ARAB REBABLIC OF EGYPT PHYSICS

MINISTRY OF EDUCATION TIME ALLOWED: 3 HOURS

الامتحان التجريبي لشهادة اتمام الدراسة الثانوية العامة للعام الدراسي 2015/2014

Answer **FOUR** questions only of the following:

First Question:

A) Mention one application:

1- Eddy currents
2- Dewar's flask
2- Laser in the medical field
4- X rays in industry
3- Specialized electronic components.

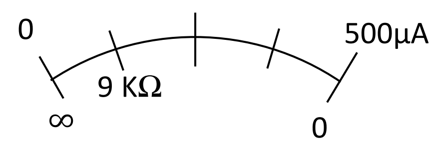
B) **First**: Explain how you can demonstrate practically the phenomenon of self induction using an electromagnet, a battery, a switch and connecting wires only. Draw a labeled diagram for the used electric circuit.

Second: Mention one factor that can **reduce** each of:

1- The electric conductivity of a pure silicon crystal.
2- The wavelength associating the electron beam.
3- The characteristic wavelengths of (x) rays.
4- The loss in the electric power through the transmission lines.

C) The given diagram indicates regular divisions on the ohmmeter scale. Use the given data to find:

1- The resistance of the ohmmeter.
2- The electromotive force of the cell inside the ohmmeter.



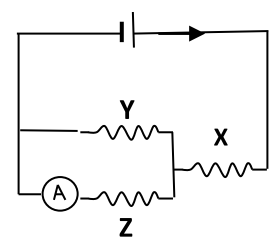
Second Question:

A) What is meant by …?

1- The work function of a metal = 1.9 eV
2- The current gain of a transistor = 99
3- The magnetic flux density at a point = 0.2 Tesla
4- The sensitivity of a sensitive galvanometer = 40 microampere / division

B) **First:** Three identical resistors of platinum are connected as shown to an electric cell of negligible internal resistance.

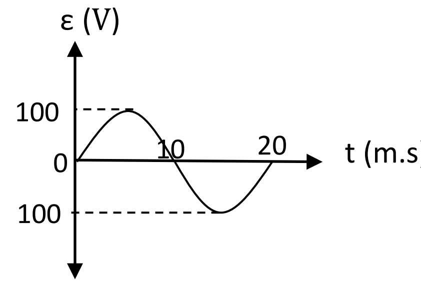
1- Explain the change in the current intensity through the electric cell when the resistor (Z) is immersed in liquefied helium.
2- Find the ratio between readings of the ammeter (A) **after and before** immersing the resistor (Z) in liquefied helium.



Second: What is the condition required for …?

1- Examination of a minute object using a microscope.
2- Existence of a repulsive force between parallel wires of copper.
3- Formation of absorption line spectrum of a gas.
4- Stimulated emission.

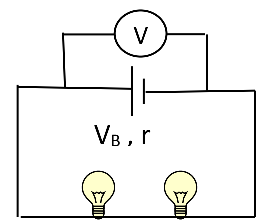
C) The opposite graph represents the variation of the electromotive force generated in the coil of an AC dynamo that rotates at angular velocity (ω) during 20 milliseconds. **Starting from zero position**, find:



1- The frequency of the generated current.
2- The emf generated after 2.5 milliseconds.
3- The average emf generated during 5 milliseconds.

Third Question:

A) Choose the correct answer:



1- In the opposite circuit, when the filament of a bulb is blown off, the voltmeter reading …   (increases – decreases – unchanged – zero)
2- In the adiabatic process, compressing a thermally insulated gas leads to a positive change of …   (gas volume – work done by the gas – gas temperature – heat gained by the gas)
3- In Compton effect, what decreased for the (x) ray photon is its … (mass – speed – radius – wavelength)
4- A circular coil is connected to a battery of zero internal resistance. The number of coil turns is doubled without changing its diameter. Being connected to the battery, The magnetic flux density at its center would be … (doubled – 4 times greater –halved – unchanged)
5- The quantity that increases in the secondary coil of an ideal step down transformer is … (electric power – current value – current frequency – magnetic flux).

B) **First**: Draw a label diagram for the helium – neon laser device.

1- Why are the two gases chosen together?
2- Compare the resonant cavity in this device and that in the ruby laser.

Second: Mention the rule or the method used to define each of:

1- The direction of the motor coil rotation.
2- The direction of the current induced in the dynamo coil.
3- The polarity of a diode semiconductor.

C) A straight metallic wire of length (ℓ), cross sectional area 10 mm^2 and the resistivity of its material 2.8×10^{-8} Ω·m is connected to a battery of emf 3V and zero internal resistance.

1- Find the magnitude of the magnetic force affecting on the wire when placed perpendicularly to a magnetic field of flux density 10^{-3} Tesla.

2- What happens to the magnitude of the force when the wire diameter is doubled?

Fourth Question:

A) Mention **one** of the results that happen:

1- To the concentration of charge carriers in a silicon crystal when doped with boron atoms.

2- Inside a diamagnetic material when exposed to an external magnetic field.

3- To the glowing of tungsten bulbs connected in parallel when some are removed.

4- In the secondary coil of a step up transformer when the primary coil is connected to an electric cell.

5- To the magnetic flux density at the axis of a solenoid that carries an electric current when its wire is doubly wounded.

B) **First:** You have got a galvanometer of coil resistance (R_g) and full scale deflection (I_g)

1- How is the galvanometer modified in order to extend its range to $I > I_g$?

2- Write down the mathematical expression that finds the total resistance of the device after modification.

3- Deduce the resistance of multiplier required to convert the galvanometer into a voltmeter.

Second: What are the physical quantities measured by the following units?

❶ Volt. second ❷ Ohm. second ❸ Ampere. second
❹ Radian. $second^{-1}$ ❺ Newton. meter ❻ $Ampere.m^2$

C) A photon of wavelength 486.1 nm is emitted by the hydrogen atom.

1- Calculate the photon energy.
Given that ($h = 6.625 \times 10^{-34}$ J.s, $c = 3 \times 10^8$ m/s).

2- Using the opposite table that illustrates values of some energy levels in the hydrogen atom, determine the two levels between which the electron is transmitted.

Level	Energy (electron volt)
K	– 13.6
L	– 3.4
M	– 1.51
N	– 0.85

(Visible wavelengths range between 400 nm to 700 nm)

Fifth Question:

A) Compare each pair of the following:

1- Connecting resistors in series and in parallel in terms of the voltage across the resistors.

2- The effect of increasing the frequency and the intensity of light on the emitted electrons in the photoelectric effect.

3- A beam of helium – neon laser and a beam from neon lamp when passing through spectrometer

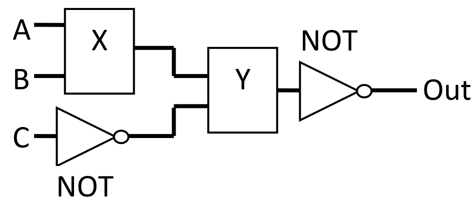
4- The real gas and the ideal gas in terms of the interaction between molecules.

5- The electric motor and the moving coil galvanometer in terms of the direction of the electric current in the coil when connected to a battery.

B) **First:** The truth table in front of you gives the input and the output of logic gate network.

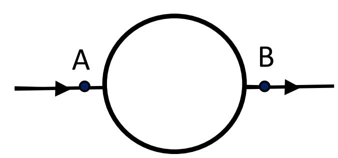
1- Identify the gates labeled (X) and (Y).

2- Find the output (Z) in the table.



A	B	C	Out
1	1	1	0
0	1	1	1
0	0	0	Z

Second: A straight wire of resistance 48Ω is shaped as a closed circular loop of diameter (d), and then a 6V battery is connected across its diameter as shown. Find:



1- The total resistance between the points (A, B).

2- The intensity of current through the loop wire.

3- Explain why the magnetic flux density is zero at the loop center.

C) The table below gives the variation in the electromotive force (ε) induced in the secondary coil and the rate of change of electric current (ΔI/Δt) through the primary coil.

ε (Volt)	5	10	20	25	30
ΔI/Δt (A/s)	25	50	100	125	150

Represent these data graphically where the rate of change of electric current on the abscissa and the electromotive force on the ordinate. From the graph find:

1- The rate of change of current intensity through the primary coil that induces 15 V in the secondary coil.

2- The coefficient of mutual induction between the two coils.

3- Mention a method to change this coefficient without reconstructing the coils.

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