

Kafrelsheikh
University
Faculty of Science
3-nd year physics
students
December 2017



Time. 2h
Subject. Exam in...
Solid state physics
Total Marks.
Date:

Answer the following questions-

Question no 1

Rewrite the false sentence in correct manner

1	A 3D translational periodic arrangement of atoms in space is called a crystal.																
2	A 3D translation ally periodic arrangement of points in space is called a lattice.																
3	Motif or basis: an atom or a group of atoms associated with each lattice point																
4.	Each lattice point in a lattice. Has identical neighborhood of. other lattice points.																
5	One can select a small volume of. the crystal which by periodic repetition generates the entire crystal (without overlaps or gaps)																
6	Primitive Unit Cell: Lattice Points only at corners																
7	Non-Primitive Unit cell: Lattice Point at corners as well as other some points																
8	Cubic $a=b=c$, $\alpha=\beta=\gamma=90^\circ$																
9	Tetragonal $a=b \neq c$, $\alpha=\beta=\gamma=90^\circ$																
10	Orthorhombic $a \neq b \neq c$, $\alpha=\beta=\gamma=90^\circ$																
11	Hexagonal $a=b \neq c$, $\alpha=\beta=90^\circ$, $\gamma=120^\circ$																
12	Rhombohedral $a=b=c$, $\alpha=\beta=\gamma \neq 90^\circ$ OR Trigonal																
13	Monoclinic $a \neq b \neq c$, $\alpha=\beta=90^\circ \neq \gamma$																
14	Triclinic $a \neq b \neq c$, $\alpha \neq \beta \neq \gamma$																
15	<table border="0"> <thead> <tr> <th>Crystal system</th> <th>Bravais lattices</th> </tr> </thead> <tbody> <tr> <td>1. Cubic</td> <td><i>P I F</i></td> </tr> <tr> <td>2. Tetragonal</td> <td><i>P I</i></td> </tr> <tr> <td>3. Orthorhombic</td> <td><i>P I F C</i></td> </tr> <tr> <td>4. Hexagonal</td> <td><i>P</i></td> </tr> <tr> <td>5. Trigonal</td> <td><i>P</i></td> </tr> <tr> <td>6. Monoclinic</td> <td><i>P C</i></td> </tr> <tr> <td>7. Triclinic</td> <td><i>P</i></td> </tr> </tbody> </table>	Crystal system	Bravais lattices	1. Cubic	<i>P I F</i>	2. Tetragonal	<i>P I</i>	3. Orthorhombic	<i>P I F C</i>	4. Hexagonal	<i>P</i>	5. Trigonal	<i>P</i>	6. Monoclinic	<i>P C</i>	7. Triclinic	<i>P</i>
Crystal system	Bravais lattices																
1. Cubic	<i>P I F</i>																
2. Tetragonal	<i>P I</i>																
3. Orthorhombic	<i>P I F C</i>																
4. Hexagonal	<i>P</i>																
5. Trigonal	<i>P</i>																
6. Monoclinic	<i>P C</i>																
7. Triclinic	<i>P</i>																
16	The most common shape of a unit cell is a parallelepiped with lattice points at corners																
17	If an object is brought into self coincidence after some operation it said to possess symmetry with respect to that operation. • Symmetry of lattices																

①



Answer the following questions:

- 1 **Draw** a graph showing the number of remaining radioactive nuclei of a radioisotope after a period of time equal to four times its half-life time, assuming that the number of radioactive nuclei at the beginning of the decay is 1000 nucleus and the isotope half-life time is 5 hours. **(7 marks)**
- 2 **Explain** why the Sievert is more suitable unit in health physics than the Gray. **(5 marks)**
- 3 **Calculate** the neutron flux at a distance of 95 cm from a neutron source which emits 3.5×10^7 n/s. **(5 marks)**
- 4 **Discuss** briefly the different regions of operation of gas-filled detectors – **Support** your answer with a graph. **(7 marks)**
- 5 **Write** the α -, β - and γ -decay equations – **Give** an example for each decay. **(7 marks)**
- 6 **Explain** the interaction of radiation with cells. **(10 marks)**
- 7 **Find** the energy resolution of the NaI(Tl) detector at the 661.65 keV γ -ray peak of ^{137}Cs , where the full width at half maximum of the γ -ray peak is 50 keV. **(7 marks)**
- 8 **Draw** a schematic diagram of a γ -ray spectrometer and describe briefly the function of each component in the circuit. **(9 marks)**
- 9 **What** are the sources of background (natural) radiation? **(7 marks)**
- 10 **Define the following:**
Ionization – absorbed dose – stochastic effects **(6 marks)**

**Questions Ended
With Best Wishes**



Answer the following questions:

1. What the difference between intrinsic and extrinsic semiconductors. (10 degree)
2. Explain how does the computer charger work. (10 degree)
3. Write short note about:
a. Diode approximations. b. Zener diodes. c. Logic gates. (15 degree)
4.
a. Using silicon diode, how you can limit the input voltage of 2.5 V to 0.95 V.
b. Compare between silicon controlled rectifier, triac and diac. (15 degree)
5. Field-effect transistors (FETs) allow the user to control a current with another signal, Explain and show how to use it as amplifier. (10 degree)
6. What is the Operational Amplifier (OP-Amp), giving at least five applications of it. (10 degree)

End of the test

With my best wishes

Dr. Mahmoud Saad



Answer the following questions:

Q1- (30 degree) Give notes about:

Optical wave guide, plan mirror as wave guide, wave theory of optics, monochromatic wave, the Helmholtz equation, the equation of Gaussian beam, and the properties of Gaussian beam {intensity, power, beam radius, beam divergence, depth of focus, phase, and wave front}.

Q2- (20 degree) (Dielectric medium) Describe in detail:

Linear, nondispersive, homogeneous, isotropic, nonlinear, dispersive, and anisotropic media

Q3- (polarization of light) (20 degree)

- a) What are Jones Vectors? How can you use it to determine total intensity and phase difference of wave?
- b) How can you represent of polarization devices {wave retarder & polarization rotator} using Jones matrix?

With my best wishes Dr. Abdel-Hamid El-Shaer



Answer the following questions:

- 1 **Discuss** in details the basic properties of the nuclear force. **(8 marks)**
- 2 **Draw** a graph showing the proton-proton cycle that occurs inside the Sun. **(8 marks)**
- 3 **Explain** the proton-proton interaction – support your answer with a graph. **(8 marks)**
- 4 **Calculate** the Coulomb barrier threshold in MeV for the reaction ${}^{14}_7\text{N}(\alpha, {}^1_1\text{H}){}^{17}_8\text{O}$. **(8 marks)**
- 5 **Find** the mass defect in MeV for the nucleus of ${}^4_2\text{He}$, where $m_{(\text{H-1 atom})} = 1.007825 \text{ u}$, $m_{(\text{neutron})} = 1.008665 \text{ u}$ and $m_{(\text{He-4 atom})} = 4.002603 \text{ u}$. **(8 marks)**
- 6 **Calculate** the mass of meson where the velocity of light = $2.998 \times 10^8 \text{ m s}^{-1}$ and the Plank's constant = $4.134 \times 10^{-21} \text{ MeV.s}$, then compare it with the rest mass energy of the electron. **(8 marks)**
- 7 **Define the following:** reaction cross section, the Q-value, the nuclear binding energy. **(6 marks)**
- 8 **Draw** the hypothetical arrange of nucleons for the following nuclei ${}^1_1\text{H}$, ${}^2_1\text{H}$, ${}^3_2\text{He}$ and ${}^4_2\text{He}$ in a single energy level with indicating the spin direction of each nucleon and the total spin of each nucleus. **(8 marks)**
- 9 **Explain** (in nuclear equations) the following reactions: stripping, compound nucleus, pick-up and capture reactions. **(8 marks)**

**Questions Ended
With Best Wishes**



Answer the following questions:

1. The radiation emitted by glowing solid objects consists of a *continuous* distribution of frequencies ranging from infrared to ultraviolet, Explain. **(10 degree)**
2. Write short note about:
 - a. Photoelectric Effect. b. Pair Production. c. de Broglie.s Hypothesis. **(15 degree)**
3. High energy photons are scattered from electrons initially at rest. Assume the photons are backscattered and their energies are much larger than the electron's rest-mass energy, $E > mec^2$. (a) Calculate the wavelength shift. (b) Show that the energy of the scattered photons is half the rest mass energy of the electron, regardless of the energy of the incident photons. (c) Calculate the electron.s recoil kinetic energy if the energy of the incident photons is 100 MeV. **(10 degree)**

4. (أ) احسب الدالة المميزة للموثر $\hat{A} = \frac{d}{dx} - 2x$ (ب) أوجد موثر الطاقة. **(15degree)**

(ج) احسب كثافة التيار للدالة $\psi(x) = A e^{ikx}$

5. اذا كانت حركة جسيم في مجال جهد يوصف بالتالي:

$$V(x) = \begin{cases} 0, & 0 \leq x \leq L \\ \infty, & \text{otherwise} \end{cases}$$

فاحسب الدالة المميزة و متوسط الإزاحة ومتوسط كمية الحركة الخطية، مع شرح المعني الفيزيائي لذلك.

(20 degree)

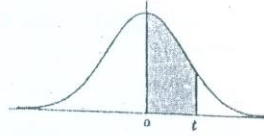
End of the test

With my best wishes

Dr. Mahmoud Saad

STANDARD NORMAL CURVE AREAS

This table gives areas under the standard normal distribution ϕ between 0 and $t \geq 0$



t	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

Table 6.2



Q1- (15 degree)

Find the transpose and the conjugate of the matrix A and then prove that A is Hermitian conjugate.

While,

$$A = \begin{pmatrix} 1 & 2 & 3i \\ 2 & 4-i & 0 \\ 1 & 2 & 1 \end{pmatrix}$$

Q2- (20 degree)

Evaluate the line integral

$$I = \oint [(e^x y + \cos x \sin y) dx + (e^x + \sin x \cos y) dy] \text{ around the ellipse } x^2/a^2 + y^2/b^2 = 1$$

Q3- (15 degree)

Find the value of

$$\int_0^1 t^7(1-t)^5 dt \quad \text{and} \quad \int_0^{\pi/2} \sin^7 x \cos^6 x dx$$

Q4- (20 degree)

a- Show that



The function $y = \sin(x)$ is a solution of

$$\left(\frac{dy}{dx}\right)^3 + \frac{d^4 y}{dx^4} + y = 2 \sin(x) + \cos^3(x)$$

b-

$$\text{Solve } y' + xy = xy^3.$$

With my best wishes Dr. Atef Elbendary

	Physics Department Academic Year 2017/2018 Computer Language (2) Ph 327 (70 marks)	
Kafrelsheikh University	1 Page	College of Science

Date: 17/1/2017

Time: 120 minutes

Question number one: (30 Marks)

- a. Write C# program to allow the user to input the temperature in Celsius and then the program find the temperature in Fahrenheit; using this equation $F = 1.8 * C + 32$ (15 Marks)
- b. Write C# program that computes net_salary. (15 Marks)
 The program reads (base, over, and discounts), and use this statement $net_salary = base + over - discounts$.

Question number two: (20 Marks)

- a. Write a C# Sharp program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies. (10 Marks)
- b. Write a C# program to initialize array of length 3 array elements; declare the array and print the elements. (10 Marks)

Question number three: (20 Marks)

- a. Write a C# program to determine whether an input number is an even number. (10 Marks)
- b. Write C# program Calculates Acceleration, given the velocity and time. (10 Marks)

Best Regards

Dr/Mai Ramadan

Page 1 of 1

32	X-ray crystallography is a technique in crystallography in which the pattern produced by the diffraction of x-rays through the closely spaced lattice of atoms in a crystal is recorded and then analyzed to reveal the nature of that lattice. <input type="radio"/>	
33	Similarly, measurement of the separation of the X-ray diffraction maxima from a crystal allows us to determine the type of the unit cell and from the intensities of diffracted beams one can obtain information about the arrangement of atoms within the cell. <input type="radio"/>	
34	Bragg law cannot identifies the angles of the incident radiation relative to the lattice planes for which diffraction peaks occurs	
35	Bragg derived the condition for constructive interference of the X-rays scattered from the reflection from the surface of the crystal <input type="radio"/>	
36	The diffracted beams are found to occur when the reflections from planes of atoms interfere constructively	
37	We consider the scattering from lattice points rather than atoms because it is the basis of atoms associated with each lattice point that is the true repeat unit of the crystal;.	

Question no 2

Write about

A --crystal dynamics.

B --Imperfections in solid.

Question no 3

A – Define Miller indices. ■

B – Draw the following surfaces in cubic crystal ■

$(100) - (010) - (001) - (100) - (010) - (001)$. ■

انتهت الاسئلة

3

18	. Lattices have Rotational symmetry Reflection symmetry																			
19	All parallel directions have the... same Miller indices																			
20	<table border="0"> <tr> <td>7 crystal Systems</td> <td>Required symmetry</td> </tr> <tr> <td>System</td> <td>Three 4-fold axis</td> </tr> <tr> <td>• Cubic</td> <td>one 4-fold axis</td> </tr> <tr> <td>• Tetragonal</td> <td>three 2-fold axis</td> </tr> <tr> <td>• Orthorhombic</td> <td>one 6-fold axis</td> </tr> <tr> <td>• Hexagonal</td> <td>one 3-fold axis</td> </tr> <tr> <td>• Rhombohedral</td> <td>one 2-fold axis</td> </tr> <tr> <td>• Monoclinic</td> <td>none</td> </tr> <tr> <td>• Triclinic</td> <td></td> </tr> </table>	7 crystal Systems	Required symmetry	System	Three 4-fold axis	• Cubic	one 4-fold axis	• Tetragonal	three 2-fold axis	• Orthorhombic	one 6-fold axis	• Hexagonal	one 3-fold axis	• Rhombohedral	one 2-fold axis	• Monoclinic	none	• Triclinic		
7 crystal Systems	Required symmetry																			
System	Three 4-fold axis																			
• Cubic	one 4-fold axis																			
• Tetragonal	three 2-fold axis																			
• Orthorhombic	one 6-fold axis																			
• Hexagonal	one 3-fold axis																			
• Rhombohedral	one 2-fold axis																			
• Monoclinic	none																			
• Triclinic																				
21	X ray, invisible, low penetrating electromagnetic radiation of much long wavelength (higher frequency) than visible light.																			
22	Visible light photons and X-ray photons are both produced by the movement of electrons in atoms.																			
23	X-rays can be created by bombarding a metal target with low energy electrons																			
24	A larger atom is more likely to absorb an X-ray photon, because <input type="radio"/> larger atoms have greater energy differences between orbitals - the energy level more closely matches the energy of the photon. Smaller atoms, where the electron orbitals are separated by relatively low jumps in energy, are less likely to absorb X-ray photons.																			
25	Diffraction is a wave phenomenon in which the apparent <input type="radio"/> bending and spreading of waves when they meet an obstruction.																			
26	Diffraction dose not occurs with electromagnetic waves, such <input type="radio"/> as radio waves, and also in sound waves and water waves.																			
27	Destructive Interference <input type="radio"/> . Results when two out-of-phase <input type="radio"/> light waves cancel each other, resulting in darkness.																			
28	The diffraction pattern of a crystal dose not depends on the <input type="radio"/> crystal structure and on the wavelength.																			
29	When the wavelength of the radiation is comparable with or smaller than the lattice constant, one can find diffracted beams in directions quite different from the incident radiation																			
31	By measuring the directions of the diffraction and the corresponding intensities , one obtains information concerning the crystal structure responsible for diffraction																			

②



Answer the following questions-

Question no 1

Rewrite the false sentence in correct manner

- | | | | | | | | | | | | | | | | | | |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|----------|--------------|---------------|------------|-----------------|----------------|--------------|----------|-------------|----------|---------------|------------|--------------|----------|
| 1 | A 3D translational periodic arrangement of atoms in space is called a crystal. | | | | | | | | | | | | | | | | |
| 2 | A 3D translation ally periodic arrangement of points in space is called a lattice. | | | | | | | | | | | | | | | | |
| 3 | Motif or basis: an atom or a group of atoms associated with each lattice point | | | | | | | | | | | | | | | | |
| 4 | Each lattice point in a lattice. Has identical neighborhood of. other lattice points. | | | | | | | | | | | | | | | | |
| 5 | One can select a small volume of. the crystal which by periodic repetition generates the entire crystal (without overlaps or gaps) | | | | | | | | | | | | | | | | |
| 6 | Primitive Unit Cell: Lattice Points only at corners | | | | | | | | | | | | | | | | |
| 7 | Non-Primitive Unit cell: Lattice Point at corners as well as other some points | | | | | | | | | | | | | | | | |
| 8 | Cubic $a=b=c$, $\alpha=\beta=\gamma=90^\circ$ | | | | | | | | | | | | | | | | |
| 9 | Tetragonal $a=b \neq c$, $\alpha=\beta=\gamma=90^\circ$ | | | | | | | | | | | | | | | | |
| 10 | Orthorhombic $a \neq b \neq c$, $\alpha=\beta=\gamma=90^\circ$ | | | | | | | | | | | | | | | | |
| 11 | Hexagonal $a=b \neq c$, $\alpha=\beta=90^\circ$, $\gamma=120^\circ$ | | | | | | | | | | | | | | | | |
| 12 | Rhombohedral $a=b=c$, $\alpha=\beta=\gamma \neq 90^\circ$
OR Trigonal | | | | | | | | | | | | | | | | |
| 13 | Monoclinic $a \neq b \neq c$, $\alpha=\beta=90^\circ \neq \gamma$ | | | | | | | | | | | | | | | | |
| 14 | Triclinic $a \neq b \neq c$, $\alpha \neq \beta \neq \gamma$ | | | | | | | | | | | | | | | | |
| 15 | <table border="0"> <tr> <td>Crystal system</td> <td>Bravais lattices</td> </tr> <tr> <td>1. Cubic</td> <td><i>P I F</i></td> </tr> <tr> <td>2. Tetragonal</td> <td><i>P I</i></td> </tr> <tr> <td>3. Orthorhombic</td> <td><i>P I F C</i></td> </tr> <tr> <td>4. Hexagonal</td> <td><i>P</i></td> </tr> <tr> <td>5. Trigonal</td> <td><i>P</i></td> </tr> <tr> <td>6. Monoclinic</td> <td><i>P C</i></td> </tr> <tr> <td>7. Triclinic</td> <td><i>P</i></td> </tr> </table> | Crystal system | Bravais lattices | 1. Cubic | <i>P I F</i> | 2. Tetragonal | <i>P I</i> | 3. Orthorhombic | <i>P I F C</i> | 4. Hexagonal | <i>P</i> | 5. Trigonal | <i>P</i> | 6. Monoclinic | <i>P C</i> | 7. Triclinic | <i>P</i> |
| Crystal system | Bravais lattices | | | | | | | | | | | | | | | | |
| 1. Cubic | <i>P I F</i> | | | | | | | | | | | | | | | | |
| 2. Tetragonal | <i>P I</i> | | | | | | | | | | | | | | | | |
| 3. Orthorhombic | <i>P I F C</i> | | | | | | | | | | | | | | | | |
| 4. Hexagonal | <i>P</i> | | | | | | | | | | | | | | | | |
| 5. Trigonal | <i>P</i> | | | | | | | | | | | | | | | | |
| 6. Monoclinic | <i>P C</i> | | | | | | | | | | | | | | | | |
| 7. Triclinic | <i>P</i> | | | | | | | | | | | | | | | | |
| 16 | The most common.shape of a unit cell is a parallelopiped with lattice points at corners | | | | | | | | | | | | | | | | |
| 17 | If an object is brought into self coincidence after some operation it said to possess symmetry with respect to that operation.
•.Symmetry of lattices | | | | | | | | | | | | | | | | |

①