OCTOBER 2023
EBS 408
ELECTRICITY AND MAGNETISM THEORY
30 MINUTES

Candidate's Index Number
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B.ED)
FOURTH YEAR, SECOND SEMESTER MID-SEMESTER QUIZ, OCTOBER 2023

25TH OCTOBER 2023 **ELECTRICITY AND MAGNETISM THEORY** **3:00 PM – 3:30 PM**

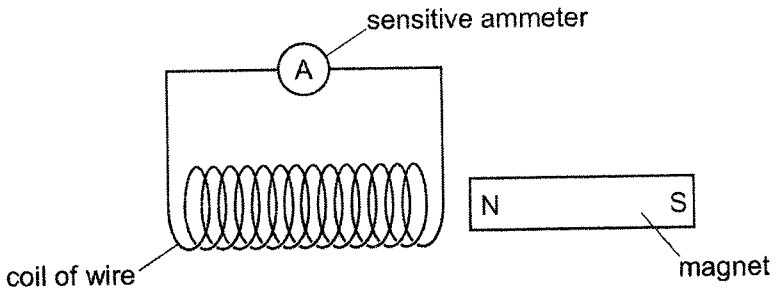
Answer ALL the questions.
[20 MARKS]

Items 1 to 20 are stems followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

1. An apparatus consists of a coil of *N* turns moving near a bar magnet. Which action would induce maximum emf?
   A. Double the number of turns and double the speed of the coil.
   B. Double the number turns and half the speed of the coil.
   C. Half the number of turns.
   D. Half the speed of the coil.

Use this information below to answer questions 2 and 3.

A student is investigating electromagnetic induction. She has a bar magnet and a coil that is connected to a sensitive ammeter. (see figure below).



2. Which action does **not** produce any reading on the ammeter? Move .....
   A. both the magnet and the coil to the left at the same speed.
   B. both the magnet and the coil towards each other at the same speed.
   C. the coil to the right.
   D. the magnet to the right.

3. How would the ammeter deflection change if a magnet with double the magnetic field is pushed into another coil of half the cross-sectional area?
   A. Greater deflection
   B. No deflection
   C. Same deflection as before
   D. Smaller deflection

4. The product, NBA, where N is the number of coils, B is the magnetic flux density and A is the area intercepting the field lines is referred to as magnetic .....
   A. field intensity.
   B. field product.
   C. flux factor.
   D. flux linkage.

5. An emf of 50 V is induced when a coil of 250 turns is subjected to a flux changing. Calculate the rate of change of the flux and indicate whether it is increasing or decreasing.
   A. 0.02 T/s, decreasing
   B. 0.02 T/s, increasing
   C. 0.2 T/s, decreasing
   D. 0.2 T/s, increasing

6. The voltage arising from the magnetic force driving free electrons in a conductor is referred to as ..... force.
   A. free potential
   B. locomotive
   C. motional electromotive
   D. None of the above

7. A generator converts kinetic energy to electric energy. How does this conversion happen?
   A. Kinetic energy makes charges free to flow as current.
   B. Kinetic energy moves a conductor along with magnetic field to produce current.
   C. Kinetic energy moves a conductor relative to magnetic field to drive current.
   D. Options A and B only

8. Electric field (E) is induced in a conductor moving with velocity (v) at an angle θ to magnetic field (B)? What is the relationship between E, v, θ *and* B
   A. $B = v\,E\cos\theta$
   B. $B = v\,E\sin\theta$
   C. $E = v\,B\cos\theta$.
   D. $E = v\,B\sin\theta$

9. Which electric machine produces electric energy as a coil moves in magnetic field? A .....
   A. generator
   B. motor
   C. relay switch
   D. transformer

10. What do displacement current and conventional current have in common? Both .....
   A. involve the flow of charges.
   B. quantities can be measured using an ammeter.
   C. quantities produce magnetic field.
   D. terms were first introduced by James Clarke Maxwell.

11. In which of the following situations will a magnetic field set up around the gap separating capacitor plates?

I. When a capacitor is losing charges
II. When capacitor is fully charged
III. When a capacitor is charging
IV. When a capacitor is fully discharged

A. I and II only
B. I and III only
C. I and IV only
D. II, III and IV only

12. Identify one of Maxwell's equations among the following.

A. $\oint \vec{E} \cdot d\vec{A} = \mu I_{enc}$
B. $\oint \vec{B} \cdot d\vec{A} = 0$
C. $\Phi_E = \vec{E} \cdot \vec{A}$
D. $F = qvB$

13. What is the characteristic property of superconductivity?

A. Below a certain temperature electrical resistance becomes zero.
B. Beyond a certain temperature, electrical resistance becomes zero.
C. Conductivity decreases with temperature.
D. Infinite amount of current when temperature rises above a certain value.

14. A typical example of superconductor is .....

A. Aluminum.
B. Copper.
C. Gold.
D. None of the above.

15. What is the unique behaviour of an inductor in a circuit? It .....

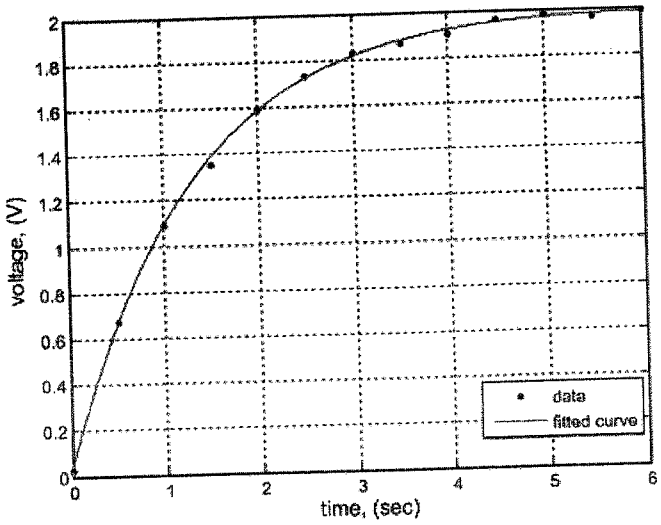
A. allows alternating current (AC) to pass easily.
B. blocks direct current (DC).
C. stores energy in electric field.
D. stores energy in magnetic field.

16. Find the back emf in a coil of inductance 60 mH bearing current that is changing at the rate of 0.20 A/s.

A. 0.3 mV
B. 12.0 mV
C. 12.0 V
D. 300 mV

Use the below to answer questions 17 and 18.

A student places a newly manufactured component in series with a resistor, a switch and a battery. He closes the switch, records the voltage across the unnamed component over time. He plots the data as shown below.



17. Suggest what the unnamed component is, with reason.
    A. Capacitor; after sufficient time has passed, the current is maximum.
    B. Capacitor; at the start of time, voltage across the component is zero.
    C. Inductor; after sufficient time has passed, the voltage is maximum.
    D. Inductor; at the start of time the current is zero.

18. Determine the voltage of the battery and the maximum current, assuming the resistance is 2Ω?
    A. V and 0.1
    B. V and 1 A
    C. V and 2 A
    D. V and 2 A

19. What circuit arrangement will not dissipate energy, assuming the components are ideal (i.e. pur
    A. *LC* circuit
    B. *RC* circuit
    C. *RL* circuit
    D. *RLC* circuit

20. What can you say about this expression, $\frac{1}{2}LI^2$. ..... of an inductor
    A. Current
    B. Energy
    C. Reactance
    D. Voltage