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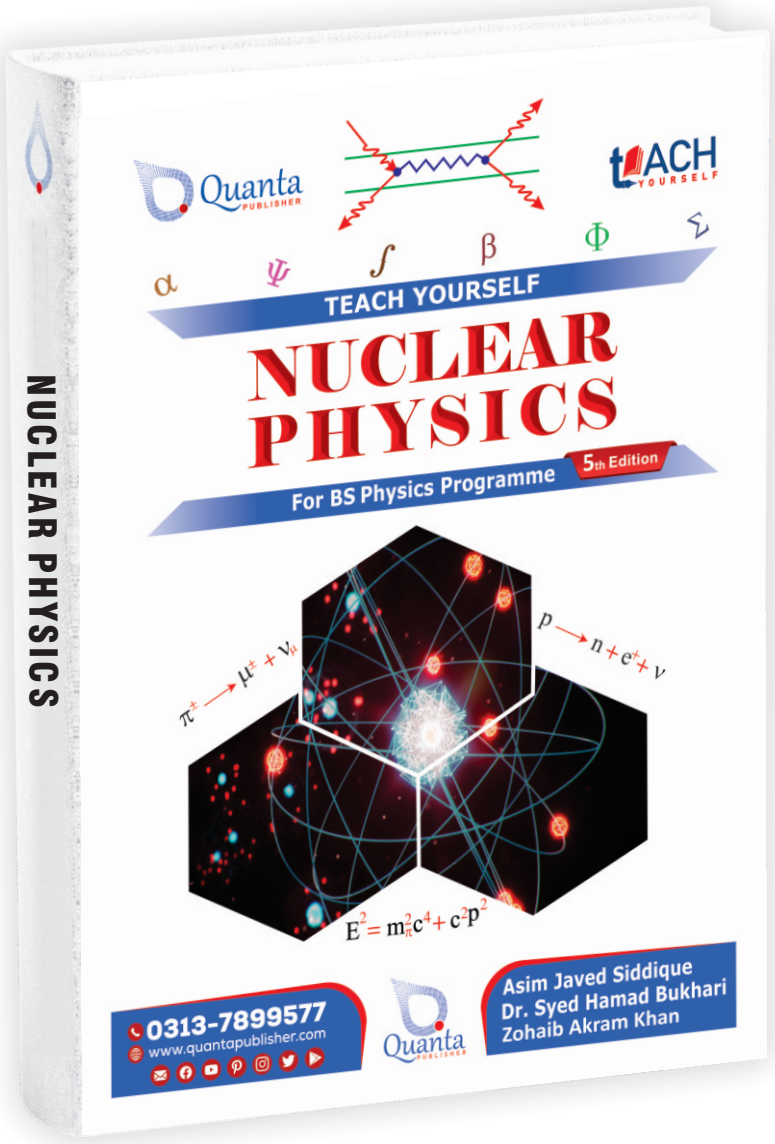
BS Physics

PAST PAPERS



UNIVERSITY OF THE PUNJAB

Roll No. .....

Seventh Semester 2018
Examination: B.S. 4 Years Programme

PAPER: Nuclear Physics-I **TIME ALLOWED: 30 mins.**
Course Code: PHY-403 **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

(Objective Type)

Attempt this paper on this sheet only.

Q. 1:-Encircle the correct answer out of the four options given. No mark will be awarded for cutting, overwriting and for use of lead pencil or ink remover. (1 x 10 = 10)

(i)- The ionization energy of an atom as compared to binding energy of its nucleus is:
(a) greater (b) same
(c) less (d) none of above

(ii)- Beta decay is also called ---------- transformation.
(a) isobaric (b) isotopic
(c) isotonic (d) none of above

(iii)- If electric dipole field has odd parity then magnetic dipole field will have ----- parity.
(a) even (b) odd
(c) mixed (d) zero

(iv)- According to shell model , even-even nuclei have spin:
(a) zero (b) one
(c) half (d) all of these

(v)- In scintillation counter, electrons are accelerated by:
(a) electric field (b) magnetic field
(c) oscillating field (d) both a and b

(vi)- Number of protons in a nucleus is called its.
(a) mass number (b) atomic number
(c) quantum number (d) none of above

(vii)- For spherically symmetric charge distribution, electric quadrupole moment is:
(a) positive (b) negative
(c) zero (d) not predicted yet

(viii)- Nuclear forces are:
(a) charge independent (b) spin dependent
(c) short range (d) all of above

(ix)- Each nucleon moves independently inside the nucleus in a fixed orbit. This is assumption of:
(a) liquid drop model (b) shell model
(c) collective model (d) all of above

(x)- In cyclotron, the frequency of rotation of charged particle decreases as the velocity:
(a) increases (b) decreases
(c) remains constant (d) none of above

UNIVERSITY OF THE PUNJAB

Seventh Semester 2018
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Nuclear Physics-I
Course Code: PHY-403

TIME ALLOWED: 2 hrs. & 30 mins.
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

(Subjective Type)

Attempt this paper on separate sheet provided.

Q. 2: **Write short answers of following questions.** **(10 x 2 = 20)**

(i)-Can we accelerate a neutron by cyclotron?

(ii)-Explain in few lines the concept that the working of a betatron is like that of a transformer.

(iii)-Give two properties of nuclear radiation used in detection instruments.

(iv)-Give differences between ionization chamber and proportional counter.

(v)-Give at least two reasons for acceptance of proton-neutron hypothesis for the constitution of nucleus.

(vi)-Why neutron number tends to exceed proton number in stable nuclei?

(vii)-The nucleons constantly emit and absorb pions. Why the neutrons and protons are never found with other than their usual masses?

(viii)-State similarities between nucleus and liquid drop model. (at least four).

(ix)-What is meant by range of alpha particles? On what factors it depend upon?

(x)-The law of conservation of energy and momentum are not obeyed in beta decay. How neutrino hypothesis explain this discrepancy?

Q. 3: **(a)**-What is principle of van de Graaff accelerator? Explain its construction and working. 01+ 05 + 01
Also give its uses.

(b)-What is meant by magnetic dipole moment? By giving an example show that magnetic moments are not additive. 01 + 02

Q. 4: **(a)**-How limitations of nuclear shell model were rectified by collective nuclear model. Also give achievements of collective nuclear model. 06

(b)- How charge particles passes through matter? Explain. 04

Q. 5: **(a)**-Explain theory of gamma decay in detail by explaining multi-polarity of gamma rays. 07

(b)- State basic properties of nuclear forces. 03

G.C University, Faisalabad

Final Term Examination Paper, Fall -2018

(For Affiliation Colleges)

Subjective Part

Subject: Nuclear Physics-I **Course Code: PHY-506**
Class: BS (PHY)6th **Time Allowed: 150min** **Total Marks: 30**

Name of Student: **Roll No:**

Note: Attempt All Questions.

Q#2

Drive in details the three processes for the interaction of gamma with matter.

Q#3

What is Energy mass distribution of fission fragments?

Q#4

Discuss Van De Graff Generator.

Q#5

What is elastic scattering of neutron in the Laboratory System (L-Systems) and center of Mass System (C-system). Derive $E/E_{o=A}^2 +1+2A \cos p/(A+1)^2$ and relation between angles 0 and Ø .

Q#6

Derive a relationship for the velocity and energy of alpha particles. Discuss their absorption.

BS Physics 7th Semester

Course Title: Nuclear Physics –II
Course Code: Phy –603
Credit Hour: 3(3 – 0)

Maximum Marks: 24
Time: 2:30 Hours
Fall-2018-19

BS PHYSICS(SEVENTH SEMESTER)

SUBJECTIVE PART

Note: Attempt all questions.

Q.1(a) Derive threshold energy equation $E_{th} = -Q\left(\frac{m_a + m_b}{m_a}\right)$ for a nuclear reaction X(a, b)Y.

(b) Calculate Q–value of a nuclear reaction $_1H^1(n, \gamma)_1H^2$. The nuclear mass of deuteron is 2.0147361 u. [6 + 2]

Q.2 Calculate magnetic moments for odd–even nuclei, even–odd nuclei and even–even nuclei using shell model. [2 + 6]

Q.3 Explain how Sun derives its energy using PP–I chain, PP–II chain and PP–III chain reactions and CNO cycle. [4 + 4]

GCUF

Government College University Faisalabad

EXTERNAL SEMESTER EXAMINATIONS SPRING 2020

BS PHYSICS(6th Semester)

Course Code: Phy – 506 Max Marks: 75(50 + 25)

Course Title: Nuclear Physics–I Cr. Hr(3 – 0)

MCQS Marks: 50 Time: 90 minutes

Choose the correct answer:

01. All nucleons are paired up in even–even nuclei. Its total angular momentum is
(a) J = 0 (b) J = 2
(c) J = – 2 (d) ± 2

02 Parity of even – even nucleons is
(a) Negative (b) Positive
(c) ± 3 (d) ± 1

03 Spin parity of even–even nuclei is
(a) $J^{\pi} = 0^{-}$ (b) $J^{\pi} = 1^{+}$
(c) $J^{\pi} = 0^{+}$ (d) $J^{\pi} = 2^{-}$

04 J of odd–even nuclei is decided by last
(a) Unpaired proton (b) Unpaired neutron
(c) Both a & b (d) None of these

05 J of even–odd nuclei is decided by last
(a) Unpaired proton (b) Unpaired neutron
(c) Both a & b (d) None of these

06 Nucleus of $_{28}Ni^{57}$ is
(a) Odd –Even (b) Even – Even
(c) Odd – Odd (d) Even –Odd

07 Spin of $_{1}H^{1}$ nucleus is
(a) $\frac{1}{2}$ (b) $\frac{3}{2}$
(c) 0 (d) 1

08 Spin of $_{1}H^{2}$ nucleus is
(a) $\frac{1}{2}$ (b) $\frac{3}{2}$
(c) 0 (d) 1

09 Spin of $_{8}O^{16}$ nucleus is
(a) $\frac{1}{2}$ (b) $\frac{3}{2}$
(c) 0 (d) 1

10 The isospin of a nucleus $_{z}X^{A}$ is
(a) $\frac{1}{2}(Z + N)$ (b) $\frac{1}{2}(Z - N)$
(c) $\frac{1}{2}(A - N)$ (d) $Z - N$

11 The isospin of $_{7}N^{14}$ nucleus is
(a) $\frac{1}{2}$ (b) $\frac{3}{2}$
(c) 0 (d) 1

12 The isospin of $_{8}O^{16}$ nucleus is
(a) $\frac{1}{2}$ (b) $-\frac{3}{2}$
(c) 0 (d) – 1

13 Quadrupole moment Q of a spherical nucleus is
(a) $Q = 0$ (b) $Q < 0$
(c) $Q > 0$ (d) All

14 Nuclear magneton(μ_N) is
(a) 5.05×10^{-27} J/T (b) 5.05×10^{-31} J/T
(c) 5.05×10^{-19} J/T (d) 5.05 J/T

15 The gyro–magnetic ratio for neutron is
(a) + 1.8324 rad/s. (b) – 8.8324 rad/s.
(c) Zero (d) – 1.8324 rad/s.

16 The nuclei above the band of stability are
(a) Neutron–rich (b) Proton–rich
(c) Electron rich (d) None of these

17 Neutron to proton ratio of C–13 nucleus is
(a) $\frac{1}{1}$ (b) $\frac{7}{6}$
(c) $\frac{4}{3}$ (d) $\frac{13}{3}$

18 Binding energy of α–particle is
(a) Zero (b) 28.2 MeV
(c) 4 MeV (d) 28.2 GeV

19 Binding energy per nucleon of α–particle is
(a) Zero (b) 7.05 MeV/A
(c) 4 MeV/A (d) 28.2 GeV/A

20 The BE/A is maximum for
(a) Copper (b) Zinc
(c) Zirconium (d) Iron

21. Nuclear force is
(a) Spin dependent (b) Charge independen
(c) Short range (d) All

22 The nuclides $_{16}S^{40}$, $_{17}C\ell^{40}$, $_{18}Ar^{40}$, $_{19}K^{40}$ and $_{20}Ca^{40}$ are
(a) Isotopes (b) Isotones
(c) Isodiaphers (d) Isobars

23 The nuclides $_{16}S^{36}$, $_{17}C\ell^{37}$, $_{18}Ar^{38}$, $_{19}K^{39}$ and $_{20}Ca^{40}$ are
(a) Isotopes (b) Isotones
(c) Isodiaphers (d) Isobars

24 The nuclides $_{6}C^{12}$, $_{8}O^{16}$, $_{7}N^{14}$ are
(a) Isotopes (b) Isotones
(c) Isodiaphers (d) Isobars

25 The mass density of nuclear matter is
(a) 2.4×10^{17} kg/m^3 (b) 2.4×10^{27} kg/m^3
(c) 2.4×10^{37} kg/m^3 (d) Zero

26 Which one is electrostatic accelerator
(a) Van de Graaff generator (b) Cyclotron
(c) Betatron (d) Synchrotron

27 Which one is cyclic accelerator
(a) synchrocyclotron (b) Cyclotron
(c) Betatron (d) All of these

28 Van de Graaff generator could acccelerate particles up to
(a) 10 MeV (b) 5 MeV
(c) 20 MeV (d) 50 MeV

29 Which of the following accelerate the particles in cyclotron?
(a) Electric field (b) Magnetic field
(c) Both (a) & (b) (d) None of these

30 Which of the following deflects the particle in cyclotron?
(a) Electric field (b) Magnetic field
(c) Both (a) & (b) (d) None of these

32 **In betatron, electron moves in orbit**
(a) of constant radius (b) of variable radius
(c) of radius as r^2 (d) of radius as r^3

33 **In betatron, electrons are injected during**
(a) decreasing magnetic field (b) peak magnetic field
(c) increasing magnetic field (d) zero magnetic field

34 **The vacuum chamber is coated with silver to**
(a) avoid any insulation (b) avoid eddy currents
(c) increase conductivity (d) none of these

35 **In synchrocyclotron, the frequency is**
(a) varied (b) kept constant
(c) varies as q^2 (d) varies as r^2

36 **For linear accelerator, the velocity is proportional to**
(a) n (b) n^2
(c) $\sqrt{n}$ (d) n^{-1}

37 **For linear accelerator, the distance travelled by ion depends on**
(a) n (b) n^2
(c) $\sqrt{n}$ (d) n^{-2}

38 **The photomultiplier converts light energy into**
(a) Electrical energy (b) Sound energy
(c) Heat energy (d) Nuclear energy

39 **The tungsten wire fixed along the axis of GM tube acts as**
(a) Anode (b) Cathode
(c) Grid (d) Triode

40 **Cyclotron cannot accelerate**
(a) Neutron (b) Deuteron
(c) Proton (d) All of these

41 **The region of two dees of cyclotron acts as**
(a) Faraday cage (b) Gauss cage
(c) Einstein cage (d) Pascal cage

42 **Which of the following is alpha particle**
(a) $_{+1}e^0$ (b) $_{-1}e^0$
(c) $_0n^1$ (d) $_2He^4$

43 **Which of the following is β^{-1} particle**
(a) $_{+1}e^0$ (b) $_{-1}e^0$
(c) $_0n^1$ (d) $_2He^4$

44 **Which of the following is β^{+1} particle**
(a) $_{+1}e^0$ (b) $_{-1}e^0$
(c) $_0n^1$ (d) $_2He^4$

45 **Which of the following is true for gamma ray. It carries**
(a) Positive charge (b) Negative charge
(c) Infinite mass (d) Zero rest mass and neutral

46 **Which type of radiation is stopped by a sheet of paper**
(a) Alpha particle (b) Beta particle
(c) Gamma ray (d) X rays

47 **Which is missing element from the equation $_{88}Ra^{226} \rightarrow ? + _2He^4$**
(a) $_{86}Rn^{230}$ (b) $_{86}Rn^{220}$
(c) $_{86}Rn^{228}$ (d) $_{86}Rn^{222}$

48 **Which is missing element from the equation $_6C^{14} \rightarrow ? + _{-1}e^0$**
(a) $_7N^{13}$ (b) $_6C^{12}$
(c) $_8O^{17}$ (d) $_7N^{14}$

49 **A reaction that releases more energy that is put into is called**
(a) Endothermic (b) Exothermic
(c) Nuclear (d) **Chemical**

50 **The reaction $_0n^1 + _{92}U^{235} \rightarrow _{36}Kr^{92} + _{56}Ba^{141} + 3\ _0n^1$ is called**
(a) Fission (b) Alpha decay
(c) Fusion (d) Beta decay

Roll.....

GC University, Faisalabad.

External semester Examination Spring -2022

Degree/Discipline: BS Physics (6th Semester)
Course Title: Nuclear Physics-I
Course Code: PHY-506

Time: 30 minutes

Objective part
Marks: 20
Credit Hours: 3(3-0)

Q.NO.1. Choose the right one:

1. The actual mass of a ^{35}Cl atom is 36.966 amu. Calculate the mass defect (amu/atom) for a ^{35}Cl atom.
A. 0.623 amu B. 0.388 amu C. 0.263 amu D. 0.341 amu
2. The half-life of radioactive carbon is 5600 years. What will be the time after which the activity has reduced to one-quarter?
A.2800 years B. 8400 years C.1400 years D.11200 years
3. A nucleus consists of 90 protons and 144 neutrons. After emitting two beta-particles followed by an alpha-particle, this nucleus has:
A. 90P and 140 N B.86 P and 142 N C.90 P and 142 N D.86 P and 140N
4. The decay rate of an isotope is initially $R0$ but after one half-life has gone by, the rate is $R0/2$. At the end of the *next* half-life, the decay rate will be:
A. 0 B. $R/4$ C. R/e D. $R/2$ E. R/e^2
5. When free protons and neutrons join to form a nucleus the energy is:
A. Absorb B. Destroyed C. Created D. Stays the same E. Released
6. If the half-life time of a radioactive material is 2 days, how much of the material will be left after 6 days?
A. 1/2 B. 1/4 C. 1/6 D. 1/8 E. 1/16
7. Which of the following about the gamma ray is true?
B. It carries a negative charge. C. It can be deflected by a magnetic field.
D. It can be deflected by an electric field. E. It has zero rest mass and a neutral charge.
8. When nucleons form a stable nucleus, binding energy is:
A. created from nothing. B. destroyed into nothing.
C. transformed into visible light. D. absorbed as high energy photons or particles.
E. released as high energy photons or particles.
9. An isotope with a high Binding Energy per nucleon:
A. will decay in a short period of time. B. is very unstable. C. is very stable.
D. has very few electrons. E. has more protons than neutrons.
10. What force is responsible for the radioactive decay of the nucleus?
A. Gravitational force B. Weak Nuclear force C. Strong Nuclear force D. Electromagnetic force
11. Most stable isotope in nature is of
A. Iron-56 B carbon-12 C.uranium-235 D.uranium-238
12. Any charged particle n motion creates a
A. Electric field B. Magnetic field C. spin. D. None
13. One atomic mass unit (AMU) is equal to
A. 1.66×10^{-24} g B. 1.66×10^{-22} g C. 1.66×10^{-27} g D. 1.66×10^{-29} g
14. What law did Ernest Rutherford use to estimate the size of the nucleus?
A. Conservation of nucleon number B. Conservation of angular momentum
C. Conservation of linear momentum D. Conservation of energy
15. What force is responsible for the radioactive decay of the nucleus?
A. Gravitational force B. Weak Nuclear force C. Strong Nuclear force D. Electromagnetic force
16. As per radioactive decay law, the small amount of disintegration of the isotope in a small period is equal to
A. $-\lambda N$ B. λN C. $-2\lambda N$ D. $2\lambda n$
17. The average (mean) life for particle decay is
A. 1.145 times greater than half-life B. 1.245 times greater than half life
C.1.345 times greater than half-life D. 1.445 times greater than half life
18. Which of the following is not true of the nuclear force?
A. For two protons in close proximity, the nuclear force and the electric force have comparable magnitudes.
B. The nuclear force has a short range, of the order of nuclear dimensions.
C. Nucleon in large nucleus interacts via nuclear force only with nearby nucleons, not with ones far away.
D. The nuclear force does not depend on charge.
E. The nuclear force favors binding of pairs of protons or neutrons with opposite spin angular momenta.
19. Which one of the following statements about the atomic nucleus is accurate?
A.The nucleus is held together mostly by the electrical and gravitational forces.
B. Large nuclei are denser than light nuclei C. All nuclei have nearly the same density.
D.A nucleus containing 20 nucleons will have approximately twice the radius as a nucleus containing 10 nucleons.
E. Heavy nuclei most easily undergo nuclear fusion.
20. Nucleus "a" contains 5 protons and 5 neutrons and has radius R. The radius of nucleus "b", which contains 35 protons and 45 neutrons, is closest to:
A. $8R$ B. R C. $2R$ D. $1.4R$ E. $4R$

GC University, Faisalabad.

External semester Examination Spring -2022

Degree/Discipline: BS Physics (6th Semester)
Course Title: Nuclear Physics-I
Course Code: PHY-506

Time: 2 Hours: 30 minutes

Subjective part
Marks: 80
Credit Hours: 3(3-0)

Note: Attempt all questions.

Q: No: 2

(a) Define parity, even and odd parity. Write the mathematical form of parity and the factor on which the parity depends. 10

(b) Discuss the working of GM counter by drawing the voltage diagram. And also define the terms of dead time and recovery time. 10

Q: No: 3

(a)What are design parameters for a cyclotron i-e to accelerate alpha particle to a maximum energy of 30Mev.The Dees are to have a radius of r = 0.6m 06

(b) Compare the properties of alpha, beta and gamma rays in detail. 10

Q: No: 4

(a) Discuss the working of Cyclotron by drawing the diagram. And show that for a particle of constant mass the frequency does not depend upon the radius of the particles orbit. 12

(b) Derive the expression for radioactive decay law by taking N_o number of atoms at t= 0. 10

Q: No: 5

(a) Describe the following terms in detail 12

1- Nuclear mass

2- Nuclear size

(b) By considering mean field potential which decreases with distance r, how Yukawa calculated the mass of an intermediate meson? 10

Course Code: PHY-506 Course Title: Nuclear Physics-I Semester: 6th

Time Allowed: 100 minutes Marks: 24 Session: 2019-2023

Q NO 1:

a) Differentiate between linear accelerator and betatron?
b) Why is the velocity of particles inside the dees of the cyclotron constant?
c) What is virtual particle?
d) Prove 1amu=931?
e) What do you understand by internal conversion?

Q NO 2:

Draw a sketch of G.M. Counter. Explain its aim, construction and working.

Q NO 3:

Give an overview about the passage of charged particles through matter?

Q NO 4:

Write a detail note on multipolarity of Gamma rays.

Roll. 6

GC University, Faisalabad.

External semester Examination Fall2021-2022

Degree/Discipline: BS Physics (7th Semester)
Course Title: Nuclear Physics-II
Course Code: PHY-603

Time: 2hrs.30 mints

Objective part
Marks: 80
Credit Hours: 3(3-0)

Note: Attempt all questions. All questions carry equal marks.

Q: No: 2

(a) Define nuclear cross section and its unit. Mathematically derive the statement, the nuclear cross secti the no of reactions taking place per unit volume per second for unit incident flux and unit atomic density 10

(b) For a nuclear reaction in which a light projectile M_x of kinetic energy E_x interact with a nucleus M_X (assumed stationary) the outgoing particle is M_y of energy E_y and the product heavy nucleus is M_Y of e E_Y derive the Q value equation for this reaction. 10

Q: No: 3

(a) The excitation energy is approximately equal to the kinetic energy of the incident particle E_K plus it binding energy in the compound nucleus E_B. Derive the net excitation energy in the form 10

$$E_e = E_K \left(\frac{M_X}{M_X + m_a}\right) + E_B$$

(b) Write the Breit-Wigner formula and explain the terms in this equation. How this formula is differer the general formula for cross section. 10

Q: No: 4

(a) In carbon nitrogen cycle the carbon and nitrogen are not used up but are regenerated. Justify the sta by writing this cycle reaction.

(b)For which useful purpose the D-T reactions can be used. Show graphically the variation of fusion cr section as a function of deuteron energy. 10

No: 5

(a) How collective model is different from the other models. Discuss in detail by considering the assum made for collective model 10

(b) Find the total angular momentum and parity for the ground state of $_{16}S^{33}$ nucleus from shell model. the electric quadrupole moment of $_{16}S^{33}$ from collective model. 10

Roll.....

GC University, Faisalabad.

External semester Examination Fall 2021-2022

Degree/Discipline: BS Physics (7th Semester)
Course Title: Nuclear Physics-II **Time: 30 mints**
Course Code: PHY-603

Objective part
Marks: 20
Credit Hours: 3(3-0)

Q. No.1: Choose the correct option and encircle it.

1. Realistic potential used to find occupancy and position of energy levels of nucleons
(a) Rectangular potential (b) Harmonic oscillator potential(c) woods-saxon potential (d) step potential
2. What happens when a neutron is absorbed by a nucleus of an atom of U2357
a) Mass number increases b) 1 electron is let out c) U^{236} isotope form d) Nucleus becomes unstable

3. Most of the energy released in fission process is in process of _____
a) Kinetic Energy b) Thermal Energy c) Light Energy d) Heat Energy

4. _____ nuclear reactor does not require a heat exchanger to supply steam to power turbine.
a) Pressurized water b) boiling water c) helium cooled d) molten sodium cooled

5. Thermal neutrons which are used to cause the fission of U-235 have energy _____ eV.
a) <1 b) <0.025 c) >200 d) 1-25

6. Which of the following types of nuclear reactors is most prone to radioactive hazards?
a) Gas cooled reactor b) Molten Sodium Reactor c) Boiling water reactor d) Pressurized water reactor

7. Value of binding fraction in Mev per nucleon for uranium is approximately
a) 5.6 b) 6 c) 7.6 d) 7

8. The sharp resonance in elastic scattering is explained by
(a) Shell model (b) L.D.M (c) collective model (d) optical model

9. The term $(A-2Z)^2/A$ is the energy
(a) Symmetry (b) coulomb (c) surface (d) Asymmetry

10. The magic numbers are
(a) 36, 54, 86 (b) 34, 54, 84 (c) 18, 36, 82 (d) 36, 54, 120

11. Collective model of nucleus explain the
(a) Magnetic quadrupole moment (b) nuclear isomerism (c) stripping reactions (d) none

12. Coulomb disruptive energy is proportional to
(a) Z^2/A (b) Z^2 (c) Z^2/A^2 (d) ZA^2

13. Potential energy of La-148 and Br-87 fission products is
(a) 200 Mev (b) 190 Mev (c) 150 Mev (d) 198 Mev

14. Internal temperature of Sun is
(a) 6×10^7 K (b) 5×10^7 K (c) 7×10^7 K (d) 2×10^7 K

15. Fast neutrons having energy greater than one Mev can cause fission of
(A) $_{92}U^{238}$ (B) $_{92}U^{235}$ (C) Both A& B (D) None

16. The nuclear reaction X ------ Y + Z occurs spontaneously. If Mx, MY, and MZ are the masses of the three particles, which of the following relationships is true?
(a) Mx < My - Mz (b) Mx < My + Mz (c) Mx > My + Mz (d) Mx - My < Mz

17. A free proton (mp = 1.007825 U) captures a neutron (mn = 1.008665 U) and forms a deuterium (md = 2.014102 U). Which of the following is true about the mass of deuterium?
(a) Less than 1.007825 U + 1.008662 U (b) Greater than 1.007825 U + 1.008662 U
(c) Less than 1.007825 U - 1.008662 U (c) It is equal to 1.007825 U + 1.008662 U

18. How many neutrons are released during the following reaction? $_{92}U^{235} + _0n^1 \rightarrow _{38}Sr^{88} + _{54}Xe^{139} + ?\ _0n^1$
(a) 2 (b) 3 (c) 4 (d) 6 (e) 12

19. The nuclear forces inside the nucleus are
(a) Short range (b) long range (c) large (d) None

20. A nucleus consists of 90 protons and 144 neutrons. After emitting two beta-particles followed by an alpha-particle, this nucleus has:
(a) 90P and 140 N (b)86 P and 142 N (c)90 P and 142 N (d)86 P and 140N

External semester Examination Fall2022-2023

Degree/Discipline: BS Physics (7th Semester)
Course Title: Nuclear Physics-II Time: 2hrs.30 mints
Course Code: PHY-603

Subjective part
Marks: 80
Credit Hours: 3(3-0)

Note: Attempt all questions. All questions carry equal marks.

Q: No: 2

(a) Define nuclear reaction, differentiate artificial and natural radioactivity. Discuss various types of nuclear reactions 10

(b) For a nuclear reaction in which a light projectile M_x of kinetic energy E_x interact with a nucleus M_X (assumed stationary) the outgoing particle is M_y of energy E_y and the product heavy nucleus is M_Y of energy E_Y derive the Q value equation for this reaction. 10

Q: No: 3

(a) The excitation energy is approximately equal to the kinetic energy of the incident particle E_K plus its binding energy in the compound nucleus E_B. Derive the net excitation energy in the form 10

$$E_e = E_K \left(\frac{M_X}{M_X + m_a}\right) + E_B$$

(b) Write the Breit-Wigner formula and explain the terms in this equation. How this formula is different from the general formula for cross section. 10

Q: No: 4

(a) In carbon nitrogen cycle the carbon and nitrogen are not used up but are regenerated. Justify the statement by writing this cycle reaction. 10

(b) Explain how Bohr-wheeler theory explained the nuclear fission on the basis of liquid drop model? 10

Q: No: 5

(a) How collective model is different from the other models. Discuss in detail by considering the assumptions made for collective model. 10

(b) Find the total angular momentum and parity for the ground state of $_{16}S^{33}$ nucleus from shell model. Also find the electric quadrupole moment of $_{16}S^{33}$ from collective model. 10