COVENANT UNIVERSITY

OMEGA SEMESTER TUTORIAL KIT (VOL. 2)

PROGRAMME: PHYSICS

100 LEVEL

DISCLAIMER

LIST OF COURSES

PHY121: Electricity and Magnetism

PHY122: Atomic and Nuclear Physics

***Not included**

COVENANT UNIVERSITY

CANAANLAND, KM 10, IDIROKO ROAD
P.M.B 1023, OTA, OGUN STATE, NIGERIA.

COLLEGE: COLLEGE OF SCIENCE AND TECHNOLOGY

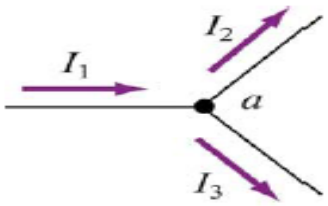
DEPARTMENT: PHYSICS **COURSE CODE:** PHY 121

SESSION: 2015/2016 **SEMESTER:** OMEGA

COURSE TITLE: ELECTRICITY AND MAGNETISM **TIME:** $1\frac{1}{2}$ HOURS

INSTRUCTION: ANSWER ALL QUESTIONS

Use the diagram below to answer questions 1 and 2.



1. What is the Kirchoff's current expression for junction "a" in the figure above?

A. $I_2 = I_1 + I_3$ B. $I_2 = I_1$ C. $I_3 + I_2 = I_1$ D. $I = I_3 + I_2$

2. If the same value of current exits junction "a" above, and $I_2 = 4$ A, determine the value of I_1?

A. 6 A B. 12 A C. 8 A D. 7A

3. If a current of 5 amps flows through a resistance of 40 ohms, the voltage across that resistor is?

(A) 100V (B) 200V (C) 300V (D) 250V

4. Coulomb's law of electrostatics is equal to

(A) $F \propto \frac{q}{r^2}$ (B) $F \propto r^2/q$ (C) $F \propto \frac{q_o q_1}{r}$ (D) $F \propto \frac{q_o q_1}{r^2}$

5. The ……of a capacitor is defined as the ratio of the magnitude of charge to the potential difference

(A) Capacitance (B) Farad (C) Capacitor (D) Conductor

6. Find the capacitance of a capacitor that retains a charge of 200 C when the potential difference applied is 50 V?

(A) 8 Farad (B) 6 Farad (C) 4 Farad (D) 20 Farad

7. A parallel plate capacitor has a capacitance of 10 μF . If the plates are 10 mm apart, what is the area of the plates? (Take $\varepsilon_0 = 8.85 \times 10^{-12} C^2 / Nm^2$).

(A) 11500 m^2 (B) 11300 m^2 (C) 11250 m^2 (D) 11000 m^2

8. Calculate the current supplied to a battery of 6 V emf and internal resistance of 0.5 Ω, when the external resistance is 2.5 Ω?

(A) 2 A (B) 20 A (C) 24 A (D) 0.2 A

9. Two capacitors 2 μF and 5 μF are connected in parallel, calculate their equivalent capacitance?

(A) 10 μF (B) 7 μF (C) 0.7 μF (D) 25 μF

10. Calculate the quantity of charge stored by a capacitor of capacitance 18 Farad and potential difference of 3 V?

(A) 8 C (B) 18 C (C) 54 C (D) 10 C

11. Calculate the current density of a wire of cross-sectional area $3\times10^{-3}m^2$ when the current flowing through is $1.2\times10^{-4}A$?

(A) 0.04 A/m^2 (B) 4 A/m^2 (C) 40 A/m^2 (D) 400 A/m^2

12. Determine the equivalent capacitance of two capacitors 6 μF and 3 μF connected in series

(A) 18 μF (B) 9 μF (C) 3 μF (D) 2 μF

13. Calculate the resistance of a wire of length 0.65 m, cross-sectional area of 1.25 m^2 and resistivity of $3\times10^{-6}\Omega m$?

(A) $1.56\times10^{-6}\Omega$ (B) 0.00016Ω (C) 20000Ω (D) 1.20 Ω

14. One of the following is a peculiar problem of Wheatstone bridges.

(A) Current leakage in high resistance measurement
(B) Errors due to improper grounding
(C) Shielding
(D) Dissipation factor

15. The direction of magnetic field around a conductor is described by …….
(A) Flemings left hand rule
(B) Right hand thumb rule
(C) Ampere's law
(D) Michael faraday's induction rule.

16. Electromagnetic induction using a solenoid and a bar magnet is summarized as…….
(A) Change in magnetic field produces an induced current
(B) The direction of motion of bar magnet is same as induced current
(C) The induced current is in reverse direction to direction of plunge of the magnet
(D) It is difficult to describe.

17. The expression of Biot- Savart's law for a long straight loop is given by:

(A) $B=\frac{\varphi_0 I}{4\pi a}\theta$ (B) $B=\frac{\varphi_0 I a^2}{2\left(a^2+x^2\right)^{3/2}}$ (C) $B=\frac{\varphi_0 I}{2\pi a}$ (D) $B=\frac{\varphi_0 I}{2\pi a}\int_0^a \partial s$

18. For there to be an induction, there must be a change in the magnetic field which also results in a change in magnetic flux.

(A) False (B) True (C) Not applicable (D) Sometimes

19. Suppose a rod is moving with a speed of 5.0m/s perpendicular to a 0.80-T magnetic field. If the rod has a length of 1.6 m and both the rails and the rod have negligible electrical resistance. If the light bulb has a resistance of 96 ohms, find (i.) the emf produced by the rod and (ii.) the current induced in the circuit

(A) 6.4V and 0.057A (B) 6.2V and 0.067A (C) 6.4V and 0.067A (D) 6.2V and 0.066A

20. A 20μF capacitor is placed across an AC generator that applies a potential drop with amplitude (peak value) of 100V. Find the capacitive reactance and the current amplitude when the frequency is 6000Hz?
    (A) 133Ω, 0.752A (B) 13.33Ω, 75.2A (C) 1.33Ω, 75.2A (D) 1.33Ω, 7.5A.
21. The potential drop across a 40mH inductor is sinusoidal with a peak potential drop of 120V. Find the inductive reactance and the peak current when the frequency is 60Hz?
    (A) 15.1Ω, 7.95A (B) 503Ω, 0.239A (C) 15.1Ω, 0.239A (D) 503Ω, 7.95A.
22. A cassette recorder uses a plug-in transformer to convert 120V to 12V, with a maximum current output of 200mA. What is the current input?
    (A) 2mA (B) 20mA (C) 0.2A (D) 24A
23. A doorbell requires 0.4A at 6V. It is connected to a transformer, whose primary coil contains 2000 turns and it is connected to a 120V ac line. How many turns should there be in the secondary?
    (A) 1000 (B) 4000 (C) 40,000 (D) 100
24. Calculate the force between two parallel conductors carrying current of 7 A and 3.2 A respectively, their lengths are 0.2 m and 0.5 m respectively if they are 1 m apart, take the permeability of free space as $4\pi \times 10^{-7}$ Tm/A.
    (A) 0.896 N (B) 8.960 N (C) 4.408 N (D) 4.480 N

25. A coil of wire consists of 20 turns each of which has an area of 0.0015 m². A magnetic field is perpendicular to the surface. Initially, the magnitude of the magnetic field is 0.050 T and 0.10s later, it increased to 0.060 T. Find the average emf induced in the coil during this time.

    (A) -4.0×10^{-3} (B) -3.0×10^{-3} (C) 3×10^{-3} (D) 4.5×10^{-2}
26. A basic device for detecting/measuring a small electric current by means of a mechanical motion derived from electromagnetic forces produced by the current is known as a…….

    (A) A transformer (B) A generator (C) A galvanometer (D) None of the above.

27. Induced current depends on the
    I. number of turns in the coil
    II. strength of the magnet
    III. speed with which the magnet is plunged into the coil

(A) I only (B) II only (C) I and II only (D) II and III only

28. The principle of operation of an induction coil is based on
    (A) Ohm's law (B) Ampere's law (C) Faraday's law (D) Coulomb's law
29. What capacitance should be used to produce a 2.00MΩ reactance at 60.0Hz?
    (A) 1.33nF (B) 13.3nF (C) 133nF (D) 13.3mF.
30. A series RLC circuit has R = 425 Ω, L = 1.25H, C =3.50 **μ**F. It is connected to an AC source with f = 60 Hz. Determine the impedance of the circuit?
    (A) 333Ω (B) 313Ω (C) 413Ω (D) 513Ω.
31. A 240V (RMS), 60Hz voltage source is applied to a series RLC circuit consisting of a 50-ohm resistor, a 0.5H inductor and a 20 **μ**F capacitor. Find the impedance of the circuit?
    (A) 74.7Ω (B) 188.5Ω (C) 377Ω (D) 477Ω.
32. What is the resonant frequency of a 0.500mH inductor connected to a 40.0 **μ**F capacitor?
    (A) 0.10 kHz (B) 1.13 KHz (C) 0.015KHz (D) 1.52 KHz.

33. An AC generator consists of 8 turns of wire of area 0.09 m^2 and a total resistance of 12 Ω. The loop rotates in a magnetic field of 0.5 T at a constant frequency of 60 Hz. What is the maximum EMF induced?

    (A) 240V (B) 516V (C) 136V (D) 100V.

34. A 75kVA transformer has a step-down ratio of 12:1, with 2400 primary turns and a primary voltage of 3.3kV. Calculate the full load primary and secondary currents?

    (A) $I_1 = 22.7A$, $I_2 = 273A$ (B) $I_1 = 33.7A$, $I_2 = 273A$ (C) $I_1 = 22.7A$, $I_2 = 373A$ (D) $I_1 = 23.5A$, $I_2 = 293A$

35. The coil of an AC motor has a resistance of 4.1 ohms and the motor is plugged into an outlet where the voltage is 120.0 volts (rms). If the coil develops a back emf of 118.0 volts (rms) when rotating at normal speed and the motor is turning a wheel, find (i) the current when the motor first starts up and (ii.) the current when the motor is operating at normal speed?

    (A) 26A, 0.47A (B) 29A, 0.49A (C) 15A, 0.29A (D) 0.29A, 0.04A

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DEPARTMENT: PHYSICS **COURSE CODE:** PHY 121
SESSION: 2015/2016 **SEMESTER:** OMEGA
COURSE TITLE: ELECTRICITY AND MAGNETISM

MARKING GUIDE

1. C	11. A	21. A	31. A
2. C	12. D	22. B	32. B
3. B	13. A	23. D	33. C
4. D	14. A	24. D	34. A
5. A	15. B	25. B	35. B
6. C	16. A	26. C	
7. B	17. B	27. C	
8. A	18. B	28. C	
9. B	19. C	29. A	
10. C	20. C	30. D	

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TITLE OF EXAMINATION: B.Sc EXAMINATION
COLLEGE: COLLEGE OF SCIENCE AND TECHNOLOGY
SCHOOL: SCHOOL OF NATURAL SCIENCES
DEPARTMENT: PHYSICS
SESSION: 2015/2016 SEMESTER: OMEGA
COURSE CODE: PHY 122 CREDIT UNIT: 2 UNITS
COURSE TITLE: ATOMIC AND NUCLEAR PHYSICS TIME: 2 HOURS
INSTRUCTION: ATTEMPT ALL QUESTIONS

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1. Which model of atomic structure was developed to explain the results of the experiments regarding penetration of thin metal foil by beam of $\alpha - particles$

   [A] Bohr model [B] Billiard ball atom [C] Plum-pudding model [D] Nuclear atom

   [E] Quantum mechanical atom

2. What happens when fast moving electrons are stopped and fall on the metallic target in an evacuated glass tube?

   [A] - rays are produced [B] X- rays are produced [C] - particles are produced

   [D] Refraction rays are produced [E] Cathode rays are produced

3. Complete the following statement: For the ground state of the hydrogen atom, the Bohr model correctly predicts..... [A] only the angular momentum [B] only the angular momentum and the spin [C] only the energy [D] the energy, the angular momentum, and the spin [E] the angular momentum and the energy

4. An alpha particle of mass 6.65×10^{-27}kg travels at right angles to a magnetic field with a speed of 6×10^{5} m/s. If the flux density of the field is 0.2 Wb/m^2, calculate the acceleration of the alpha particle. (e = 1.6×10^{-19} C) .....
   [A] 2.89×10^{12} m/s^2 [B] 2.89×10^{10} m/s [C] 7.56×10^{12} m/s^2 [D] 8.92×10^{24} m/s^2
   [E] 3.58×10^{11} m/s^2

5. Using question 4 above, calculate the force acting on the alpha particle.....

[A] 2.56×10^{12} N [B] 2.56×10^{-12} N[C] 1.92×10^{-14} N [D] 1.92×10^{14} N [E] 0.32×10^{14} N

6. A beam of 450 nm light is incident on a metal having work function 2.0 eV and placed in a magnetic field B. The most energetic electrons emitted perpendiculars to the field are bent in a circular arc of 20cm radius. The value of B is .....
[A] 6.14×10^{-5} [B] 1.46×10^{-5} [C] 4.12×10^{-5} [D] 2.56×10^{-5}
[E] None of the above

7. One reason the Bohr model of the atom failed was because it did not explain why

[A] accelerating electrons do not emit electromagnetic radiation. [B]moving electrons have a greater mass. [C]electrons in the orbits of an atom have negative energies. [D]electrons in greater orbits of an atom have greater velocities. [E]Spinning electrons have a greater angular momentum

8. A beam of protons is accelerated from rest through a potential difference of 600V and between two parallel plates of 30cm apart. It then enters a uniform magnetic field, which is perpendicular to the direction of proton beam. If the flux density is 0.35T, calculate the radius of the path which the beam describes (e/m = 1.756×10^{11} C/kg).
[A] 9.30×10^{-10} [B] 3.90×10^{-8} [C] 9.30×10^{8} [D] 9.30×10^{-8}
[E] 4.38×10^{-8}

9. Compute the energy of a photon of red light of wavelength 150 nm. Given ($h = 6.63 \times 10^{-34}$ Js, $c = 3 \times 10^{8}$ m/s, 1 eV = 1.6×10^{-19} J).....
[A] 3.10×10^{-19} J [B] 1.33×10^{-20} J [C] 1.33×10^{-18} J [D] 8.29×10^{-19} J
[E] 4.33×10^{-20} eV

10. Calculate the wavelength of the second member of Pfund series of hydrogen atom if the Rydberg constant is 10.97×10^{6} m^{-1}.....
[A] 4.65×10^{-18} Hz [B] 4.65×10^{-10} Hz [C] 4.75×10^{12} Hz [D] 4.65×10^{-6} Hz
[E] 5.10×10^{13} Hz

11. The minimum intensity of light to be deflected by human eye is 10^{-10} / ^{2}. The number of photons of wavelength 5.6×10^{-7} entering the eye, with pupil area 10^{-6} ^{2} per second for vision will be nearly.....

[A] 100 [B] 200 [C] 300 [D] 400 [E] 320

12. Calculate the binding energy of $^{7}_{3}$ in electron volt. Take the atomic mass of $^{7}_{3} = 7.01600$, mass of proton = 1.00783u, mass of neutron = 1.00867u, unified atomic mass unit (amu), u = 931 MeV, 1 eV = 1.6×10^{-19} J
[A] 39.2×10^{6} J [B] 39.2×10^{12} J [C] 6.28×10^{12} J [D] none of the above [E] 3.92×10^{12} J

13. Which one of the following will result in an electron transition from the n=4 level to n= 7 level in a hydrogen atom?
[A] emission of a 0.28 eV photon

[B] emission of a 0.57 eV photon
[C] emission of a 0.85 eV photon
[D] absorption of a 0.85 eV photon
[E] absorption of a 0.57 eV photon

14. A beam of x-rays with wavelength 0.06 00 nm is Compton-scattered by the electrons in a sample. At what angle from the incident beam should you look to find x-rays with a wavelength of 0.0621 nm?

[A] 82.3^{o} [B] 97.8^{o} [C] 0.021^{o} [D] 0.86^{o} [E] 68.5^{o}

15. The kinetic energy of the ground state electron in hydrogen is +13.6 eV. What is the potential energy?
[A] -13.6 eV [B] +27.2 eV [C] -27.2 eV [D] +56.2 eV [E] Zero

16. The binding energy of an isotope of chlorine is 489 MeV. What is the mass defect of this chlorine nucleus in atomic mass unit
[A] 0.5346 u [B] 0.5346 MeV/u [C] 0.5346 kg [D] none of the above [E] 0.56 MeV/u

17. Which radioisotope is used to detect thrombosis?
[A] Sodium-24 [B] phosphorus-32 [C] lead-206 [D] none of the above [E]Neutron

18. If a photon has momentum of magnitude 5.24×10^{-34} / . What is the energy of this photon in electron volts?
[A] 1.75×10^{-42} [B] 2.52×10^{-6} [C] 9.83×10^{-7} [D] 1.57×10^{-25}
[E] 3.83×10^{-17}

19. The energy of the emitted electrons from the metal surface depends on.....

[A] Frequency [B] Wavelength [C] Speed [D] Intensity [E] Momentum of the radiation

20. The Uncertainty principle can be written as:

I. $\Delta\ \Delta\ \geq \frac{h}{4}$ II. $\Delta\ h \geq \frac{\Delta}{4}$ III. $\Delta\ \Delta\ \geq \frac{h}{4}$ IV. $\Delta \geq \frac{h}{4}$

[A] I only [B] III only [C] I and III only [D] II and IV only [E] II and III only

21. Determine the uncertainty in the energy of a photon in the energy of a photon which is radiated in a time interval 10^{-6} ?
[A] 1.46×10^{-29} [B] 1.57×10^{-28} [C] 5.26×10^{-28} [D] 5.28×10^{-35}
[E] 2.56×10^{-29}

22. An electron in an excited level of energy (-21.4 eV) falls to the ground level of energy

(-24.6 eV). Determine the wavelength of the photon emitted in the process.

[A] 3.88×10^{-7} Hz [B] 3.2 eV [C] 3.88×10^{-7} eV [D] 3.88 Hz [E] 5.33 eV

23. Compute the energy of a photon of red light of wavelength 450 m. Given h = 6.63×10^{-34}Js, c = 3×10^{8}m/s, 1eV = 1.6×10^{-19}J.
[A] 4.42×10^{22} J [B] 4.42×10^{-22} J [C] 3.67×10^{19} J [D] 3.67×10^{19} eV [E] 4.42 eV

24. A charged oil drop is suspended in a uniform field of 300V/cm so that it neither falls nor

rises. Find the charge on the drop, given its mass as 9.75×10^{-12}g. Take g = 9.8 m/s^2.
[A] 3.19×10^{-18} C [B] 9.75×10^{-12} C [C] 9.75×10^{12} C [D] 3.19×10^{-19} C
[E] 7.25×10^{12} C

25. A beam of gamma radiation having photon of 510 is incident on a foil of aluminium. Calculate the wavelength of radiation at 60^0.
[A] 30600 m [B] 3.65×10^{-12} [C] 4.85×10^{-12} [D] 1.21×10^{-12} [E] 6400 m

26. Iodine-131, a radioisotope that is used in the treatment of thyroid cancer, is produced in a

two-stage process. First, tellurium-130 ($^{130}_{52}$) is bombarded with neutrons inside the core of a nuclear reactor. This results in the formation of the very unstable Tellurium-131 and a gamma ray. Tellurium-131 decays by beta emission to produce a daughter nuclide and an antineutrino. Identify the daughter nuclide
(A)$^{130}_{52}$ (B) $^{132}_{52}$ (C) $^{130}_{53}$ (D) none of the above (E) $^{131}_{53}$

27. The formula for charge to mass ratio is given as .....

[A] $\frac{E}{B}$ [B] $\frac{E}{B^2 r}$ [C] $\frac{B}{V^2 r}$ [D] $\frac{v}{B^2 r}$ [E] $\frac{r}{B^2 v}$

28. An electron having 450 eV of energy moves at right angle to a uniform magnetic field of flux density 1.5×10^{-3} T, find the radius of the electron (assume e/m is 1.78×10^{11} Ckg^{-1}, me = 9.1×10^{-31} kg) .....
[A]2.74×10^{-2} [B] 6.72×10^{-3} [C] 4.72×10^{-2} [D] 4.72×10^{-5}

[E]2.74×10^{-2}

29. ..... represent wavelengths radiated from atoms when electrons change from one energy level to another.
[A] Radiation [B] Balmer [C] Line spectra [D] magnetic field [E] 0

30. An electron has a de Broglie wavelength of 3.15×10^{-14} m. Determine its kinetic energy in Joules.
[A] 2.11×10^{-2} [B]2.43×10^{-10} [C]2.09×10^{-47} [D]3.28×10^{55} [D]3.28×10^{55}

31. The photoelectric workfunction of potassium is 4.5 eV. If light having a wavelength of 250 nm falls on potassium, what is the speed of the electron?
[A] 1.66×10^{11} / [B] 0.47 / [C] 407 / [D] 1.51×10^{-19} /
[E] 0.2466×10^{10} /

32. An emission spectrum gives one of the lines in the Balmer series of the hydrogen atom at 410 nm. This wavelength results from a transition from an upper energy level to n = 2. What is the principle quantum number of the upper level?
[A] 6 [B] 5 [C] 4 [D] 3 [E] 7

33. The Bohr model of the atom was able to explain the Balmer series because:

[A] larger orbits required electrons to have more negative energy in order to match the angular momentum.

[B] differences between the energy levels of the orbits matched the difference between energy levels of the line spectra.

[C] electons were allowed to exist only in allowed orbits and nowhere else.

[D] larger orbits required electrons to have more negative energy in order to match the positive energy.

[E] none of the above

34. X rays of wavelength 0.0423 nm are scattered from the atoms of a crystal. The second-order maximum in the Bragg's reflection occurs when the angle is 22.7°. What is the spacing between adjacent atomic planes in the crystal?

[A] 0.11 nm [B] 1.09 nm [C] 3.96 nm [D] 0.05 nm [E] 1.05 nm

35. Calculate the wavelength of the third member of Lyman series of hydrogen atom if the Rydberg constant is $10.97 \times 10^{6}\ m^{-1}$

[A] 1213 A° [B] 972 A° [C] 278 A° [D] 875 A° [E] 1025 A°

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PHY 122 (2015/2016) EXAMINATION MARKING GUIDE

1.	D	11.	C	21.	C	31.	C
2.	B	12.	A	22.	A	32.	A
3.	C	13.	E	23.	B	33.	B
4.	A	14.	A	24.	A	34.	A
5.	C	15.	C	25.	B	35.	B
6.	B	16.	A	26.	E		
7.	A	17.	A	27.	B		
8.	D	18.	C	28.	C		
9.	C	19.	A	29.	C		
10.	D	20.	C	30.	B		