Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	PHYSICS FOR LIFE SCIENCES
COURSE CODE	:	DAU 34203
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Define the term 'near point'.

(2 marks)

(b) Calculate the power of the eye when viewing an object 3 m away. Considering the distance between lens and retina is 2 cm?

(4 marks)

(c) (i) Briefly explain what happened to human's near point with passage of time.

(ii) State **two (2)** factors that influence the quality of image form by optical microscope.

(iii) State reasons why reflecting telescope used for capturing images from distance away and rather than refracting microscope?

(5 marks)

(d) (i) Explain 'wave-particle duality' behavior of light.

(ii) Briefly explain the principle of continuous X-ray generation

(iii) State the other name for continuous X-ray

(4 marks)

(e) Prove that Bohr radius for hydrogen atom is given by $r_n = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{mv_n^2}$

(5 marks)

(f) An insect stood in front of mantis along the central axis 20 cm from its eye. The lateral magnification of the mantis provided by the lens is m =-0.25, and the index of refraction of the lens material is 1.65. Determine the radius of its lens.

(5 marks)

Q2 (a) State the definition of photon.

(2 marks)

(b) Briefly explain the Photoelectric effect.

(2 marks)

(c) The work function of tungsten is 4.50 eV. Electrons ejected from a tungsten surface when light whose photon with wavelength 213.76 nm shines on the surface

(i) Calculate the photon energy

(ii) Find the kinetic energy obtained by the electron

(iii) Calculate the maximum speed of the ejected electron from the surface

(8 marks)

(d) Calculate the de Broglie wavelength of:

(i) a 1.00 keV electron,

(ii) a 1.00 keV photon, and

(iii) a 1.00 keV neutron.

(6 marks)

(e) A camera with single lens of focal length 75 mm takes a picture of a person standing 27 m away. If the person is 180 cm tall, Find the height of the image on the film?

(4 marks)

(f) (i) Write electron configuration of an atom that consist of 17 electron.

(ii) State the name of the atom with the configuration

(3 marks)

Q3 (a) Write maximum electron will be occupied by;

(i) d orbital.

(ii) f orbital.

(2 marks)

(b) (i) State the Total Energy, E_{total} according to relativistic theory.

(ii) Write the Rest Mass energy.

(iii) Write the energy equation as carried by massless object.

(iv) Prove that de Broglie equation is given by $p=h/\lambda$ referring to total energy equation.

(8 marks)

(c) State at least **three (3)** reasons the limitation of Bohr atomic model

(3 marks)

(d) A clock moves along x axis at speed of $0.600c$ and reads zero as it passes the origin. Calculate;

(i) Lorentz factor.

(ii) Time as it passes $x = 180$ m? according to stationary frame reference

(iii) The clock read according to moving frame reference

(7 marks)

(e) An electron accelerated from rest to $0.9900c$,

(i) Calculate the work done

(ii) Write the energy in the form of MeV?

(5 marks)

Q4 (a) Write the postulate of Bohr atomic model

(4 marks)

(b) Explain briefly why constant speed of light become reference in the einstein's theory of relativity

(2 marks)

(c) A particular nearsighted patient can't see objects clearly when they are beyond 25 cm .

(i) Calculate focal length of contact lens have to correct this problem?

(ii) Determine the power of the lens, in diopters. (Neglect the eye-lens distance)

(5 marks)

(d) Draw the diagram of p_x,p_y, and p_z orbital

(3 marks)

(e) Sketch the graph of relativistic momentum versus speed

(3 marks)

(f) Prove that the minimum wavelength of X-ray is given by $\lambda_{min} = \frac{hc}{eV}$

(3 marks)

(g) An ancient ship was found at sea by archaeologist. If the ^{14}C only remain 40% on the ship, calculate the age of the ship. (Given $t_{1/2}$ of ^{14}C is 5730 yr.)

(5 marks)

Q5 (a) Write **three (3)** factors that effects of ionizing radiation on matter

(3 marks)

(b) States **three (3)** uses of radioisotopes in modern era

(3 marks)

(c) Calculate the radius of ^{58} Ni

(3 marks)

(d) Name **two (2)** types of non-ionizing radiation

(2 marks)

(e) Write **three (3)** types of *beta decay* reactions

(3 marks)

(f) Given The neutral atomic mass of $^{62}_{28}Ni$ is 61.928349 u, calculate:

(i) mass defect

(ii) total binding energy

(iii) binding energy per nucleon

(6 marks)

(g) Calculate radiation released in Balmer series of hydrogen atom

(i) the longest wavelengths.

(ii) the shortest wavelengths.

(5 marks)

-END OF QUESTIONS –

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LIST OF FORMULA

$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$	$M = \frac{h_i}{h_o} = -\left\|\frac{d_i}{d_o}\right\|$
$E = \frac{hc}{\lambda} = hf$	$KE = (\gamma - 1)m_o c^2$
$n = \frac{c_0}{v}$	$n_1 \sin\theta_1 = n_2 \sin\theta_2$
$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$	$E^2 = m_o^2 c^4 + p^2 c^2$
$\frac{pc}{E} = \frac{v}{c}$	$E = \gamma m_o c^2$
$\lambda = \frac{h}{e}\sqrt{\frac{4\pi\varepsilon_o r}{m}}$	$v = \frac{e}{\sqrt{4\pi\varepsilon_o r}}$
$n\lambda = 2\pi r_n$	$2\pi r_n = \frac{nh}{e}\sqrt{\frac{4\pi\varepsilon_o r_n}{m}}$
$r_n = \frac{n^2 h^2 \varepsilon_o}{\pi m e^2}$	$r_n = n^2 a_o$
$E_n = -\frac{e^2}{8\pi\varepsilon_o r_n}$	$E_n = -\frac{me^4}{8\varepsilon_o^2 h^2}\left(\frac{1}{n^2}\right) = \frac{E_1}{n^2}$
$\frac{1}{\lambda} = -\frac{E_1}{hc}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$	$\Delta m = Z(m_H) + (A - Z)(m_n) - m_x$
$E = mc^2$	$E_i - E_f = hf$

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LIST OF CONSTANT

Avogadro's Number, $N_A = 6.023 \times 10^{23}$ atoms
Electron charge, $e = 1.6 \times 10^{19}C$
Electron mass, $m_e = 9.109 \times 10^{-31}kg$
Neutron mass, $m_n = 1.675 \times 10^{-27}kg$
Proton mass, $m_p = 1.673 \times 10^{-27}kg$
Atomic mass number, $u = 1.6605 \times 10^{-27}kg$
$= 931.5MeV$
Plank's Constant, $h = 6.626 \times 10^{-34}J$
Speed of light, $c = 3 \times 10^{8}ms^{-1}$
Electric constant permitivitty of free space, $\varepsilon = 1.6 \times 10^{-12}C^2/Nm^2$
Radius of the orbit contain wavelength, $r_n = 5.3 \times 10^{-11}m$
Mass of electron $m_e = 9.1 \times 10^{-31}kg$