

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Sixth Semester B.Sc Physics Degree Examination, March 2018
PH6B10 – Thermal & Statistical Physics
 (2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A (Answer all questions. One mark each)

Answer all questions in a sentence.

1. What is a quasi static process?
2. State the zeroth law of thermodynamics.
3. Is there any change in internal energy during an isothermal change?
4. What is isochoric process?
5. Define efficiency of a heat engine.
6. Absolute zero is attainable. Comment on the statement.
7. State Nernst theorem.
8. What is phase space?
9. What are Bosons? Give two examples.
10. What do you mean by most probable speed?

(10 x 1 = 10 Marks)

Section B

(Answer all questions in two or three sentences.2 marks each)

11. What is the principle of a refrigerator?
12. What is Bose Einstein's distribution law?
13. A spontaneous process is reversible. Justify your answer.
14. State and explain Wien's displacement law.
15. Distinguish between intensive and extensive variables.
16. Draw the T-S diagram for Carnot's engine.
17. What is equipartition theorem?

(7 x 2 = 14 Marks)

Section C

(Write in a paragraph about half a page. Answer any five.Each question carries 4 marks)

18. Derive the relation between C_p and C_v from First law of thermodynamics.
19. State and prove Carnot's theorem.
20. Write a note on entropy and available energy.
21. Derive Clausius- Clapyeron equation .What is its implication?
22. Derive T ds equations.
23. Derive expressions for the r.m.s speed and the most probable speed.
24. What is Fermi energy?

Section D

(Answer any 4 questions .Each carries 4 marks)

25. A quantity of air is at 420K is compressed to $1/3^{\text{rd}}$ of its volume. Determine the change in temperature. $r=1.4$
26. A Carnot's engine working between a source at 400K and a sink absorbs 2000J of heat and rejects 1600J to sink. What is the temperature of sink? Also calculate its efficiency.
27. Find the r m s velocity of Nitrogen molecules at 27°C . Molar mass 0.028kg and $R=8.13\text{J/mol/K}$
28. The Fermi energy of a system is 14.6J Calculate the average ground state zero point energy.
29. One mol of Nitrogen expands isothermally to four times its original volume. Calculate the change in entropy. $R=8.3\text{J/mol/K}$
30. Calculate the change in entropy when 50 gms of water at 30°C is mixed with 120 gms of water at 90°C .
31. The brightest part of the spectrum of a star is having a wavelength 310 nm. What is the surface temperature of star?

(4 x 4 = 16 Marks)

Section E

(Answer any 2 in two pages.Each question carries 10 marks)

32. Discuss the theory and working of Diesel engine. Derive the expression for its efficiency.
33. Obtain Maxwell's thermodynamic relations from thermodynamic potentials.
34. Give the important features of Maxwell-Boltzmann, Bose -Einstein and Fermi -Dirac statistics. Compare it.
35. What is Entropy? What is its physical significance? Show the entropy of a perfect gas remains constant in a reversible process, but increases in an irreversible process.

(2 x 10 = 20 Marks)

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(Pages : 2)

Reg. No:.....

Name:

49

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Sixth Semester B.Sc Physics Degree Examination, March 2018
PH6B11 – Solid State Physics, Spectroscopy & laser Physics
(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A

(Answer all in a sentence, each question carries one mark)

What are miller indices?

What is Raman effect?

What is primitive lattice?

Explain how a spectrum is produced?

What is meant by polarizability ellipsoid?

Write any two applications of LASER beams

What is centrifugal distortion?

What is meissner effect?

What is symmetric top molecule?

0 What is crystallography?

(10×1=10 Marks)

SECTION B

(Answer in two or three sentences)

Answer all questions, Each question carries 2 Marks

1 Explain the concept of stimulated emission.

2 What are the informations that can be obtained from a rotation spectrum?

3 Calculate the packing factor of diamond cubic structure

4 Explain NaCl Crystal structure

5 What is Born-Oppenheimer Approximation?

6 What are hot bands in vibrating diatomic molecule?

7 Discuss population inversion and metastable state associated with LASER

(7×2=14 Marks)

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(Pages : 3)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Sixth Semester B.Sc Physics Degree Examination, March 2018
PH6B12 – Nuclear Physics, Particle Physics & Astrophysics
 (2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A

Answer all in a sentence; each question carries one mark

1. What is meant by isomerism?
2. Give the energy equivalent of proton mass
3. Give the relationship between decay constant and half life of radioactive decay.
4. What is the roll of control rods in nuclear reactor?
5. Give the dimension and unit of nuclear cross section
6. What is an alpha particle?
7. Give the spin of quarks
8. A μ^- particle collides with a proton, and a neutron plus another particle are created. What is the other particle?
9. Give the relationship between parsec and light year
10. What is meant by luminosity of a star?

(10 x 1=10 Marks)

SECTION B

Answer all questions; Each question carries 2 mark

11. Find the density of N^{14} nucleus.
12. Give any two applications of NMR
13. What are magic numbers? Give its relevance
14. What are the limitations of LINAC?
15. What are mesons? Which is the lightest meson?
16. Give the quark model of proton and π^+ meson.
17. State which quantum number is not conserved in the reaction $n \rightarrow p + e$. Write the correct equation.

(7 x 2=14 Marks)

SECTION C

Answer any five questions; Each question carries 4 marks

18. Explain mass parabola from semi empirical formula for binding energy
19. Explain the meson exchange theory of nuclear forces.
20. What is a nuclear reactor? Explain the working of a breeder reactor
21. Explain the neutrino theory of beta decay.
22. What is latitude effect of cosmic rays? What is its reason?
23. Obtain the expression for kinetic energy of two colliding particles in the Center of Mass coordinate system.
24. Explain the working of GM counter. What is the relevance of the plateau of the curve

(5 x 4=20 Marks)

SECTION D

Answer any four questions; Each question carries 4 marks

25. Calculate the binding energy of Ne^{20} (in MeV). Given that $m(\text{Ne}^{20})=19.992u$,
 $m(n)=1.00866 u$, $m(p)=1.00728 u$.
26. The half life of ${}^{238}_{92}\text{U}$ against alpha decay is 4.5×10^9 years. Find the activity of 1.0 g of ${}^{238}_{92}\text{U}$.
27. The cross section of Cd^{113} for capturing thermal neutrons is $2 \times 10^4 \text{b}$. The mean atomic mass of natural cadmium is $112u$, and its density is 8.64g/cm^3 . What fraction of an incident beam of thermal neutrons is absorbed by a cadmium sheet of 0.1mm thick?
28. The energy released in the fission of a single U^{235} nucleus is 200 MeV. Find the number of fissions required to produce 1 KW power
29. Deuterons are accelerated in a cyclotron. The strength of the applied magnetic field is 1.5T and mass of deuteron is $3.3 \times 10^{-27} \text{Kg}$. If the kinetic energy of the deuteron coming from the cyclotron is 16 MeV, determine the cyclotron radius.
30. Determine the Q factor of the reaction, $\text{N}^{14} + \text{He}^4 \rightarrow \text{O}^{17} + p$. State whether the reaction is endoergic or exoergic.
31. Complete the following nuclear reactions
 - a) ${}^6_3\text{Li} + _ \Rightarrow {}^7_5\text{Be} + \frac{1}{0}n$
 - b) ${}^{35}_{17}\text{Cl} + _ \Rightarrow {}^{32}_{16}\text{S} + \frac{4}{2}\text{He}$
 - c) ${}^9_4\text{Be} + \frac{4}{2}\text{He} \Rightarrow 3 \frac{4}{2}\text{He} + _$

(4 x 4=16 Marks)

SECTION E

Answer any two questions; Each question carries 10 marks

32. Explain liquid drop model of nucleus. How does it lead to the semi empirical mass formula?
Write any two applications of semi empirical mass formula.
33. What are the basic ideas of Gamov theory of alpha decay? Derive an expression for decay constant in alpha decay
34. Explain the different coordinate systems used for stellar positioning.
35. Explain the construction and working of cyclotron. What are its limitations?

(2 x10=20 Marks)

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(Pages : 3)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Sixth Semester B.Sc Physics Degree Examination, March 2018
 PH6B13(E1) – Computational Physics
 (2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A

(Answer all questions, each question carries one mark)

1. Loop is the alternate name of.....construct
2. When step size increases, round off error
3. Splitting of continuous quantity in to small discrete elements is known as
4. Which statement is used to exit from the loop before completing the execution
 - a) break
 - b) exit
 - c) stop
 - d) pause
5. Which of the operator is used to indicate not equal to
 - a) ==
 - b) !=
 - c) =
 - d) <>
6. Which of the following is not the way the tuple can be defined
 - a) b=1,2,3
 - b) b=(1,2,3)
 - c) b=1,2,3,'hel'
 - d) a=[1,2,3]
7. In python result of 6%4 is
8. Who was the founder of python language
9. If we run the following python code, What will be the output of the program?


```
x=1
x=float(x)
print x
```

 - a) 1
 - b) 1.0
 - c) int (1)
 - d) float (1)
10. What will be the output of python statement


```
F=[1,4,9,2,7]
F.sort()
print F
```

(10 x 1=10 marks)

SECTION B

(Answer all questions, each question carries two marks)

11. Explain how infinite looping is achieved in Python
12. What is meant by slicing of a string? Write a line code to demonstrate slicing
13. Write a python program to add element 10 to the list [1,2,3] and to print that
14. Explain about truncation error
15. What is the difference between 'input' and 'raw-input'
16. Explain the term curve fitting
17. Explain the difference between list and tuple

(7 x 2=14 marks)

SECTION C

(Answer any five questions, each question carries 4 marks)

18. Explain Iteration construct Sequential construct and Conditional construct
19. Briefly explain the use of range() function in python
20. Briefly explain about the data type dictionary. How can you separate key and value from the dictionary
21. Find the equation of best fit straight line from the following data

X	1	2	3	4	5	6	8	9
Y	2	5	7	10	12	13	15	19

22. Construct a forward difference table using the following data

X	1	1.5	2	2.5	3
Y	1	2.25	4	6.25	9

23. Using Simpson's one-third rule, find the value of integral $\int_0^2 \frac{dx}{1+x}$ correct to third decimal place. Take $h=0.5$
24. Solve the differential equation $dy/dx = x+y$ at $y(0.3)$ using Runge Kutta method Initial condition given as $y=1$ at $x=0$. Take the step size as 0.1

(5 x 4=20 marks)

SECTION D

(Answer any four questions, each question carries 4 marks)

1. Write a python program to generate the factorial of a given number
2. Write a program to check either the given year is leap year or not
3. Four resistances are connected in series, write a program to find total resistance. Value of each resistance must taken as input
4. Root of $f(x)=x^3-10x^2+5=0$ lies close to $x=0.7$. Write the python program to compute the root with Newton Raphson method
5. Write a python program to integrate $f(x) = 1/(1+x^2)$ using trapezoidal rule
6. Suppose the position of a point in two dimensional space is given in polar coordinates (r,θ) Write a python programs to enter r and θ (in degrees) and to convert them to Cartesian coordinates ($x=r\cos\theta$ and $y=r\sin\theta$)
7. Develop a python program for Taylor series expansion for $\cos x$

(4 x 4=16 marks)

SECTION E

(Answer any two questions, each question carries 10 marks)

1. Explain the difference in working of a ladder if and nested if with examples
2. Use the second order Runge Kutta method to integrate $dy/dx=\sin y$, $y(0) = 1$ from $x=0$ to 0.5 in steps of 0.1 . Keep four decimal places in computations
3. Write a program to solve two dimensional projectile motion of a body moving under gravity. Use Euler method
4. Write a python program to find velocity and position of freely falling body in a planet. Acceleration due to gravity in that planet is given as input

(2 x 10=20 marks)