مستوى ثالث - فيزياء - ف (٣٢٩) - فيزياء الأطياف

Mansoura University Faculty of Science Physics Department Subject: Physics		Second Term **Third Level, Physics** Date : **June 2011** Time allowed : **2** hours
Course: **Special Course; Phys 329** **Molecular Spectra**		Full Mark:: **80** Marks

Answer The Following Questions : Each Question (**20**) Marks

[1]-(A) Which of the following molecules will show a microwave rotational spectrum ;

HBr , OCS , CH_4 , CH_3Cl , SF_6 & H_2O. **[6 Marks]**

(B) Write a short note about the dispersing elements usually used in any spectroscopic equipment. **[8 Marks]**

(C) Prove that any molecule can never has zero vibrational energy. **[6 Marks]**

[2]-(A)-(a) A certain transition involves an energy change of $6x10^{-22}$ J per molecule. If there are 10^8 molecules in the ground state , what is the approximate equilibrium population of the excited state at temperatures of ; 40^o k , 400^o k & 4000^o k ? . **[6 Marks]**

(b) What would your answer have been if the energy change was twenty times greater ? . **[4 Marks]**

(c) Comment on the obtained results . **[4 Marks]**

[B] Discuss briefly how the molecular absorption spectrum can be used for bond length and bond strength determination. **[6 Marks]**

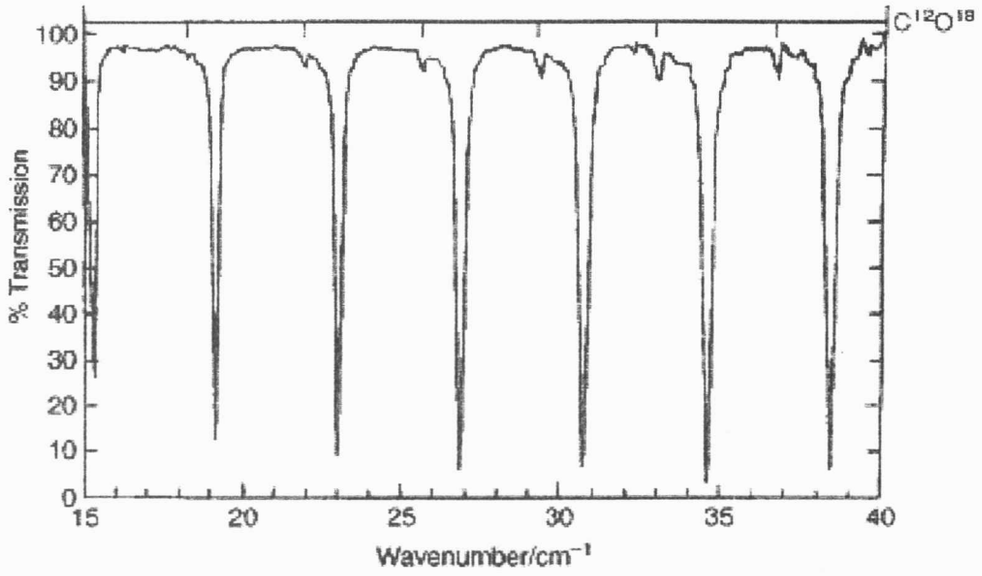
[3]-(A) Sketch the rotational-vibrational energy level for a diatomic molecule showing the possible transitions between the different levels with the spectrum arising from them. **[10 Marks]**

(B) A space spectrometer was designed to seek $^{12}C^{16}O$ in the atmosphere of Saturn by looking for lines in its rotational spectrum. If the bond length of $^{12}C^{16}O$ is **112.8 pm**, then find;

(a) At what wavenumber do the first two rotational transition lines appear? **[5 Marks]**

(b) Can you calculate such these lines for $^{13}C^{16}O$ as well? **[5 Marks**

[4]-(A) The rotational spectrum shown below represents the transitions with j=3 up to j=9 in a hetero-diatomic molecule. Make measurements to determine the average separation between the adjacent transitions. Then calculate the rotational constant for this molecule. **[4 Marks]**



(B) The fundamental and the first overtone transitions of the $^{14}N\ ^{16}O$ molecule are centered at 1876.06 cm^{-1} and 3724.20 cm^{-1}, respectively. Evaluate each of the following physical quantities ; **[4 Marks for each item]**

(a) The unharmonicity constant.
(b) The equilibrium vibration frequency.
(c) The exact zero-point energy.
(d) The force constant of this molecular bond.

Some useful physical constants and quantities ;

c = 2.998×10^{8} $m.s^{-1}$, **h** = 6.626×10^{-34} j.s., **k** = 1.381×10^{-23} $j.k^{-1}$, $\pi = 3.143$, N = 6.023×10^{23} $molecule.mole^{-1}$, the masses of the ^{12}C , ^{13}C, ^{14}N & ^{16}O atoms (in Kg) are; 19.93×10^{-27}, 21.59×10^{-27}, 23.25×10^{-27}& 26.56×10^{-27} respectively.

Examiners: 1- Dr. Mohamed MANSOUR
2- Dr. Abdelrahman LASHEEN

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester **Third level : Physics** Date : 28/6/2011 Time allowed : 2 hours
Course (s): Mathematical physics (2) (Phy325)		Full Mark:: 80 Mark

Answer the following Question : (30 Marks)

[1] a- Transform

$$u_t = \alpha^2 u_{xx} + x\cos t \qquad 0 < x < 1, \quad 0 < t < \infty$$

with BC's $u(0,t)=1, \quad u_x(1,t)+hu(1,t)=1, \qquad 0 < t < \infty$

and IC. $u(x,0) = \sin(\pi x) \qquad 0 \le x \le 1$

into a new problem with zero BCs **(10 Marks)**

b- Solve the diffusion problem

$$u_t = u_{xx} - u_x, \qquad 0 < x < 1, \qquad 0 < t < \infty$$

with BC's $u(0,t)= 0, \quad u(1,t) =0, \qquad 0 < t < \infty$

and IC. $u(x,0) = e^{x/2} \qquad 0 \le x \le 1$

by separation of variables method. **(20 marks)**

Answer two Questions only: Each Questions (25) Marks

2) Solve the Non-homogeneous PDE's Problem:

$$u_t = u_{xx} + \sin(3\pi x) \qquad 0 < x < 1, \quad 0 < t < \infty$$

with BC's $u(0,t) = 0, \quad u(1,t) = 0, \quad 0 < t < \infty$

and IC. $u(x,0) = \sin(\pi x) \qquad 0 \le x \le 1$

by using the eigenfunction – expansion method **(25 marks)**

3) Solve the following problem by means of the Laplace transform

$$u_t = u_{xx} \qquad 0 < x < \infty, \quad 0 < t < \infty$$

with B.C. $u(0,t)=\sin t \qquad 0 < t < \infty$

and IC. $u(x,0) = 0 \qquad 0 \le x < \infty$

(25 marks)

Notes: $\mathcal{L}\ \sin t = 1/(s^2+1)$ And $\mathcal{L}^{-1} e^{-x\sqrt{s}} = (x e^{-\frac{x^2}{4t}})/2\sqrt{\pi t^3}$

4) Solve the following problem by means of the Fourier transform

$$u_t = 4\, u_{xx} \qquad -\infty < x < \infty, \quad 0 < t < \infty$$

I.C. $u(x,0)= e^{-x^2}, \qquad -\infty < x < \infty,$ **(25 marks)**

1. أ.د. السيد الوكيل 2. أ.د. محمد مدكور

Mansoura University Faculty of Science Physics Department Subject: Physics		2nd Term Credit hours Students: Physics Level: 3 Date : June 2011 Time allowed : 2 hours
Course: Physics 320, Computer Programming		Full Mark : 80 Mark

Answer the 1st question then any other two questions

[1] **a-What will be the values of X and INDEX after the execution of the following instruction:**

```
      X = 8.0
      Y= 3. 0
      I = 5
10    GOTO (20, 30, 40, 50, 50), I
20    I = I+ 1
      X = X + 2.0
      Y = Y – 7.0
      GOTO 10
30    X = X – 3.0
      I=I+2
      GO TO 60
40    X = X – 4.0
      Y=Y- X
      I = I – 2
      GOTO 10
50    X = X + 2.0
      Y=Y + X
      I = I– 1
      GOTO 10
60    CONTINUE
      END
```

[10] Marks

b- Determine the values of Y, X, and J after execution of the following:

i-

```
      Y=3.0
      X=2.0
      DO 10 J=1,13,3
      IF(J*3.GE.13)X=X+3.0
      X=X+Y
      Y=Y+X
10    CONTINUE
      END
```

[10] Marks

ii-

```
      Y=5.0
      X=8.0
      DO 10 J=1,7,2
      IF(J*2.GE.13) GOTO 10
      Y=Y+X
      X=X+1.0
10    CONTINUE
      END
```

[10] Marks

[2] **a- Write the following expressions in FORTRAN FORM:** **[12] Marks**

i- $\beta = \frac{-1}{2x} + \frac{a^2}{4x^2}$

ii- $t = \tan^{-1}(\sqrt{2}\tan x)$

iii- $g = \frac{1}{2}\ln\frac{1+\sin x}{1-\sin x}$

iv- $B = \frac{e^{x/\sqrt{2}}\cos(\sqrt{x/2} + \pi/8)}{\sqrt{2\pi x}}$

b- Determine the correct format expression, and correct the wrong from the following :

i.	100	FORMAT(10X,13F6.2)
ii.	200	FORMAT(4F7.2,4E13.8)
iii.	300	FORMAT(7I2,6F5.3.3E12.5)
iv.	400	FORMAT(3X,5I2,7F5.3,3E11.6)

[8] Marks

c-Sow the order of execution of the given following statement: **[5] Marks**

```
Y= EXP(A*B/(C*D)-X**3)+COS(SQRT(X/2.)+PI/8.)/SQRT(2.*PI*X)
```

P.T.O. ⟶

[3] Write a FORTRAN program to calculate the SUN-Earth distance, for any day number. The output must be in a form of table containing the day No. in I3, and corresponding distance r in E12.5. The relation is given by:

$$r = a \;/\; \sqrt{1+0.033\cos\left(2\pi d_n / 365\right)}$$

The astronomical unit and the day number you can input through the screen.

(25 Marks)

[4] a) Draw the flowchart for the redistribution of 100 points in descending form using the logical IF statement. (10 Marks)

b) Write a Fortran program for redistribution of 100 points in descending form. The data are in format 12F6.2, and in a file named (ASCEN.DAT). (15 Marks)

Good Luck

Examiners: 1- Prof. Dr. Magdy Tadros Yacoub* **2-** Prof. Dr. Esam Abu Elwafa

المستوى الثالث - فيزياء - مقالات نظرية مفاعلات ٣٢٨

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester Third level : Physics Date : 2/7/2011 Time allowed : 2 hours
Course (s): Theoretical Reactors (Phy 328)		Full Mark:: 80 Mark

Answer the following Question : (30 Marks)

[1] a- Derive the time-dependent diffusion equation using Fick's rule. **[15] Marks**

b- Solve the time-independent diffuse equation for infinite-medium plane source. Calculate the mean square distance to a neutron travels from the source before it is absorbed. **[15] Marks**

Answer two Questions only: Each Questions (25) Marks

[2] a- Discuss the boundary conditions for complete solution the time-dependent diffusion equation. **[10] Marks**

b- Discuss the critical condition and derive the geometric buckling of a hemispherical reactor **[15] Marks**

[3] Discuss the critical problem is based on an integral equation formulation for the neutron flux. **[25] Marks**

[4] a- Discuss the iteration method which is used in solving the neutron diffusion equation for one dimensional problems. **[25] Marks**

With our best wishes
Examiners:

1- أ.د. السيد عبد العاطى الوكيل 2- أ.د. محمد مدكور

Mansoura University	Academic Level: 3rd Level
Faculty of Science	Program: Physics
Physics Department	2nd Term Exam: 18 June 2011
Subject: Phy. 327	Time Allow: 2 hours
Physics: Polymer Physics	Full Mark: 80 Marks

Answer (ALL) Questions:

1) A- Define the polymerization? Explain the three steps of chain polymerization. [8.0 Mark]

B- Write briefly on: [12 Mark]

- Ceiling temperature.
- Electron microscope technique to study polymer structure.
- Electrical conductivity of polymer.

2) Compare between: [20 Mark]

a- Anionic and Cationic polymerization.
b- Thermoplastic and Thermosets polymer.
c- Cis- and trans- isomerism.
d- Branched and Crosslinked polymer.

3) A-Explain the physical meaning of glass-transition temperature. [6 Mark]

B-Discuss two different methods used to determine Tg. [14 Mark]

4) A-What are the physical states of polymer? Discuss in details the first and second order phase transitions in polymer. [12 Mark]

B- Describe Differential Scanning Calorimetry Analysis. [8 Mark]

"With Good Luck"

Examiners:

1- Dr. Maysa Ismail. *2- Dr. A. Lashin.*

Faculty of Science Physics Department Mansoura University	Final Exam. in physics Subject: Fine Magnetism May 2011	Third Level Physics Students Time: 2 hours

Answer the following questions

1-**(a): List the main differences between :**

1- Intrinsic magnetism and the technical magnetism
2- Ferromagnetic and ferrimagnetic materials
3- FeO and Fe_2O_3 interms of ferrimagnetic order
4- Chemical shift of Q^4 and Q^1 units in the silicate network structure

b): write shortly what does the nuclear magnetic resonance mean.

2- **a): Define each of the followings:**

Curie temperature- Magnetization of ferromagnetic material
Magnetic domain – Chemical shift interaction

b): Complete each of the following

1- Chemical shift of bridging bond is ------- than that of nonbriging one
2- Q^3 of silicon nuclei is ------- than that of Q^0
3- Chemical shift is a function of the (nucleus- its environment – or both)
4- An ordered material may posses (higher – lower) chemical shift when it compared with that of amorphous structure.
5- Material posses chemical shift interaction of (-110 , -70) represents a more shielded structure.

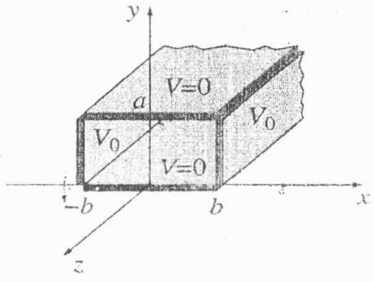
3 a): Sketch diagrams represent the main differences in terms of electron paring between:
1- Ferromagnetism and paramagnetic
2-Diamagnetic material and Ferrimagnetic materials
b) : write shortly on Magnetic domains in terms of Bloch wall.

Best wishes *Prof.Dr. G. EL-damrawi*

Mansoura University Faculty of Science Physics Department Subject: Physics		Physics program 3 level Date : 25/6/2011 **Full Mark: 80 Mark**
Course (s): **Phys 324 ((Electrodynamics 1))**		Time allowed : 2 hours

Answer **The** following Questions

[1] a- **Two infinitely long grounded metal plates, at y = 0 and y = a, are connected at x= ± b by metal strips maintained at a constant potential V_0, as shown in Fig. (a thin layer of insulation at each comer prevents them from shorting out). Find the potential inside the resulting rectangular pipe.** [12] Mark

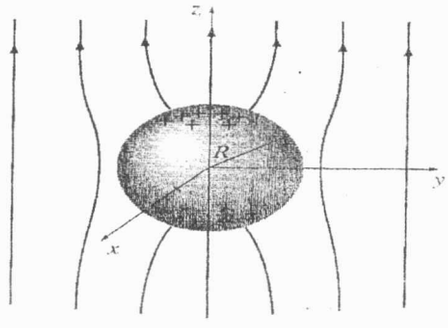


b- **How Maxwell fixed Ampere's Law ?** [8] Mark

[2] a- **Solving the following equation in azimuthal symmetry,** [10] Mark

$$\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial V}{\partial r}\right)+\frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial V}{\partial\theta}\right)+\frac{1}{r^2\sin^2\theta}\frac{\partial^2 V}{\partial\phi^2}=0$$

b- **An uncharged metal sphere of radius R is placed in an otherwise uniform electric field $\mathbf{E} = E_0\,\hat{\mathbf{Z}}$. (The field will push positive charge to the "northern" surface of the sphere, leaving a negative charge on the "southern" surface (See Fig.). This induced charge, in turn, distorts the field in the neighborhood of the sphere.) Find the potential in the region outside the sphere.** [10] Mark



[3]

a- Drive Maxwell's equations in polarized matter. [10] Mark

b- Drive the continuity equation.

[10] Mark

[4]

a- State and prove Poynting theorem. [10] Mark

b- Write short account on:
Boundary conditions for reflection and transmission of sinusoidal electromagnetic waves.

[10] Mark

Examiners : Prof. Dr. S A El Wakil , 2- Prof. Dr. ESam Abo el waffa ,
Prof. Dr. A A El Degiady, Dr. Emad El Shewy* .

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester **Third level : Physics** Date : 14/6/2011 Time allowed : 2 hours
Course : electronic circuits (Phy321)		Full Mark:: 80 Mark

Answer **The Following** Questions

1- a) Derive the condition required for stable biasing of the transistor circuit shown in figure (1-a).

b) The Zener diode used in the regulator circuit of figure (1- b) has the following data : I_{zk} =1 mA , I_{zM} = 540 mA , r_z =3 ohms and (V_{zT}=15 volts at I_{zT}=160 mA) .Determine the output voltage V_{out} at I_{zk} and at I_{zM} then, determine the minimum value of R_L that can be used .

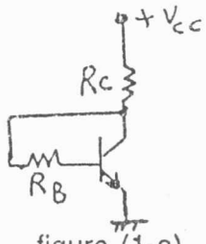


figure (1-a)

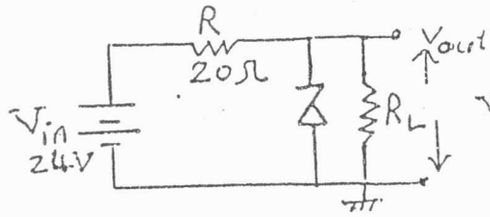


figure (1-b)

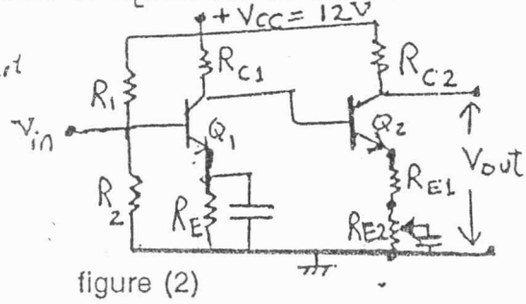


figure (2)

2- a) Derive an expression for the voltage gain of the non - inverting operational amplifier.

b) Determine the overall minimum and maximum gain of the two stage amplifier circuit shown in figure (3), where R_1 = 10 K, R_2 = 2.2 K , R_{C1} = 3 K , R_E = 650 ohm & R_{C2} =1 K , R_{E1}= 100 , R_{E2} = 0 To 900 ohm & $\beta_{dc} = \beta = 150$.

3 - a) Derive an expression for the voltage gain of the non - inverting operational amplifier.

b) Determine the values of R in figure (5) which make the voltage gain of the inverting - operational amplifier varries from -10 to - 60 .

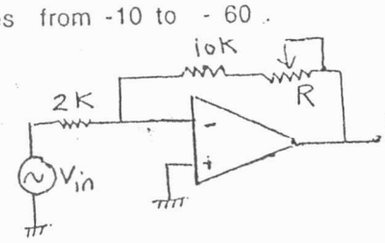


figure (3)

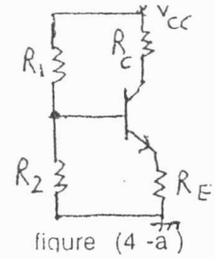


figure (4 -a)

4-a) Derive the condition required for stable operating point of the transistor circuit shown in figure (4 -a) .

b) Derive an expression for the output voltage of the operational amplifier circuit in figure (4-b) ,then determine the value of R which make the output voltage equal the average value of the input voltages

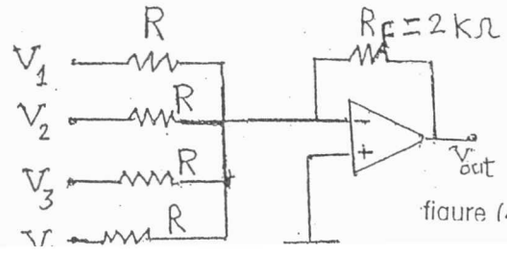


figure (4-b)

٣ فيزياء - فيزياء نووية ف ٢٠٤

Mansoura University Faculty of Science Physics Department Time allowed : 2 hours		Second Term (May 2011) Level : Third Program : Physics Course Code : Phys323 Date : 21/6/2011
Course Title : Nuclear Physics 2		Full Mark:: 80 Marks

Answer **THREE** Questions Only: السؤال الأول اجبارى

[1a] – Evaluate r_0 the nuclear radius unit by the Coulombic radius . **[10] Marks**

[1b] – Prove that the surface thickness of the nucleus corresponds to 4.4 a where a is the surface thickness factor . **[10] Marks**

[1c] - Define and give in table the relation between l , j and m_j and their capacities . **[10] Marks**

[2a] – Study the magnetic dipole moment of the nucleus containing Z protons and N neutrons classically and quantum mechanically . **[10] Marks**

[2b] - Prove that the electric quadrupol3 moment of an ellipsoidal nucleus with major axis b and minor axis a is given by $Q = (2/5) Z (b^2 - a^2)$ where Z is the number of protons . **[10] Marks**

[2c] - Define the parity of the nucleus. Represent this in Cartesian and spherical polar coordinate . When parity is conserves and non-conserved . **[5] Marks**

[3a] - List the evidences for the shell structure and explain the role of the of the number of stable isotopes with examples . **[10] Marks**

[3b] - Study the single particle shell model using the square well potential with infinite wall to give the levels from the bottom of the well . **[10] Marks**

[3c] - Calculate the energies in MeV for the first three s-states . **[5] Marks**

[4a] - By applying energy conservation in nuclear reaction obtain the Q-value in terms of the change in kinetic energies and rest masses . Obtain also an expression for the Q-value independent of the kinetic energy of the recoil nucleus . **[15] Marks**

[4b] - Introduce the concept of cross section for calculating the attenuation of an incident beam of particles when they strike a target nuclei . **[10] Marks**

لجنة التصحيح :

ا.د / على حسن الفراش

ا.د.م/ أحمد أبوالعلا أحمد