QP CODE: 22100926

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, APRIL 2022

Sixth Semester

CORE - PH6CRT10 - RELATIVITY AND SPECTROSCOPY

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

E17A7579

Time: 3 Hours   Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What are inertial frames of reference?

2. Write down the Galilean transformation equations.

3. Write down Lorentz transformation equations.

4. Explain how the binding energy per nucleon is explained based on mass energy equivalence.

5. List any two physical phenomena explained with the help of quantum theory of radiations.

6. What is the relation between S and M_s?

7. What is the value of spin angular momentum?

8. Write an expression to find out Lande g factor using quantum numbers L, S and J.

9. Define fluorescence.

10. Name the main components of a microwave spectrometer.

11. List the basic requirements for a NMR spectrometer.

12. What is the application of ESR?

(10×1=10)

13. Assuming Lorentz-Fitzgerald contraction, calculate the apparent length of a meter scale moving at a speed of 2.5×10^8 m/s.

14. At what speed is a particle moving it the mass is equal to three times its rest mass.

15. Write a note on general theory of relativity.

16. With the help of a diagram , explain α particle scattering experiment.

17. A beam of electrons bombards a sample of Hydrogen. Through what potential difference must the electrons be accelerated if the first line of Balmer series is to be emitted?

18. Determine possible values of total angular momentum of an f electron according to vector atom model.

19. Compare the intensities of spectral lines of CO molecule for the spectral lines J=1 to 0 and J=2 to 1 at 300 K. Given that 2B=3.84235. Mass of Carbon atom is 12.000 X 1.67343×10^{-27} kg , and that of oxygen atom is 16.9994 X 1.67343×10^{-27} kg.

20. The fundamental vibration frequency of HCl is 2989 cm^{-1} find the force constant of HCl molecule.Given m_H =1.673 x 10^{-27} kg , m_{Cl} =58.06x 10^{-27} kg .

21. With neat diagram explain the experimental setup to observe Raman effect.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Explain three consequences of Lorentz transformations.

23. Discuss the addition of velocities and prove that nothing can travel faster than c.

24. Discuss the quantum theory of anomolous Zeeman Effect.

25. Explain the quantum theory of Raman spectroscopy of molecules. How it is differ from that of the classical theory? How the intensity of stokes and anti-stokes lines can be explained by quantum theory of Raman Effect?

(2×10=20)

QP CODE: 23105168

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, MARCH 2023

Sixth Semester

CORE COURSE - PH6CRT10 - RELATIVITY AND SPECTROSCOPY

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

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Time: 3 Hours   Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Explain newtonian relativity.

2. Write the two assumptions of Galilean transformation equations.

3. Write the final expression for the addition of velocities.

4. State the principle of equivalence in general theory of relativity.

5. Breifly descibe the Quantum theory of radiation.

6. What is meant by 'stationary' orbits for an electron?

7. What are the new concepts introduced by the vector atom model?

8. Write all the posssible values of the quantum number J of an atom for which L=3 and S=1.

9. Write the selection rules for a rotational and vibrational transition of a diatomic molecule.

10. How fluorescence and phosphorescence occur in molecules?

11. CH4 do not show IR or Microwave spectrum. But it shows Raman spectrum. Justify your answer.

12. Write any two medical applications of NMR.

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Calculate the length of rod of length one meter moving with a speed of 2.5×10^8 m/s.

14. Find the total energy of neutron whose momentum is 1.2GeV.

15. Calculate the KE of an electron moving with a velocity of 0.98 c in the laboratory system.

16. Explain Thomson's model of atom.

17. Write a note on orbital and spin magnetic moment of an electron.

18. How strong is LS coupling in Paschen-Back Effect?

19. [a] What is meant by the term induced dipole moment?[b] Give the expression for induced dipole moment of a molecule exposed to external radiation.

20. With a help of a neat diagram explain the working of a microwave spectrometer.

21. Explain the theory of ESR and the construction of ESR spectrometer.

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Describe Michelson-Morley experiment and explain the results.

23. Derive the basic equation of Lorentz transformation and prove that at very low velocity the lorentz transformation equation reduces to Galelian trnasformation equations.

24. What is anomalous Zeeman effect? Explain it using vector atom model.

25. Explain the rotational spectrum of diatomic molecules. How much the spectral lines are separated and how the intensity of the lines varies with temperature.

BSc DEGREE (CBCS) EXAMINATION, MARCH 2020

Sixth Semester

Core course - PH6CRT10 - RELATIVITY AND SPECTROSCOPY

B.Sc Physics Model I,B.Sc Physics Model II Computer Applications,B.Sc Physics Model III Electronic Equipment Maintenance,B.Sc Physics Model II Applied Electronics

2017 Admission Onwards

6DD1DCF3

Time: 3 Hours

Marks: 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Distinguish between inertial and non-inertial frame of reference.

2. What is the importance of Michelson-Morley experiment?

3. Discuss the concept of space and time in the special relativity theory.

4. Explain gravity waves.

5. How is a continuous spectrum produced?

6. What is the direction of spin magnetic moment of an electron with respect to its spin angular momentum?

7. What are the possible values for the total angular momentum quantum number J for an atom with orbital angular momentum quantum L and spin angular momentum quantum number S?

8. What is anomalous Zeeman effect?

9. Iron could not be heated with a Microwave oven. But microwave oven can be used to heat food materials. Why?

10. Briefly explain the experimental arrangement of Raman effect.

11. What is the use of Raman spectroscopy?

12. Give the equation resonance condition in NMR.

(10×1=10)

Answer any **six** questions.

Each question carries **5** marks.

13. Obtain Galilean transformation equations.

14. Calculate the length of rod of length one meter moving with a speed of 2.5×10^8 m/s.

15. Find the speed and momentum of a proton whose total energy is 3.5GeV.

16. The series limit wavelength of Balmer series in Hydrogen spectrum is 364.6 nm . Find the wavelength of the first member of this series.

17. Explain the concepts underlaying vector atom model.

18. How is anomolous Zeeman Effect is exaplained using quantum theory?

19. Derive the expression for energy of a diatomic molecule from the theory of a harmonic oscillator

20. Obtain a simple relation for the relative intensity of Stokes lines and anti Stokes lines. How does the intensity varies with temperature?

21. A free electron is placed in a magnetic field of strength 1.3 T. Calculate the resonance frequency if g=2.0023.

$(6 \times 5 = 30)$

Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Derive the basic equation of Lorentz transformation.

23. Derive Einstein's mass energy relation. Give examples to prove the mass energy equivalence.

24. Explain how Rutherford developed the nuclear theory of the atom.

25. Explain the occurrence of Raman effect based on the Classical theory.

$(2 \times 10 = 20)$

B.Sc DEGREE (CBCS) EXAMINATION, APRIL 2021

Sixth Semester

CORE COURSE - PH6CRT10 - RELATIVITY AND SPECTROSCOPY

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

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Time: 3 Hours   Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Explain Newtonian relativity.

2. Write down the Galilean transformation equations.

3. Write down inverse Lorentz transformation equations.

4. Explain gravitational red shift.

5. Explain why scattering of α particles by thin foils take place.

6. What are the different regions of the electromagnetic spectrum?

7. Name all the quantum numbers employed in the vector atom model.

8. Is LS coupling applicable to all the atoms?

9. What is asymmetric top molecule? Give an example.

10. Why does the glass tube of a fluorescent lamp is coated with phosphor?

11. What is Rayleigh scattering?

12. Define ESR.

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. What is the mean life of a meson travelling with a velocity 70% of the velocity of light? The proper mean life time is 2.2×10^{-8}s.

14. A particle of rest mass m_0 moves with speed .707 c, Calculate its mass, momentum, total energy and KE.

15. Calculate the kinetic energy of an electron moving with a velocity 0.98 times the velocity of light in the laboratory system.

16. The first member of the Balmer series of Hydrogen spectrum has a wavelength of 656.3 nm. Compute the wavelength of the second member of the Paschen series.

17. Prove that M shell can contain a maximum of 18 electrons. Represent (n, l, m_l, m_s) values of these 18 electrons.

18. Derive an expression for Lande g factor.

19. Calculate the zero point energy of HCl molecule. Given m_H =1.673 x 10^{-27} kg , m_{Cl} =58.06x 10^{-27} kg and force constant is 481 N/m.

20. [a]What is meant by the term induced dipole moment?
[b]Give the expression for induced dipole moment of a molecule exposed to external radiation.

21. Explain the principle of NMR and obtain the resonance condition.

(6×5=30)

Part C

*Answer any **two** questions.*
*Each question carries **10** marks.*

22. Describe Michelson-Morley experiment and explain the results.

23. Deduce relativistic law of addition of velocities and prove that the velocity of light is the maximum attainable velocity in nature.

24. Discuss the theory of Paschen-Back Effect.

25. Explain the construction of Microwave and Raman spectroscopes.

(2×10=20)