1B6A24310 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2024

BPH6B10 - Thermodynamics

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

The symbols used in this question paper have their usual meanings

Section A - Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What do you understand by macroscopic and microscopic viewpoints of thermodynamic system?
2. Give theoretical basis of ideal gas temperature scale.
3. State and explain first law of thermodynamics.
4. Define molar heat capacity. What is its unit?
5. Define intensive and extensive coordinates.
6. Why efficiency of heat engine is always less than unity?
7. Distinguish between ideal gas and real gas.
8. Define (a) reversible process and (b) irreversible process.
9. State Clausius' statement of second law of thermodynamics.
10. Give the principle of increase of entropy.
11. Define Gibbs function. Give its role during phase change.
12. What is a throttling process?

(Ceiling – 20)

Section B - Paragraph/Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Using PV diagram show that hydrostatic work depends on path.
14. One mole of a gas at 32^0C expands adiabatically until its volume is doubled. Calculate the work done (γ= 1.4).
15. From the first law of thermodynamics derive the relation C_p-C_v=nR.
16. Calculate change in entropy when 100g of water at 40^0C is converted into steam at 100^0C.

    Specific heat of water = 4200 J/Kg/K, Latent heat of steam = 2.26 x10^5J/Kg.
17. Derive Clausius' inequality for any closed irreversible process.

18. Explain internal and external irreversibility with suitable example.

19. Write down Clausius-Clapeyron equation. Explain the effect of pressure on the melting and boiling point of substance.

(Ceiling – 30)

Section C –Essay Type

(Essays - Answer in about two pages, any one question. Answer carries 10 marks)

20. Describe the working of a Carnot's engine.Derive expression for efficiency.

21. Obtain Maxwell's equations from basic thermodynamic relations. Explain how entropy change is calculated using Maxwell equation.

(1x10 = 10)

60

1B6A24311 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2024

BPH6B11 - Statistical Physics, Solid State Physics, Spectroscopy and Photonics

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

The symbols used in this question paper have their usual meanings

Section A - Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is Morse curve?
2. Briefly explain about crystal symmetry.
3. What is a unit cell and space lattice?
4. Define the term rotational constant.
5. Define the term packing fraction.
6. What are hot bands? Why are they called so?
7. Give any two applications of LASER
8. What are P and R branches?
9. What are metastable states?
10. Explain Raman Effect.
11. What is phase space?
12. What are miller indices?

(Ceiling -20)

Section B - Paragraph /Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries maximum of 5 marks)

13. What is Raman Effect? Explain the quantum theory of Raman Effect.
14. The fundamental and first overtone transitions of $^{14}N^{16}O$ are centred at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibration frequency, the anharmonicity and the exact zero point energy
15. Deduce the packing factor for body centred cubic structure
16. List out the properties of Fermi-Dirac statistics.
17. Mark the (1, 0, 1) position, [001] direction and draw (110) plane in simple cubic structure.
18. Describe various pumping techniques.
19. Explain the effect of an harmonicity on the vibrational spectra of diatomic molecule.

(Ceiling-30)

SECTION C- Essay type

(Essays - Answer in about two pages, any one question. Answer carries 10 marks)

20. State the features of Maxwell-Boltzmann distribution. Derive an expression for the average energy of an ideal-gas molecule.
21. Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator

(1x10= 10 marks)

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1B6A24312 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2024

BPH6B12 - Nuclear Physics And Particle Physics

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

Section A-short answer type

Answer all questions in two or three sentences, each correct answer carries 2 marks.

1. Discuss about the energy release in fission reaction
2. What are the advantages of a scintillation counter?
3. What do you mean by threshold kinetic energy of nuclear reaction, write down the expression for it.
4. How does the conservation of energy and momentum in beta decay explained by Pauli?
5. Explain the nuclear reaction cross section, obtain the expression for it
6. What is the principle of the working of a proportional counter
7. Calculate the approximate nuclear radius of bismuth (A=209)
8. What is neutron activation analysis?
9. What is the limitation of linear accelerator?
10. What are quarks?
11. Write down characteristicsof nuclear forces
12. What is the principle of working of the cyclotron?

(Ceiling-20)

Section B -Paragraph/Problem type

Answer all questions in half a page to one page, each correct answer carries 5 marks.

13. What do you mean by alpha decay of a radioactive nucleus? Explain the quantum theory of alpha decay.
14. Compute the Q value of the reactions:
    a) $^{3}He + ^{40}Ar \longrightarrow ^{41}K + ^{2}H$
    b) $^{7}Li + ^{2}H + ^{8}Be + n \longrightarrow$
    c) $p + ^{2}H \longrightarrow 2p + n$

15. An ionization chamber is connected to an electrometer of capacitance 0.5 pF and voltage sensitivity of 4 divisions per volt. A beam of α-particles causes a deflection of 0.8 divisions. Calculate the number of ion pairs required and the energy of the α-particles. (Given that 1 ion pair requires energy of 35 eV)
16. Discuss the nuclear fusion processes in stars
17. Name the conservation law that would be violated in each of the following:
    a) $\Lambda^0 \longrightarrow \pi^- + \pi^+$
    b) $\Omega^- \longrightarrow \Sigma^- + \pi^0$
    c) $p + pp + p + \Lambda^0 + K^0 \longrightarrow$
    d) $\Xi^0 \longrightarrow \Sigma^0 + \pi^0$
    e) $p + pp + n + K^+ \longrightarrow$
18. The atomic mass of the zinc isotope $^{64}_{30}Zn$ is 63.929u. calculate its binding energy and compare the value with binding energy prediction of semi empirical binding-energy formula.
19. Discuss the working of an electron synchrotron.

(Ceiling-30)

Section C-Essay type

(Essays- Answer in about two pages, any one question. Answer carries 10 marks)

20. What are magic numbers? How does the magic number arises, explain with the help of nuclear shell model.
21. What are nuclear radiation detectors? Explain the construction and working of a GM counter. List the advantages and disadvantages of it.

(1 × 10 = 10 Marks)

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1B6A24313 (Pages : 2) Reg. No:. .....

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2024

BPH6B13 - Relativistic Mechanics ad Astrophysics

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

The symbols used in this question paper have their usual meanings

Section A – Short answer type

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What are the postulates of special theory of relativity ?
2. What is twin paradox? Why is it called a paradox ?
3. If Person A is moving towards person B at 0.5c and person B shines a light beam at person A, what speed will person A measure for the speed of the light beam, considering the inertial frame of reference? Explain your answer
4. What is proper time interval ?
5. Explain Hubble's law of cosmic expansion.
6. What is gravitational lensing >
7. State the Cosmological principle.
8. A star has a parallax of 0.4 arcseconds. How much is its distance from the Earth in parsec?
9. Give the relationship between distance, brightness and luminosity.
10. Explain relation between colour and surface temperature of a star.
11. Is the white dwarf a stable equilibrium state? Explain why.
12. What are the features of Population-I stars?

(Ceiling 20)

Section B – Paragraph/problem type

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. A rod with proper length of 5 m moves along x-axis, making an angle of 30° with respect to the x-axis. If its speed is c/3 m/s. where c is the velocity of light, what is the change in length due to Lorentz contraction ?
14. A star emits a light of wavelength 6000Å. Due to Doppler Effect, the shift in the wavelength observed is 0.1Å. What is the velocity of the recession of the star ?
15. Discuss any two tests of general theory of relativity.
16. Draw and explain Hertzsprung – Russel Diagram.
17. What is absolute magnitude (M) of a star. Sirius is at a distance of 2.63 pc and has an apparent magnitude of -1.44. What is its absolute magnitude ?
18. Briefly describe the internal structure of Sun.
19. Write a brief note on Active Galactic Nuclei (AGN)

(Ceiling 30)

Section C – Essay type

(Essays – Answer in about two pages to one page, any one question. Answer carries 10 marks)

20. Obtain the mass dependence on speed of the particle needed to preserve the conservation of momentum in relativistic mechanics. Explore the experimental variations observed in the mass of an electron with respect to its speed.
21. Explain the star formation and life cycle of stars.

1B6A24314 (Pages : 1) G3 Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2024

BPH6B14(E3) - Material Science

(2019 Admission onwards)

Time: 2 hours Max. Marks : 60

The symbols used in the question paper have their usual meanings

Section A – Short Answer Type

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. Briefly explain the applications of three metal oxides in materials science
2. What is CFRP and what are the applications ?
3. Discuss crystallographic Planes and directions
4. What are Schottky defects?
5. Discuss atomic vibrations and phonons
6. Discuss the Atomic packing factor and coordination number in a simple cubic structure
7. Explain polar molecules and induced dipole
8. Briefly discuss diffusion in solids
9. Differentiate between Optical Microscopes and Electron microscopes
10. What is isomerism in polymers ?
11. Write a note on refractories
12. What are the applications of Polymeric materials ?

(Ceiling 20 marks)

Section B - Paragraph / Problem type

13. Explain linear and planar densities in detail
14. Derive the Composition-Conversion Equation
15. With the help of a neat diagram discuss TEM
16. Derive Bragg's Law and discuss the information that can be obtained from XRD analysis
17. Discuss advanced ceramics and conventional ceramics.
18. What are the vacancies and how the vacancies affect the diffusion phenomena in solids?
19. Determine the composition, in atom percent, of an alloy that consists of 82 wt% ZnO and 18 wt% Al_2O_3.(ZnO molar mass 81.38 g/mol and Al2O3 101.96 g/mol).

(Ceiling –30 marks)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries 10 marks)

20. Describe bonding and discuss types of bonding in detail
21. Discuss the stress-strain behavior, viscoelastic behavior of polymers

(1 x 10 = 10marks)