

Unit 11 - Week 10

Course outline

How does an NPTEL online course work?

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Week 10

Straight line current: Curl of the magnetic field

Divergence and curl of a generic magnetic field

Ampere's law in integral form and its applications

Magnetic field in a long solenoid

A comparison between electrostatics and magnetostatics

Magnetic vector potential

Tutorial on magnetic fields

Quiz : Assignment 10

Week 10 Feedback : Electromagnetism

Week 11

Week 12

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Lecture materials

Assignment 10

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-04-08, 23:59 IST.

Solenoid

Two long coaxial solenoids each carry current I , but in opposite directions. The inner solenoid (radius a) has n_1 turns per unit length, and the outer one (radius b) has n_2

1) Find B inside the inner solenoid

3 points

$$B = \mu_0 I (n_2 - n_1) \hat{z}$$

$$B = \mu_0 I n_1$$

$$B = \mu_0 I n_2 n_1$$

$$B = I (n_2 - n_1)$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $B = \mu_0 I (n_2 - n_1) \hat{z}$

2) Find B between the two coaxial solenoid

3 points

$$B = I n_2$$

$$B = \mu_0 I n_2$$

$$B = -\mu_0 I n_2^2$$

$$B = -\mu_0 I (n_2 - n_1)$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $B = \mu_0 I n_2$

3) Find B between outside the solenoid

3 points

$$B = 0$$

$$B = \mu_0 I n_1$$

$$B = -\mu_0 I n_2$$

$$B = -\mu_0 I (n_2 - n_1)$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $B = 0$

Capacitor

A large parallel-plate capacitor with uniform surface charge σ on the upper plate and $-\sigma$ on the lower is moving with a constant speed v .

4) Find the magnetic field between the plates and also above and below them.

4 points

$$B = \mu_0 \sigma v$$

in between the plates and $B = 0$ elsewhere.

$$B = 0 \text{ in between the plates and } B = \mu_0 \sigma v \text{ elsewhere}$$

$$B = \sigma v$$

in between the plates and $B = 0$ elsewhere

$$B = \mu_0 \sigma v^2$$

in between the plates and $B = \mu_0 v$ elsewhere

No, the answer is incorrect. Score: 0

Accepted Answers:
 $B = \mu_0 \sigma v$

in between the plates and $B = 0$ elsewhere.

5) Find the magnetic force per unit area on the upper plate, including its direction.

5 points

$$f_m = \mu_0 \sigma^2 v^2 / 2, \downarrow$$

$$f_m = \mu_0 \sigma^2 v^2, \uparrow$$

$$f_m = \mu_0 \sigma v^2 / 2, \downarrow$$

$$f_m = \mu_0 \sigma^2 v^2 / 2, \uparrow$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $f_m = \mu_0 \sigma^2 v^2 / 2, \uparrow$

6) Find the electric force per unit area on the upper plate, including its direction.

5 points

$$f_c = \epsilon_0 \sigma^2 v^2 / 2, \downarrow$$

$$f_c = \mu_0 \sigma^2 v^2, \uparrow$$

$$f_c = \sigma^2 / 2 \epsilon_0, \downarrow$$

$$f_c = \sigma^2 v^2 / 2 \epsilon_0, \downarrow$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $f_c = \sigma^2 / 2 \epsilon_0, \downarrow$

7) At what speed v would the magnetic force balance the electrical force?

5 points

$$v = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = c$$

$$v = \frac{1}{2\sqrt{\epsilon_0 \mu_0}} = c/2$$

$$v = \frac{1}{\sqrt{16\epsilon_0 \mu_0}} = c/4$$

$$v = \frac{1}{\sqrt{9\epsilon_0 \mu_0}} = c/3$$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $v = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = c$