**PHYSICS 2021 - 22 March 18, 2022**

**Today’s Agenda (Day 125)**

1. HOUSEKEEPING ITEMS

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1. HOMEWORK CHECK:

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1. CLASS ACTIVITY

🡪EXPLORATORY ACTIVITIES: Electromagnetism

1. **Magnetic Domains**
2. **Magnetic Fields**
3. **Investigate Electromagnetism**

HOMEWORK:

* READ: Chapter 26 – Electromagnetism
* STUDY: Chapter 25Test

<http://glencoe.mheducation.com/sites/0078807220/student_view0/self-check_quizzes.html>

Chapter 26 – Electromagnetism

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| --- | --- | --- | --- | --- |
| Isotope | Mass spectrometer | Electromagnetic wave | Electromagnetic spectrum | Electromagnetic radiation |
| Transmitter  | Antenna | Dielectric | Carrier wave  | piezoelectricity |
| Receiver |

REMINDERS:

* TEST: Chapter 25 🡪 March 17
* **QUIZ: Chapter 25 Vocabulary – March 22**
* TEST: Chapter 26 🡪 March 24

**PHYSICS 2021 - 22 Mini-Lab**

**MAGNETIC DOMAINS**

**Procedure**

**1.** Read the procedure and safety information and complete the lab form.

**2.** Magnetize **iron filings** in a **test tube** by stroking the tube with a **permanent magnet.**

**3.** Use a **compass** to demonstrate that the tube is magnetized.

**4.** Shake the tube and use the compass to demonstrate that the tube is no longer magnetized.

Analysis

**5.** Predict what would happen if the permanent magnet were turned in the other direction before stroking the test tube.

**3-D MAGNETIC FIELDS**

**Procedure**

**1.** Read the procedure and safety information and complete the lab form.

**2.** Tie a **string** to the middle of a **nail** so that the nail can hang horizontally. Put a small **piece of tape** around the string where it wraps around the nail so that the string will not slip.

**3.** Insert the nail into a **wire coil** and use a **1.5-V battery** to apply a potential difference across to the coil.

**4.** Disconnect the power and remove the nail from the coil. Now hold the string so the nail is suspended.

**5.** Predict how the nail will behave in the presence of a permanent magnet.

**6.** Test your prediction.

Analysis

**7.** Explain what evidence you have that the nail became magnetized.

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**8.** Make a 3-D drawing that shows the magnetic field around the magnet.

**DESIGN YOUR OWN: INVESTIGATE ELECTROMAGNETISM**

**Possible Materials**

bar magnets

 insulated copper wire

galvanometer, ammeter, or multimeter

scissors

paper towel tube or similar

iron filings

battery

small compasses

thin, stiff cardboard various support rods and clamps

**Background**

The relationship between electric and magnetic fields plays an important role in our everyday lives. Microphones, ear buds, electrical generators, and motors all rely on this relationship. In this activity, you will plan and conduct an investigation in order to investigate the presence of a magnetic field around a current carrying wire and to investigate the effects of a changing magnetic field on a wire loop.

**Problem**

Does a current in a wire generate a magnetic field? Can a changing magnetic field create a current?

**Objectives**

• **Plan and conduct** investigations to collect data about current and magnetic fields.

• **Collect and organize observations** from your investigation.

• **Infer** the causes of the magnetic field around the wire and of the current flowing due to the changing magnetic field.

**Plan Your Investigation**

1. Read the safety information and complete the lab form.

2. Using the list of possible materials, select the materials you will use for your investigation.

3. List any variables that might affect the current or magnetic field created.

4. Plan out your investigation and write a formal procedure. Remember that you will need to investigate both questions listed in the **Problem** section above. Be sure to consider safety hazards, both for equipment and for yourself in the investigation.

5. Obtain your teacher’s written consent for all aspects of your procedures and materials

**PHYSICS 2021 - 22 Review Questions**

**CH 26 PRACTICE PROBLEMS**

**Electromagnetism**

1. Electrons moving at a speed of 1.8×106 m/s travel undeflected through crossed electric and magnetic fields. If the strength of the electric field is 4.2×103 N/C, what is the strength of the magnetic field?

2. A beam of doubly ionized particles is accelerated by a 95-V potential difference and through a magnetic field of 0.090 T.

a. If the particles are nitrogen ions
(*m* = 2.3260×10−26 kg), what is the radius of the beam’s path?

**b.** If the beam’s path has a radius of
6.28 mm, what is the mass of the ion?

3. The charge-to-mass ratio of a particle is
4.81×107 C/kg. The particle moves at a velocity of 4.5×104 m/s through a field of 0.013 T.

a. What is the radius of the particle’s path?

**b.** How strong would the magnetic field have to be to give the particle’s path a radius of 30.0 mm?

4. A proton (*m* = 1.67×10−27 kg) enters a magnetic field of strength 0.021 T moving at 4.33×103 m/s. What is the radius of the proton’s path?

5. A beam of electrons follows a circular path with a radius of 18.01 mm in a magnetic field of strength 0.00900 T. What is the speed of the electrons?

6. A certain FM radio station broadcasts its signal at 102.7 MHz. What is the best length for an antenna designed specifically to receive signals from this radio station?

7. An ion in a mass spectrometer is accelerated through a voltage of 45 V. The ion has a mass of 6.634×10−26 kg. It passes through a magnetic field of strength 0.080 T and its path has a radius of 53.99 mm.

a. What is the charge on the ion?

**b.** How many electrons were removed to create this charge on the ion?

8. An electromagnetic wave has a frequency of 5.00×1014 Hz as it travels through a vacuum. When the same wave travels through glass, it has a wavelength of 2.24×10−7 m.

a. What is the speed of the wave in glass?

**b.** What is the dielectric constant of the glass?

**c.** What would the speed of the wave be
in a material with a dielectric constant
of 42.5?

9. A sample containing singly ionized oxygen
(*m* = 2.6569×10−26 kg/atom) and fluorine
(*m* = 3.1549×10−26 kg/atom) are run through a mass spectrometer. The ions are accelerated with a potential difference of 27 V and pass through a magnetic field of 0.091 T.

a. What is the radius of the oxygen ion’s path?

**b.** How much larger or smaller is the radius of the fluorine ion’s path?

10. A spectral analysis of a substance yields electromagnetic waves of frequencies in the 6.52×1014 Hz range. What color do these spectral lines appear?

11. An ion beam passes through crossed electric and magnetic fields without deflection. The electric field is 2340 N/C and the magnetic field is 0.026 T. When the electric field is turned off, the beam’s path takes on a curvature with a radius of 36.1298 mm.

a. What is the mass-to-charge ratio of the particle in question?

**b.** Assuming the particle is singly ionized, what is the mass of the particle?

12. Positively charged sodium ions are tracked as they travel through a magnetic field of strength 0.85 T with a velocity of 4.0×106 m/s. The observed radius of their circular path through this magnetic field is 1.12 m. What is the mass of a single sodium ion?

13. A mass spectrometer is capable of observing the curved track of a particle up to a radius of 5.0 cm using a magnetic field strength of 4.5 T. What voltage is necessary to measure the charge-to-mass ration of a proton?

14. a. What is the speed of a light wave with a wavelength of 640 nm in water? The dielectric constant for water is *K*water = 78.

b. What is the frequency of this light wave in water compared to its frequency in a vacuum?

15. A dish radio antenna with a diameter of 55 m is used to receive electromagnetic signals from deep space. What frequency is this antenna best suited to detect?

**16. a.** With a frequency of 1018 Hz, are X-rays visible to the unaided human eye?

**b.** In terms of the dielectric constant, explain why X-rays will pass through your body but will not pass through bone and metal, allowing internal details to show up on photographic plates.