PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

MAGNETIC EFFECTS OF CURRENT

Type A

1. A wire placed along the north-south direction carries a current of 8A from south to

north. Find the magnetic field due to a 1cm piece of wire at a point 200 cm north-east from the piece.

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2. A horizontal overhead power lines carries a current of 90 A in east to west direction. What is the magnitude and direction of the magnetic field due to the current $1 \cdot 5m$ below the line?

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3. A long straight wire in the horizontal plane carries a current of 50A in north to south direction. Give the magnitude and direction of $\vec{B}$ at a point $2 \cdot 5m$ east of the wire.

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4. A current of $10A$ is flowing east to west in a long wire kept in the east-west direction. Find magnetic field in a horizontal plane at a distance of (i) $10cm$. North (ii) $20cm$ south

from the wire, and in a vertical plane at a distance of (iii) $40cm$ downwards, (iv) $50cm$ upwards.

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5. Figure shows two long, straight wires carrying electric currents in opposite directions. The separation between the wires is 5.0 cm. Find the magnetic field at a point P midway between the wires.

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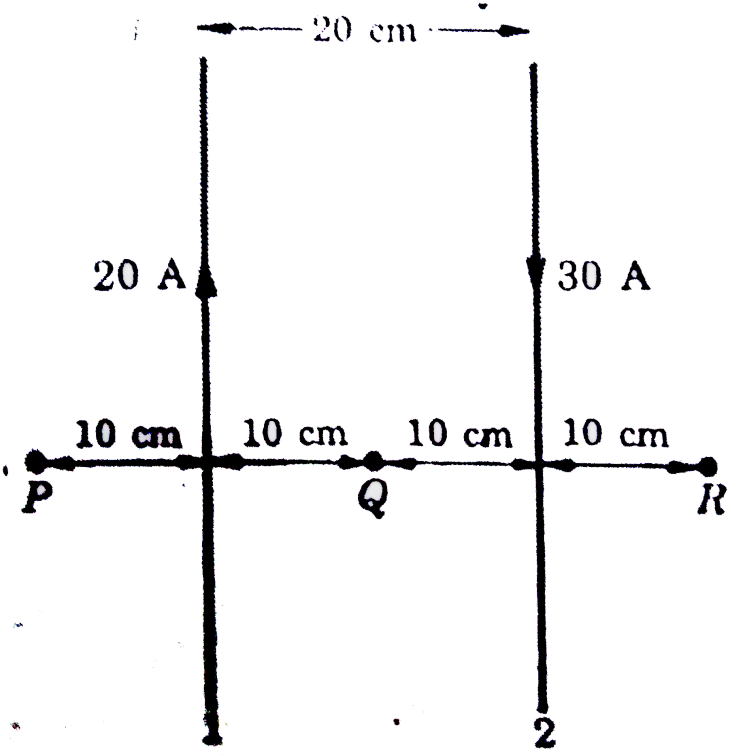
6. Fig shows two current-carrying wires 1 and 2. Find the magnitudes and directions of the magnetic field at points P,Q and R.



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7. A long, straight wire carrying a current of 30 A is placed in an external, uniform magnetic field of 4.0×10^{-4} T exists from south to north.Find at a point 2.0 away from the wire.

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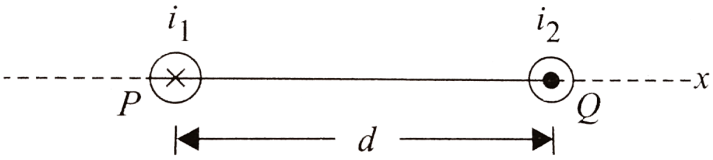
8. Two parallel wires P and Q placed at a separation d =6 cm on x-axis carry electric current $i_1 = 5A$ and $i_2 = 2A$ in opposite

directions as shown in Fig. Find the point on the line PQ where the resultant mgnetic field is zero.



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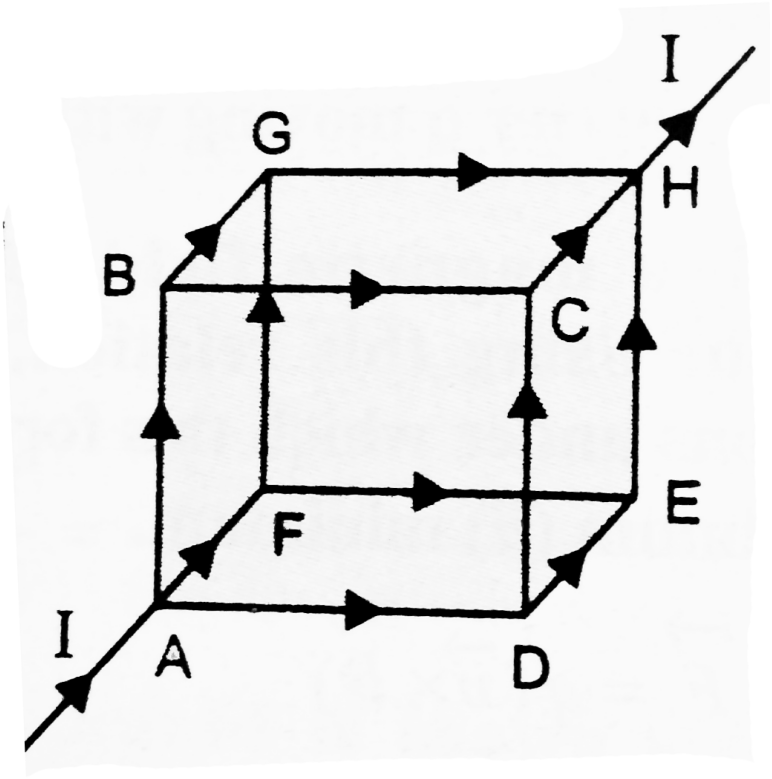
9. Figure shows a cube made from twelve uniform wires. Find the magnetic field at the centre of the cube, if a battery is connected

between the points A and H.



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10. A circular coil of wire consisting of 100 turns, each of radius $8 \cdot 0cm$ carries a current of $0 \cdot 40A$.

What is the magnetude of the magnetic field $\overrightarrow{B}$ at the centre of the coil?

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11. The plane of a circular coil is horizontal. It has 10 turns each of radius 8cm. A current of 2 A flows through it. The current appears to flow

clockwise from a point above the coil. Find the magnitude and direction of magnetic field at the centre of the coil due to the current.

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12. In Bohr model of hydrogen atom , the electron revolves around the nucleus in a circular orbit of radius $5.1 \times 10^{-11} m$ at a frequency of 6.8×10^{15} revolutions per second. Find the equivalent current at may point on the orbit of the electron

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13. Thee lectron in the hydrogen atom circles around the proton with a speed of $2.18 \times 10^6 ms^{-1}$ in an orbit of radius $5.3 \times 10^{-11} m$. What magnetic field does it produce at the proton ?

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14. An alpha particle is completing one circular round of radius $0 \cdot 8m$ in 2 seconds. Find the

magnetic field at the centre of the circle. Electronic charge $= 1 \cdot 6 \times 10^{19} C$.

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15. A circular coil of 100 turns has a radius of 10 cm and carries a current of 5A. Calculate the magnetic field (a) at the centre of the coil (b) at a point on the axis of the coil at a distanceof 5cm from the centre of the coil.

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16. The magnetic field B due to a current-carrying circular loop of radius 12cm at its center is $0.50 \times \left(10^{-4}\right)T$. Find the magnetic field due to this loop at a point on the axis at a distance of 5.0 cm from the centre.

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17. Two identical circular coils of radius 0.1m, each having 20 turns are mounted co-axially 0.1m apart. A current of 0.5A is passed through both of them (i) in the same direction, (ii) in

the opposite directions. Find the magnetic field at the centre of each coil.

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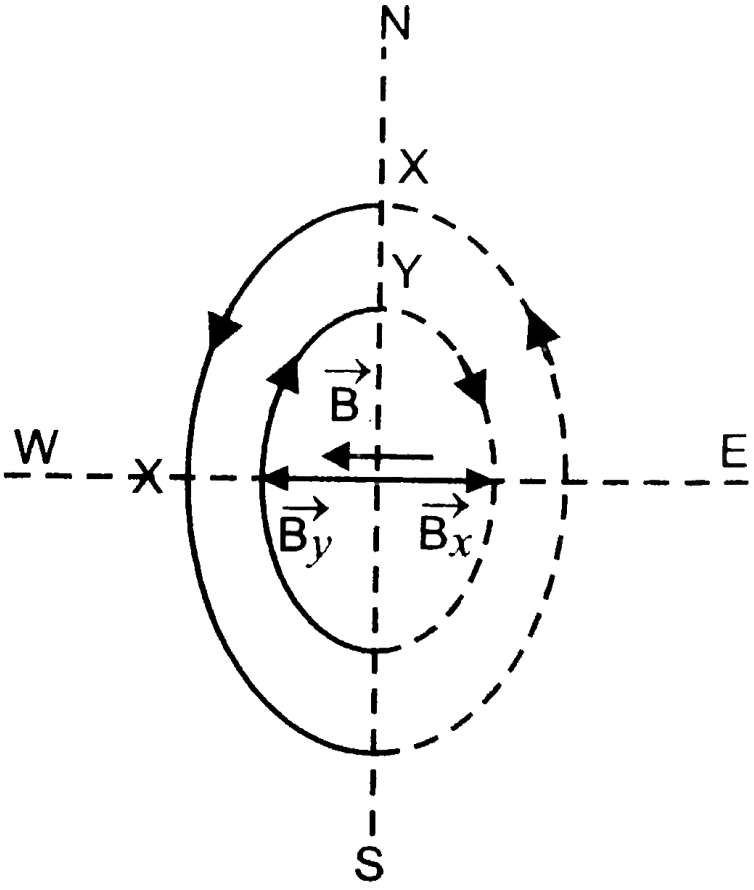
18. Two concentric coil X and Y of radii $16cm$ and $10cm$ respectively lie in the same vertical plane containing the north-south direction. Coil X has 20 turns and carries a current of 16A, coil Y has 25 turns and carries a current of 18A. The sense of current in X is anti-clockwise and in Y, clockwise, for an observer looking at

the coil facing west, Figure. Give the magnitude and direction of the net magnetic field due to the coils at their centre.



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19. A thick straight copper wire, carrying a current of 10 A is bent into a semicircular arc of radius 7.0 cm as a shown in Fig (a). (i) State the direction and calculate the magnitude of magnetic field at the centre of arc. (ii) How would your answer change if the same wire were bent into a semicircular arc of the same radius but in opposite way as shown in Fig. (b)?

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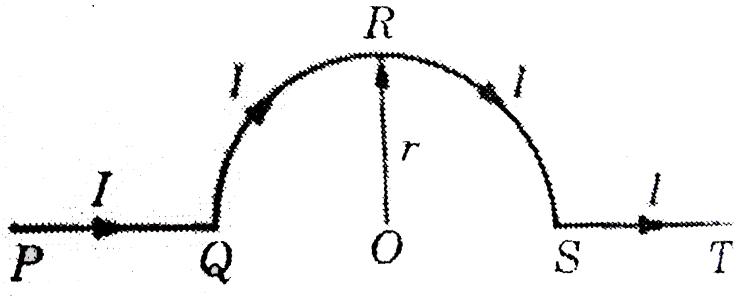
20. A long wire having a semi-circular loop of radius r carries a current I, as shown in Fig. Find the magnetic field due to entire wire.



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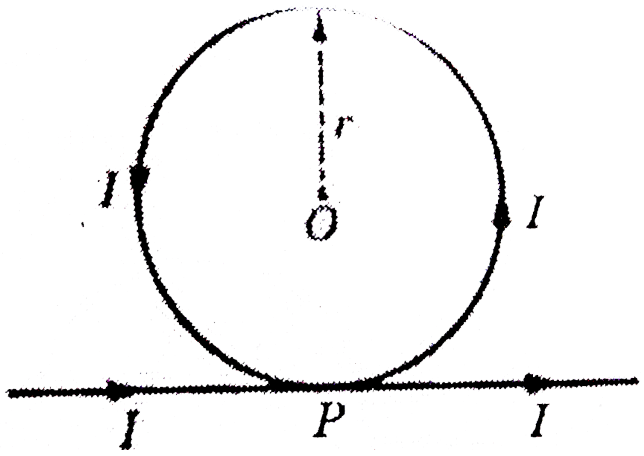
21. A long wire is bent as shown in Fig. what will be the magnitude and direction of the field at the centre O of the circular portion, if a current I is passed through the wire ? Assume that the various portions of the wire do not touch at point P.



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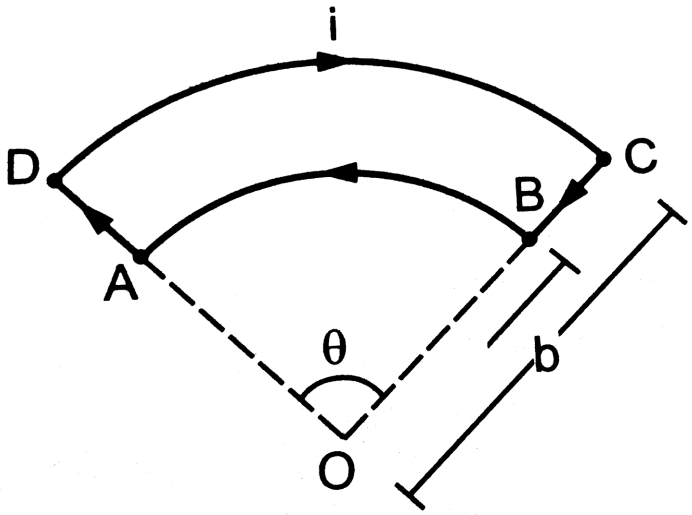
22. Figure shows a current loop having two circular arcs joined by two radial lines. Find the magnetic field B at the centre O.



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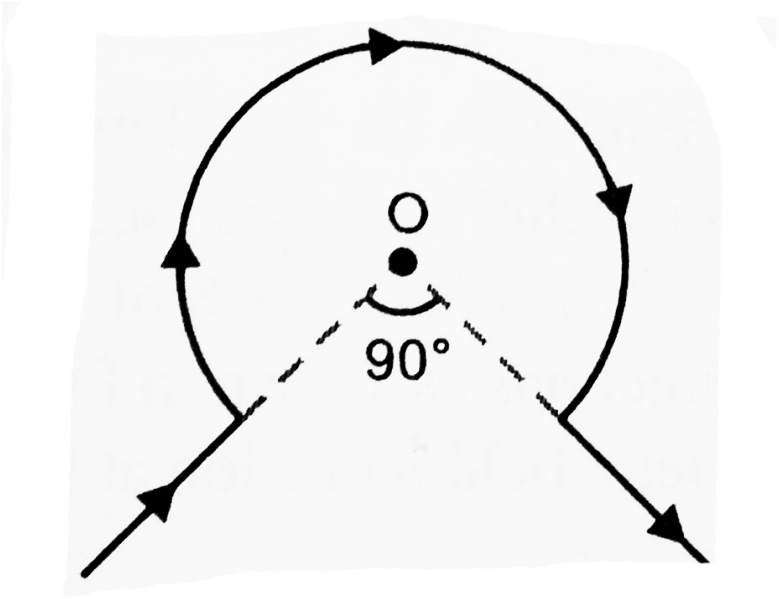
23. The wire shown in the figure, carries a current of $60A$. Determine the magnitude of the magnetic field induction at O. Given radius of the bent coil is $2cm$.



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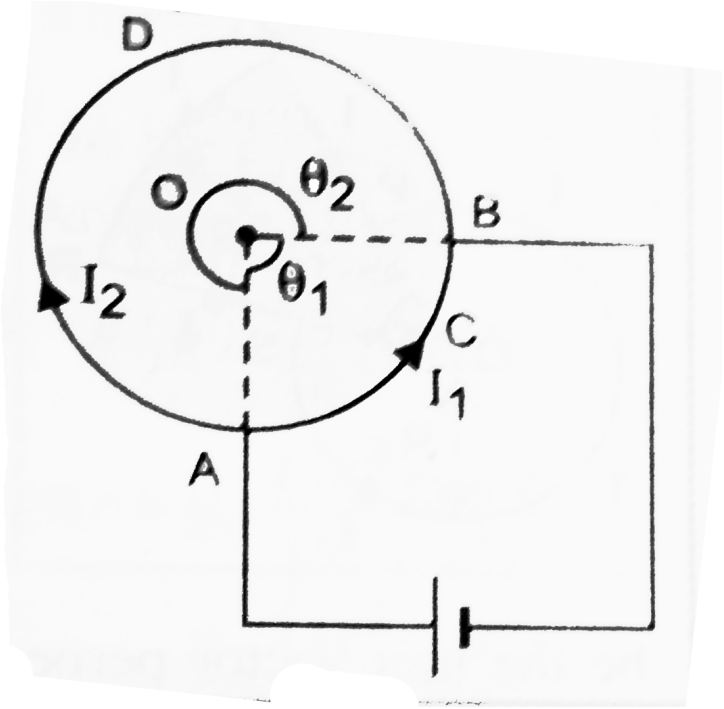
24. As shown in figure a cell is connected across two points A and B of a uniform circular conductor of radius r. Prove that the magnetic field induction at its centre O will be zero.



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25. Two wires A and B have the same length equal to $44cm$. and carry a current of $10A$ each. Wire A is bent into a circle and wire B is bent into a square. (a) Obtain the magnitudes of the fields at the centres of the two wires. (b) Which wire produces a greater magnetic field at the centre?

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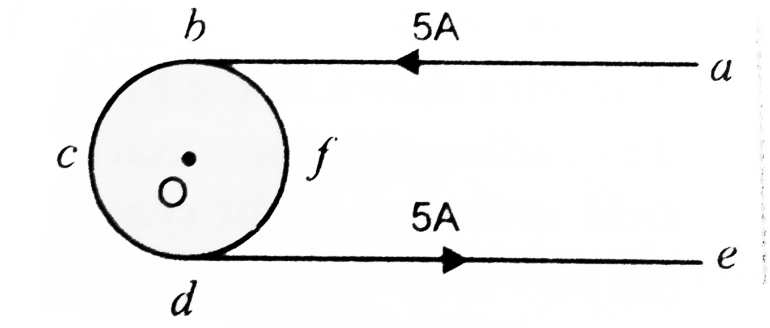
26. In figure bcdf is a circular coil of non-insulated thin uniform conductors, ab and de are very long straight parallel conductors, ab and de are very long straight parallel conductors, tangential to the coil at the points b and d. If the current $5A$ enters the coil from a to b, find the magnetic field induction at O, the centre of the coil. The diameter of the coil is $10cm$.



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27. The current-loop PQRSTP formed by two circular segments of radii R_1 and R_2 carries a current of I ampers. Find the magnetic field at the common centre O. what will be the field if angle $\alpha = 90^\circ$?

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Type B

1. A long solenoid is formed by winding 20 turns cm^{-1}. What current is necessary to produce a magnetic field of 20 mT inside the solenoid?

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2. A long solenoid is fabricated by closely winding a wire of radius 0.5 mm over a cylindrical nonmagnetic frame so that the successive turns nearly touch each other. What would be the magnetic field B at the

centre of the solenoid if it carries a current of 5 A?

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3. A copper wire having resistance 0.01 ohm in each metre is used to wind a 400 turn solenoid of radius 1.0 cm and length 20 cm. Find the emf of a battery which when connected across the solenoid will cause a magnetic field of $\left(1.0 \times 10^{-2}\right)$ T near the centre of the solenoid.

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4. A closely wound solenoid $80cm$ long has layers of windings of $400turns$ each. The diameter of the solenoid is $1 \cdot 8cm$. If the current carried is $8 \cdot 0A$ estimate the magnitude of $\overrightarrow{B}$ inside the solenoid near its centre.

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5. A solenoid $50cm$ long has 4 layers of windings of 350 turns each. The radius of the lowest layer is $1 \cdot 4cm$. If the current carried is $6 \cdot 0A$, estimate the magnitude of magnetic flux density (i) near the centre of the solenoid on its axis, (ii) near the ends on its axis, (iii) outside the solenoid near its centre.

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6. A toroid has a core (non ferromagnetic material) of inner radius $25cm$ and outer radius $26cm$ around which 3500 turns of wire are wound. If the current in the wire is $11A$, what is the magnetic field (a) outside the toroid (b) inside the core of the toroid (c) in the empty space surrounded by the toroid?

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Type C

1. An α-particle of mass $6.65 \times 10^{-27} kg$ is travelling at right angles to a magnetic field with a speed of $6 \times 10^{5} ms^{-1}$. The strength of the magnetic field is $0.2T$. Calculate the force on the α-particle and its acceleration.

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2. An alpha particle is projected vertically upward a speed of $3.0X10^{4} kms^{-1}$ in a region where a magnetic field of magnitude 1.0 T

exists in the direction south to north. Find the magnetic force that acts on the a particle.

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3. An electron is moving northwards with a velocity $3 \cdot 0 \times 10^{7} ms^{-1}$ in a uniform magnetic field of $10T$ directed eastwards. Find the magnitude and direction of the magnetic force on the electron. $\left(e = 1 \cdot 6 \times 10^{-19} C\right)$

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4. A charge of$2.0\mu C$ moves with a speed of $2.0X10^{6}ms^{-1}$ along the positive x-axis. A magnetic field $\vec{B}$ of strength $\left(0.20\vec{J}+0.40\vec{k}\right)T$ exists in space. Find the magnetic force acting on the charge

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