KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level : B.Sc.
Year : II

Course : PHYS 203
Semester : I

Exam Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date 04 JUN 2019

SECTION "A"
[20Q. × 1 =20 marks]

Choose the most appropriate answer among the given options and ***encircle*** *the letter of your choice.*

1. A Certain metal has a threshold wavelength of 600 nm. The stopping potential when the metal is irradiated with monochromatic light of wavelength 400 nm is
[a] 1.03 V [b] 1.30 V [c] 1.4 V [d] 0.8V

2. The radius of Ho^{165} is 7.731 fm. Then the radius of He^{4}
[a] 2.5 fm [b] 2.238 fm [c] 3.5 fm [d] 3.8 fm

3. An X-rays tube operates at 13.6 kV. What is the frequency of the most energetic X- rays produced?
[a] 3.29×10^{15} Hz [b] 3.29×10^{18} Hz [c] 3.29×10^{20} Hz [d] 3.29×10^{10} Hz

4. The half-life of thorium is 1.4×10^{10} years. The time required for 10% of a sample of thorium to disintegrate is
[a] 3×10^{9} years [b] 2.5×10^{11} years [c] 5×10^{10} years [d] 2.1×10^{9} years

5. The isotope ${}_6C^{11}$ decays into ${}_5B^{11}$.What kind of particle is emitted?
[a] a electron [b] a positron [c] a neutron [d] alpha particle

6. If the fission rate of U^{235} is 6.25×10^{10} fissions per second (the energy released per fission is 200 MeV) then the power produced in fission is equal to
[a] 10 watt [b] 2 watt [c] 4 watt [d] 5 watt

7. In Balmer series of hydrogen atom, H-alpha line is formed when electrons jump from
[a] 3^{rd} orbit to 2^{nd} orbit [b] 5^{th} orbit to2^{nd} orbit
[c] 4^{th} orbit to2^{nd} orbit [d] 4^{th}orbit to3^{rd} orbit

8. The wavenumber of the H-alpha line of Hydrogen is
[a] 0.1524×10^{7} m^{-1} [b] 0.95×10^{9} m^{-1} [c] 1.5×10^{7} m^{-1} [d] $2.3.95\times10^{8}$ m^{-1}

9. Rest mass energy of an electron is
[a] 1.02 MeV [b] 0.511 KeV [c] 0.511 MeV [d] 2.02 MeV

10. The wavelength of X-rays is of the order of
[a] 1 cm [b] 1 m [c] 1 micron [d] 1 A°

11. The radius of the first Bohr orbit is a_o. The n^{th} orbit has a radius:
[a] na_o [b] a_o/n [c] n^2a_o [d] a_o/ n^2

12. The energy required to detach one electron completely from H atom is equal to
[a] 13.6 eV [b] 10.2 eV [c] -1.5 eV [d] -3.4 eV

13. De-Broglie hypothesized that the linear momentum and wavelength of a free massive particle are related by
[a] Planck's constant [b] Boltzmann's constant
[c] the Rydberg constant [d] Avogadro's number

14. The potential difference applied to an X-ray tube is increased. As a result, in the emitted radiation:
[a] the maximum wavelength increases
[b] the minimum wavelength increases
[c] the minimum wavelength remains unchanged
[d] the minimum wavelength decreases

15. The relation between half-life $T_{1/2}$ of a radioactive sample and its mean life τ is:
[a] $T_{1/2} = 0.693\ \tau$ [b] $\tau = 0.693\ T_{1/2}$ [c] $\tau = T_{1/2}$ [d] $\tau = 2.718\ T_{1/2}$

Fill in the blanks.

16. The spacing between principal planes of NaCl crystal is 2.82 A°. It is found that first order Bragg reflection occurs at an angle of 10°.The wavelength of X-rays is _____.

17. The binding energy per nucleon for C^{12} is 7.68 MeV and that of C^{13} is 7.47 MeV then the energy required to remove a neutron from C^{13} is equal to _____.

18. The total accelerator voltage that will impart protons a velocity of 95% of the speed of light is _____.

19. A critical potential for hydrogen is 13.05 V. The wavelength of the radiation that will be emitted by a hydrogen atom when bombarded by an electron of corresponding energy is _____.

20. In Balmer series, the colour of H_α-line is _____.

KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

04 JUN 2019

Level : B.Sc.
Year : II
Time : 2 hrs. 30 mins.

Course : PHYS 203
Semester : I
F.M. : 55

SECTION "B"
[5Q. × 4 = 20 marks]

Attempt ALL questions.

1. What is photoelectric effect? Describe simple experiments to study photoelectric phenomena.

OR

Explain the working principle of scintillation counter.

2. What do you mean by particle accelerator? Describe the principle and working of linear accelerator.

3. Give the theory of radioactive disintegration of the radioactive substance undergoing the following decay scheme: $A \rightarrow B \rightarrow C$ (stable)

4. Give an account of the production, properties and application of X-rays.

OR

Explain the fine structure of H_α-line on the basis of vector model of atom.

5. Write short notes on:
(a) Nuclear Size (b) Packing fraction.

SECTION "C"
[5Q. × 7 = 35 marks]

Attempt ALL questions.

6. a) A UV light of 400 nm strikes a caesium surface of work function 1.9 eV. Find the velocity of electron emitted from the caesium surface. $e = 1.6\times10^{-19}$ C, $m_e = 9.1\times10^{-31}$ kg, $h = 6.6\times10^{-34}$ Js, and $C = 3\times10^{8}$ ms^{-1}

b) Calculate the distance of closest approach for a 5.5 Mev alpha particle in a head on collision with a gold nucleus (Z=79), $\varepsilon_o = 8.85\times10^{-12}$ Fm^{-1}, $e = 1.6\times10^{-19}$ C.

7. a) Calculate the binding energy of an α-particle and express the result both in the MeV and Joules.

b) In a normal Zeeman experiment, the spectral line of wavelength 4500 A° splits into three lines separated by 0.25 A° in a magnetic field of 3T. Determine e/m for the electron from these data.

8. Using Bohr's postulates obtain an expression for the energy level of hydrogen atom and show different spectral series in an energy level diagram.

OR

Give an outline of relativistic Sommerfeld theory of hydrogen atom. How does this theory explain the fine structure of H_α-line?

9. Describe Rutherford's scattering formula. How do you estimate the nuclear dimension from Rutherford scattering?

10. Describe three main processes of interaction of photons with matter by which radiation lose energy on passage through matter.

OR

Explain anomalous Zeeman Effect. Derive an expression for Lande's splitting factor.