **(D)**32



Parallel and Series Combination of Capacitors

Q.19 Find the equivalent capacitance of a given circuit between points A andB ? (Take $C = 12\ \mu F$)

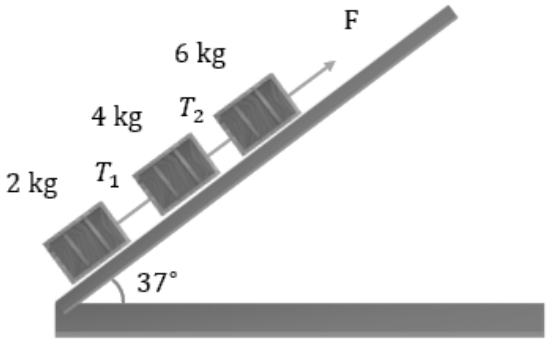
(A)7 μF **(B)**14 μF **(C)** 21 μF **(D)**12 μF



Newton's Laws of Motion

Q.20 Three blocks of masses2 kg, 4 kg and 6 kg arranged as shown in figure connected by string on a frictionless incline of37°. A force of 120 N is applied upward along the incline to the uppermost block. The cords are light. The tensions T_1 and T_2 in the strings are $\left(g = 10\ m/s^2,\ \sin 37° = \frac{3}{5}\right)$

(A) $T_1 = 8$ N **(B)** $T_2 = 36$ N **(C)** $T_1 = 20$ N **(D)** $T_2 = 60$ N



ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(C)	(A)	(C)	(C)	(A)	(B)	(B)	(C)	(C)	(B)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(B)	(C)	(B)	(A)	(D)	(A)	(C)	(B)	(C)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(D)	(B)	(C)	(C)	(B)	(D)	(A)	(B)	(B)	(C,D)