مستوى ثالثة - فيزياء - فيزياء الحالة ف ٢١٧

Mansoura University | Physics 317 EXAMS

Faculty of Science | Physics of Metals Exam.

Physics Department | First Term 2010 - 2011

Time Allowed TWO HOURS | Date: 26 – 1 – 2011

Answer the following questions: [Total Mark 80]

Q. 1- a) Interpret why many different types of metallic atoms to be dissolved in a host metal in varying amounts. [10Mark]

b) Classify and discuss in brief the types of heat treatment of metals and its alloys. [10Mark]

c) Why the metal is crystallized in one of the closed packed structure? [10Mark]

[Total Mark 30]

Q.2-a) Explain why metallic atoms in the gaseous state do not combined to form polyatomic molecule. [5Mark]

b) Each atom of gold contributes one free electron to the metal. Compute (a) the Fermi Energy, [5Mark], (b) The Fermi velocity, [5Mark], (c) the Fermi temperature for gold [5Mark] and (d) the radius of the Fermi sphere [5Mark].

Electron concentration for gold is $5.85 \times 10^{28} m^{-3}$. Electron mass is 9.11×10^{31} kg. Boltzmann's constant is 1.38×10^{23} J/K.

[Total Mark25]

Q.3-a) Investigate the factors affecting in using metals in nuclear engineering. [5Mark]

b) Demonstrate the actual cause of electrical resistivity in metal? [10Mark]

c) Discuss some of the experimental techniques used to determine the band structure in metals. [10Mark]

[Total Mark25]

$\hbar = 1.054 \times 10^{-34}$ J s , NA $= 6.022 \times 10^{23}$ molecules mol^{-1}

Prof.Dr. Mustafa Kamal

University of Mansoura Faculty of Science Physics Department		جامعة المنصورة كلية العلوم قسم الفيزياء

First Semester January 2011

المستوى الثالث - فيزياء
فيزياء المفاعلات والنيوترونات

Educational Year: Third Level Program: Physics
Time: 2 Hours Subject: Physics
Date: 15/1/2011 Course (s) code: Phys 312 [Physics of reactors and neutrons]
Full Mark: 80

Answer **the following** Questions

[1] State the types of neutron interactions and discuss in detail the nuclear Fission. [20] Mark

[2.a] Discuss the neutron cross sections and determine the neutron microscopic cross section in terms of the number of reactions per second, nuclear density, intensity of neutrons, area of a thin sheet material. [20] Mark

[3] Derive the energy distribution of thermal neutrons. [20] Mark

[4] Discuss the slowing down of reactor neutrons and prove that the energy transferred from neutron to the moderator will be zero and maximum when angle of scattering equals zero and π respectively. [20] Mark

With my best wishes
Prof. Dr. A. Elgarayhi

Examiners: 1- Prof. Dr. A. Elgarayhi 2. Prof. Dr. Aboulwafa
3. Prof. Dr. Aboubaker 4.Dr. Emad Alshwey

فيزياء تجريبية ف ٣١٢

Mansoura University Faculty of Science Physics Department		First Term Examination, **Jan** Third Year : Physics Date : **17/1/ 2011** Time : **2 hours**
Course (s) : **Experimental Physics , 313ف**		Full Mark : **80 Mark**

Answer on the following questions

[1] a- Describe and explain with the help of suitable figures, one kind of the rotary and diffusion pumps. **[15] Mark**

b- A 60 °C prism of flint glass, μ=1.6222 for D-lines, μ=1.6320 for F-lines, is set at minimum deviation for the D-lines. Find the angular separation between the two beams and if the emerging light is focused on a camera plate by an achromate focal length 60 cm, find the linear distance between the D and F spectral line. **[15] Mark**

[2] Describe a method for the qualitative and quantitative spectrographic estimation of trace elements in a powdered sample using an internal standard. **[25] Mark**

[3] Account on the following :

a- Fogging produced in the photographic plates. **[12] Mark**

b- Discuss the factors usually considered for the selection and choice of a vaccum pump. **[13] Mark**

With best wishes

1- أ.د إبراهيم فوده 2- أ.د. كرمال الفرحاتى 3- أ.د. ماهر التونسى 4- د. بكر عبد الطيف

Mansoura University Faculty of Scienc Physics Department		Third Year Physics Date: Jan. 2011 Time : 2 hours
Course (s): Quantum Mechanics		Full Mark :80 Mark

Answer the FIRST question and onlyTWO from the rest.:

1-a) A mono-energetic beam of electrons of energy E strike a potential step of height V_0 and infinite width. Calculate the reflection coefficient of the electrons in the case of $E<V_0$ and compare the result with the classical one. [15] Mark

-b) Using the time-independent perturbation theory to find the first-order correction in the energy eigenvalues and the corresponding eigenfunction of a perturbed harmonic oscillator and then calculate this correction if the perturbation $H'=bx^2$. [15] Mark

2-a) Derive the bound energy levels of a particle moving in a one-dimensional finite potential well given by $V(x)=-V_0$ inside the well and equal to zero outside the well. [15] Mark

-b) Derive the time-independent Schrodinger equation in momentum space. [10] Mark

3-a) Using the time-independent Schrödinger equation to determine the allowed energy levels and their corresponding eigenfunction of a particle of mass m and energy E moving in a harmonic oscillator potential well. [15] Mark

b) Calculate $[x , \hat{P}_x^2]$ and $[t , \hat{E}]$. [10] Mark

4-a) A particle of mass m and energy E moving inside a cubical box of length L, find the allowed energy eigen-values and their corresponding eigen-functions of the particle. Show the degeneracy of the lowest three energy levels . [15] Mark

b) Discuss the breakdown of the degeneracy of the first excited state under a small distortion (ΔL) in the length of the box in y-direction. [10] Mark

With best wishes

1- Prof. Dr. M. Abozaid
2- Prof. Dr. A. R Degheidy
3 - Dr . N. Sheshtay
4- Dr. H. Sallah

(Ph315) (١) رياضيات - الفيزياء - المستوى الثالث

Mansoura University Faculty of Science Physics Department Subject : Physics	Third Year Physics	First Term Third Year : Physics Date : 22/2/ 2011 Time allowed : 2 hours

Math. Physics ph (315)

Answer the following questions

(1) a- Prove that, (30)

$$\beta(p,q) = \frac{\Gamma(p)\,\Gamma(q)}{\Gamma(p+q)} \quad , \quad \text{and use the identity } \int_0^\infty \frac{x^{p-1}}{1+x}dx = \frac{\pi}{\sin p\pi}$$

to show that $\Gamma(p)\,\Gamma(1-p) = \frac{\pi}{\sin p\pi}$

b- Show that $\int_0^1 x^k \ln x\, dx = -\frac{1}{(k+1)^2}$, $k > -1$, and $\int_0^\infty e^{-x^4} dx = (\,^1/_4\,)!$

(2) **Answer (a) or (b) only**

a- Prove that Hermite polynomials satisfy the relations , (15)

(i) $H_{n+1}(x) = 2x\,H_n(x) - 2n\,H_{n-1}(x)$

(ii) $\int_{-\infty}^{\infty} x^2 e^{-x^2} [H_n(x)]^2 dx = \sqrt{\pi}\, 2^n n! \left(\frac{2n+1}{2}\right)$

b- (i) Prove that Bessel functions , $J_p(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{n!\,(n+p)!} \left(\frac{x}{2}\right)^{2n+p}$ (15)

are solutions of the differential equation , $x^2 y'' + xy' + (x^2 - p^2)\, y = 0$

(ii) Prove that $J_p'(x) = J_{p-1} - \frac{p}{x} J_p(x)$

(3) a- Prove that $\int_{-1}^{1} p_\ell(x)\, p_m(x)\, dx = \frac{2}{2\ell+1}\, \delta_{\ell m}$ (20)

b- Find the first three terms of Legendre series for the function,

$f(x) = |x|$, $-1 < x < 1$

(4) **Solve (a) or (b) only**

a- Use the recurrence relation $(n+1) L_{n+1}^k(x) - (2n+k+1-x) L_n^k(x) + (n+k) L_{n-1}^k(x) = 0$

to prove that $\int_0^\infty x^{k+1} e^{-x} [L_n^k(x)]^2 dx = (2n+k+1) \frac{(n+k)!}{n!}$ (15)

b- Find the value of the constant A in each of the following integrals (15)

$$A^2 \int_{-1}^{1} [p_\ell^m(x)]^2 dx = 1 \quad , \quad A^2 \int_{-\infty}^{\infty} e^{-x^2} [H_n(x)]^2\, dx = 1$$

$$A^2 \int_0^\infty e^{-x} [L_n(x)]^2\, dx = 1$$

With best wishes

د. حسام صلاح د. محمد سعد أ.د. علاء الخضرى أ.د. هيام مشالى

الستون الثالث - فيزياء - فصل متقدم (ف ٣١٦)

Mansoura University
Faculty of Science
Physics Department.
Subject: Physics(316)
Title: Advanced optics

Final term exam – First Term
Third level /physics
Date: Jan. 2011
Allowed Time: Two hours.
Full Mark: 80

Answer the following questions:

[1] a- Describe how would you produce an interference of polarized light via a crystal plate inserted between crossed polarizers?
[15] Mark

b- A birefringent plate is placed between two crossed nicols with its principle axis at 30^{o} with the polarizer. Find: i- the intensities of the O and E vibrations leaving the plate ii- The intensities leaving the analyzer?
[10] Mark

[2] a-Calculate the electric field at a large distance from a thin glass plate if a source of light is placed at a large distance from its opposite side?
[15] Mark

b- Describe briefly the normal dispersion phenomenon using Cauchy's equation?(clarify your answer with suitable drawing)
[10] Mark

[3] a-Considering an isolated small particle in vacuum illuminated with monochromatic Plane polarized light, deduce Rayleigh's equation for elastic light scattering? Discuss why the sky is blue ?
[20] Mark

b- Explain the classical description of inelastic light scattering ?
[10] Mark

Best wishes: *Prof. Dr. Kermal El-Farahaty*

Mansoura University Faculty of Science Physics Department Subject: Physics		Physics program 3 level Date : Jan 2011 **Full Mark: 80 Mark**
Course (s): **Phys 310 ((Statistical Thermodynamics))**		Time allowed : 2 hours

Answer **Three** Questions only:

[1] a- Compute the number of H_2 molecules which impinge on an area A=1cm^2 of a wall in a second with velocity which exceeds 12000m/sec assuming that, the temperature is 0 C and the total number of molecules in 1cm^3 is 2x10^{19}.

b- Using the Maxwillian distribution function of molecular speed

$$\theta(V) = 4\pi n(m/2\pi kT)^{\frac{3}{2}} V^2 e^{-\frac{E}{kT}}$$

Obtain the following quantities:

a- the most probable velocity,

b- the most probable energy,

c- the average of the speed $\langle V \rangle$

d- the fluctuation in the speed $\left\langle (V - \langle V \rangle)^2 \right\rangle$.

f- the fluctuation in the kinetic energy $(m/2)^2 \left\langle (V^2 - \langle V^2 \rangle)^2 \right\rangle$.

[26.66] Mark

[2] a- Given that the thermodynamic probability

$$W = \frac{N^N}{\prod_{i=1}^{k} N_i^{N_i}}.$$

Drive the number of particles in the i th cell.

b- Determine the internal energy U, entropy S Helmholtz function F for

$$Z = \sum_{i=1}^{k} e^{-\omega_i / kT} .$$

[26.66] Mark

[3] a- Define the concept of macro and micro states in statistical thermodynamics.

b- Consider a system of N particles and a phase space of n cells suppose that the energy of a particle has the same value in all cells, $Z = ne^{-\omega / kT}$ Determine U, S and F.

c - Starting with Plank's theory and using the partion function of oscillator

$$Z = \sum_{n} e^{-nh\upsilon / kT} \quad h ,$$

compute the mean value of the energy of oscillator.

[26.66] Mark

[4] a- Drive Einstein's equation for the specific heat for solids.

b- Using the Rayliegh - Jeans law for black body and the postulates of Plank's to compute Plank's law of radiation.

c- Drive the Stefan-Boltzmann law by using the thermodynamics approach to black- body radiation.

[26.66] Mark

Examiners : Prof. M Tadros, Dr. A Mogahed , Dr. Emad El Shewy* , Dr H. Salah.