

B.Sc.(Honours) Examination, 2019

Semester - IV

Physics (Allied)

Allied Course: BPA-41

Time: Three Hours

Full Marks: 40

Questions are of value as indicated in the margin.
Answer **four** questions taking at least **one** from each group.

Group – A

1. a) (i) Write down the expression for wavelength difference $\Delta\lambda$ between the incident and scattered rays from a X-ray scatterer.
(ii) From this calculate the value of Compton wavelength. Given $h = 6.62 \times 10^{-34}$ joule-s,
 $c = 3 \times 10^8$ m/s and mass of electron $= 9.11 \times 10^{-31}$ kg.
b) What are Stokes and anti-Stokes lines? Write two differences between them.
c) Establish the relation $E^2 = p^2 c^2 + m_0^2 c^4$, where symbols have their usual meaning.

(1+2)+(1+2)+4=10
2. a) "A moving clock runs slow". Explain this in the context of time dilation.
b) Find the velocity at which the mass of a particle becomes double its rest mass.
c) Define stopping potential. How does it vary with the frequency of incident light?
d) The work function of potassium is 2.24 eV. Calculate its threshold wavelength.
Given $1 \text{ eV} = 1.6 \times 10^{-19}$ joule.

3+2+(1+2)+2=10
3. a) Differentiate between unit cell and primitive unit cell. Explain with examples.
b) What are Miller indices? What is the interrelationship between Miller indices and the interplanar spacing between a family of planes?
c) If the intercepts of a plane along x, y and z axis are 1,2,3 units respectively find out the Miller indices of the plane. Draw the diagram.
d) State and explain Bragg's law with relevant mathematical expression and diagram.

3+2+3+2=10
4. a) What do you understand by packing fraction? Calculate the packing fraction of a simple cubic lattice.
b) State the law of exponential decay giving the relevant expression. Define half life. Hence find out an expression for the half life of a radioactive sample.
c) What is mean life? Write its expression in terms of the decay constant λ .

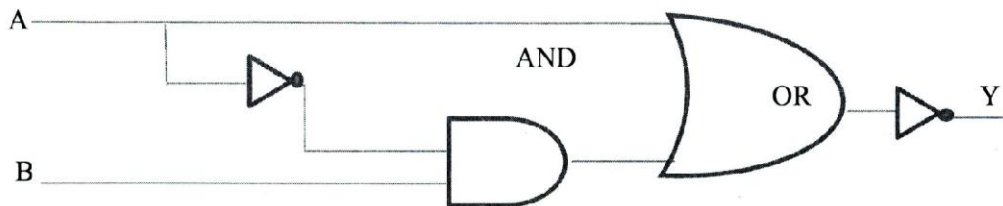
(1 + 3) + (1 + 1+2)+2=10
5. a) The half life of Radon is 4 days. After how many days will only 1/10 th of the Radon sample be left behind?
b) What do you understand by specific charge of an electron? In Thomson's method what is the condition for no deflection of the electron beam and what is the speed of the electron in the balanced condition?
c) What are cathode rays? State two of its properties.
d) An electron is moving with a velocity of 10^7 metre/sec. Find its energy in electron volt where $m = 9.1 \times 10^{-31}$ kg and $e = 1.6 \times 10^{-19}$ coulomb.

3+3+2+2=10

P.T.O.

Group – B

6. a) Obtain the binary representation of $(13.75)_2$.
 b) How can you construct an AND gate using NOR gate only? Explain with logic diagram and truth table.
 c) Write the Shockley equation for the current flowing in a p-n junction diode and hence explain the I-V characteristics in the forward and reverse biased mode of a diode with the relevant diagrams.
 d) In case of a transistor define the parameters α and β . $2+(1+2)+(1+2)+2=10$
7. a) Subtract $(10001)_2$ from $(10011)_2$ by 1's complement method.
 b) Write down the expression for the output Y and also prepare the truth table for the given logic diagram.



- c) Explain with circuit diagram the construction of a two input OR gate using semiconductor diodes. $3+(1+2)+4=10$
