Faculty of Science
Department of Physics

Final Exam(50%)
1st semester 2021-2022
Course: Biophysics
Code:P323
Time:3 hours Date: 11-9-2022

Assiut University

Answer on the following

Question (1) **(20 Mark)**

A- A Consider the flow of blood through the large artery that extends from the heart to the lungs. The radius of this artery is typically 2.0 mm, and it is about 10 cm long. ($\eta = 0.0027$ N.s/m^2)

(a) If the pressure difference across the ends of the artery is 500 Pa, what is the average speed of the blood?

(b) Now suppose this artery becomes somewhat narrower, as often happens with age. If the radius is reduced to 1.25 mm, what pressure difference is required to maintain the same average speed as in part (a)? **(5 Mark)**

B- Define: **(6 Mark)**

Depolarization –Hydrolysis - Sensory neurons - Nucleic Acids - Capillary Action - Acute Exposure

C- Write the scientific term: **(9 Mark)**

1	There are periodic gaps along a myelinate axon where there is no myelin and the axonal membrane is exposed.	
2	The pressure exerted by the earth's atmosphere is called.	
3	The atomic number and the atomic mass number of the daughter are the same as that of the parent.	
4	The volume of fluid passing by some location through an area during a period of time.	
5	The difference in the concentrations of two regions divided by the interval distance through which the particles diffuse.	
6	A nuclear decay in which an unstable isotope nuclide(parent nucleus) spontaneously release excess energy with emission of particles and /or γ-ray and that parent nucleus will transform into a new isotope nuclide (daughter nucleus) that may be stable or unstable	
7	Slowly the sodium channels come out of inactivation.	
8	The movement of molecules from an area of high concentration of the molecules to an area with a lower concentration.	
9	Potassium ion channels open up. This causes K^+ to rush out of the cell. As the K^+ leaves it causes the inside of the cell to become negative again.	

Question (2): Answer (T) for True sentences or (F) for False sentences (15 Mark)

1	Volt is unit of electric potential and potential different.	( )
2	β^- Decay is radioactive parent nucleus transforms a proton into a neutron.	( )
3	Positive lithium ion is more electrons than protons and positive net charge	( )
4	When f/f_{crit} is small, the laminar flow will dominate.	( )
5	Bernoulli's equation relates the pressure, speed, and height of any two points in a steady streamline flowing fluid of density ρ.	( )
6	Every action potential is followed by a refractory period	( )
7	Axon controls speed of signal.	( )
8	Mass flow rate is given by the following equation ρ/Q	( )
9	Units of surface tension: $Joule/m^2$.	( )
10	The IS unit of the flux J is m^2s^{-1}	( )
11	As the temperature increases, the viscosities of all liquids increase.	( )
12	In neurons Na^+ and Cl^- are typically found in lower concentrations outside the cell.	( )
13	An action potential is produced after threshold is reached.	( )
14	The current is defined time rate of flow of charges through an area.	( )
15	α- decay is the nuclear transformation in which an energetic α- particle (helium-4 atoms) is emitted.	( )

Question (3): Choose the correct answer A, B, C or D **(15 Mark)**

1) The Fick's first law is.....

A) $J = -D(\frac{dc}{dx})$ B) $J = D(\frac{dc}{dx})$ C) $J = \frac{1}{D}(\frac{dc}{dx})$ D) $J = -\frac{1}{D}(\frac{dc}{dx})$

2) Spontaneous disintegration of nuclides is called.....

A) Radioactivity B) Electron capture C) Excitation D) Ionizing

3) .....The bonds between atoms get weakened and as a result new chemicals are formed

A) Cell Death B) Somatic Effects C) Radiation Damage D) Chronic Exposure

4) .....The ones that appear in the person that is exposed to radiation. The effect can become obvious immediately after the exposure or can take a long time to cause noticeable changes

A) Cell Death B) Somatic Effects C) Radiation Damage D) Chronic Exposure

5) Low instantaneous dose received for a long period of time is termed as .....

A) Cell Death B) Somatic Effects C) Radiation Damage D) Chronic Exposure

6) .....Depends on the number of ion channels open, the lower the number the more channels are open.

A) Membrane capacitance B) Saltatory conduction C) Depolarization D) Membrane resistance

7) Slowly the sodium channels come out of inactivation. This is known as the.....

A) Relative refractory period B) Absolute refractory period C) Depolarization D) Repolarization

8) Poiseuille's law to calculate the viscosity is.....

A) $\eta = {}^{\pi r^4 tp}/_{Vl}$ B) $\eta = {}^{\pi r^4 tp}/_{2Vl}$ C) $\eta = {}^{\pi r^4 tp}/_{4Vl}$ D) $\eta = {}^{\pi r^4 tp}/_{8Vl}$

9) The dimensions of viscosity η in (**SI**) are.....

A) kg $m^{-1}s^{-1}$ B) g $cm^{-1}s^{-1}$ C) kg m s^{-1} D) kg m s

10) .....The fluid molecules are much thinner

A) Viscosity B) Laminar flow C) Turbulent flow D) Poiseuille's law

11) Low Reynolds numbers indicates that the .....

A) Viscosity B) Laminar flow C) Turbulent flow D) Poiseuille's law

12) Reynolds number is .....

A) $R = {}^{v\rho_m}/_{r\eta}$ B) $R = {}^{rv\eta}/_{\rho_m}$ C) $R = {}^{rv\rho_m}/_{\eta}$ D) $R = {}^{rv\rho_m}/_{P}$

13) Flow rate Q is given by the following equation.....

A) s/m^3 B) m^3/s C) $m^3.s$ D) $s.m^3$

Question (2): Answer (T) for True sentences or (F) for False sentences (15 Mark)

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15	α- decay is the nuclear transformation in which an energetic α- particle (helium-4 atoms) is emitted.	( )

كلية العلوم – قسم الفيزياء

جامعة أسيوط

Summer Course In: "Introduction to solid state physics" (P 350)

Sep. 2022

time: 2hours

السؤال الأول (إجبارى): (20 درجة)

I) Choose the right answer between brackets:

1) The value of the packing factor for simple cubic must be (lower- higher – equal) than that of the FCC- cubic system.
2) If d-spacing have the same order of magnitude of lattice parameter the crystalline plane is (*010, 011, 110, 101*).
3) The diameter of the cubic structure is occupied by two atoms in (S. cubic – FCC – BCC).
4) Frenkel defects include a vacancy and (substantial atom – interstitial atom – surface atom).
5) Polycrystalline material includes grains with (different- semi – same) atomic arrangement.
6) The current density depends on (electronic charge – no. of electrons per unit volume – both of them)
7) At the fourth level of the potential barrier its width includes (one – one and half – two) waves.
8) The heat capacity per mole for N molecules of diatomic gas equal (3/2 R –5/2 R – 5/2 K)
9) The electrical conductivity is related to (current density – electric field – both of them).
10) The effective field is the difference between the external field and (macroscopic – depolarizing – local) field.

II) Transfer the following sentences after putting a check mark right or wrong:

1) Space lattice represents an infinite arrangement of array points in one dimension
2) One can not prepare the perfect crystal due to surface effects.
3) For the 2nd order reflections the wavelength of the incident X-ray beam must be equal to the d- spacing.
4) The XRD of the polycrystalline material is characterized by broadening peaks
5) The point defects cause a limit distortion in the unit call of the crystal lattice.
6) X-ray is partially absorbed through a certain material medium.
7) Both the electron mobility and electrical conductivity depends on the external field
8) According to Classical theory the total energy of the atomic oscillator equal 1/2 KT
9) The width of the potential barrier includes a complete wave at the first level.
10) Nonpolar molecules of dielectric materials are characterized by permanent polarization.

أجب عن سؤالين فقط :

السؤال الثانى (اختيارى): (15 درجة)

2. a) Prove that the Bragg's low for n-order reflections is expressed as: $n\lambda = 2d \sin\theta$, explain in details the necessary conditions required for applying this low. If the Miller indices satisfy that: $h^2 + k^2 + \ell^2 = 13, 7,$ and 19 identify the different available crystalline planes.

b) X-ray beam with energy 2.7 KeV incident on BCC crystal with angle 30^0, determine the crystalline plane reflected the 1st the order spectrum (given: atomic radius of 0. 2 nm, and h = 6.62×10^{-27} erg. sec).

c) Explain the difference between the effect of an external field on nonpolar and polar molecules of dielectric materials, then express the effective and local field in terms of the external field.

للأسئلة بقية فى الورقة التالية ←

السؤال الثالث (اختياري): (15 درجة)

3. a) Use the eqn. of motion of the electron under applying an external field to prove that the drift velocity of the electron given as: $\upsilon_d = eE\tau / m$. Show that the electron mobility depends on the relaxation time.

b) A Certain crystal reflects monochromatic X-rays strongly when Bragg's glancing angle of the 1st order is 15^0, what are the glancing angles for second and third orders spectrum?

c) Compare between Scottyky and Frenkel point defects. Explain with a schematic drawing the screw dislocations.

السؤال رابع (اختياري): (15 درجة)

4. a) Apply the Schrödinger eqn. : $d^2\Psi / d^2x + (2mE/\hbar^2)\psi = 0$ to describe the waveform accompanied the electron at different levels. (ψ is the wave function of the electron).

b) Prove that the energy of X-ray beam incident on BCC crystals in terms of atomic radius (r), Bragg's angle (θ), and Miller indices ($hk\ell$) can expressed as: $E = hC/(8r\sin\theta)[3(h^2+k^2+l^2)]^{-1/2}$.

c) According to an assumptions of the heat capacity Classical theory, find an agreement between the atomic heat capacity contribution and that obtained by an experimental results.

انتهت الأسئلة

تمنياتي بالتوفيق.....أ.د. عبد المنعم سلطان

Assiut University
Faculty of Science
Department of Physics
Summer semester 2021-2022

Course: Plasma Physics
Code: P332
Time: Three hours
Final exam
50 degrees

The final exam is in 8 pages (50 degree)

First question: Choose the correct answer (15 degree: One degree for each point)

1) More than 50% of universe is made of			
A. Dark matter	B. Normal matter	C. Dark energy	D. Normal energy
2) The density of an ideal gas at 0 °C and 760 Torr pressure is ... m^{-3}			
A. 6.22×10^{21}	B. 2.66×10^{23}	C. 6.022×10^{23}	D. 2.7×10^{25}
3) For ordinary air at room temperature and $U_i = 14.5\ eV$, The fractional ionization (n_i/n_e) predicted by Saha equation is ...			
A. 10^{22}	B. 10^{-22}	C. 10^{-122}	D. 10^{122}
4) "Charged particles interact simultaneously with many other charged particles.", is the definition of ...			
A. plasma	B. quasineutral gas	C. collective behavior	D. Saha equation
5) A gas in thermal equilibrium has particles of all velocities, and the most probable distribution of these velocities is known as ... distribution			
A. Maxwellian	B. Gaussian.	C. Normal	D. Fourier
6) The criterion for plasma is ...			
A. $\lambda_D \ll L$	B. $N_D \gg 1$	C. $\omega\tau > 1$	D. all mentioned
7) In the gravitational field, the physical reason for this drift is again the change in ...			
A. Debye shield	B. Larmor radius	C. centrifugal force	D. circular motion
8) In the gravitational field, the net current density in the plasma given by ...			
A. $n(M+m)\frac{g\times B}{B^2}$	B. $(\rho_e + \rho_i)v_g$	C. Both A&B	D. None of mentioned
9) An ion engine has a 2T magnetic field, a hydrogen plasma is to be shot out at an E ⊥ B velocity of 3000 km/s. What internal electric field must be present in the plasma?			
A. $6 \times 10^6\ V/m$	B. $6 \times 10^3\ V/m$	C. $1.5 \times 10^6\ V/m$	D. $1.5 \times 10^3\ V/m$
10) A typical plasma density might be ... ion– electron pairs per m^3			
A. 10^{-38}	B. 10^{38}	C. 10^{-18}	D. 10^{18}
11) Perhaps 80 % of plasma phenomena observed can be explained by ...			
A. Debye model	B. crude model	C. waves model	D. None of mentioned

Good Luck
Dr. Hadeer El-Hawary

12) Equation of … means that the incoming fluid equals the outcoming fluid.			
A. continuity	B. state	C. motion	D. Saha
13) The random motion of the particles in the fluid element is described as a …			
A. stress tensor	B. thermal effect	C. collective effect	D. conservation
14) Any periodic motion of a fluid can be decomposed by …			
A. group velocity	B. Fourier analysis	C. plasma frequency	D. electrostatic oscillation
15) In a plasma with no neutrals and few collisions, an analogous phenomenon occurs. This is called an … wave			
A. electron	B. sound	C. ion acoustic	D. all mentioned

1)	2)	3)	4)	5)
6)	7)	8)	9)	10)
11)	12)	13)	14)	15)

Second question: Put T for true statements and F for false statements (5 degrees: One degree for each)

1) The increase in temperature makes n_n more than n_i, and the plasma eventually becomes fully ionized.
2) Charged particle gas gives straight line orbits between collisions.
3) The components of velocity perpendicular to B and parallel to B may then belong to different Maxwellian distributions with temperatures $T_\perp$ and $T_\parallel$.
4) Plasma particles, therefore, tend to *reduce* the magnetic field, and plasmas are paramagnetic.
5) In equation of continuity, sink means that the incomed fluid is larger than the outcome.

1)	2)	3)	4)	5)

Good Luck

Dr. Hadeer El-Hawary

Third question: Answer the following (30 degrees: 5 degrees for each)

1- **In the TFTR (Tokamak Fusion Test Reactor) at Princeton, the plasma was heated by injection of $200keV$ neutral deuterium atoms, which, after entering the magnetic field, are converted to $200keV$ D ions $(A = 2)$ by charge exchange. These ions are confined only if $r_L \ll a$, where $a = 0.6\ m$ is the minor radius of the toroidal plasma. Compute the maximum Larmor radius in a $5\ T$ field to see if this is satisfied.**

2- **Suppose that a so-called Q-machine has a uniform field of $0.2\ T$ and a cylindrical plasma with $KT_e = KT_i = 0.2\ eV$. The density profile is found experimentally to be of the form**

$$n = n_0 \exp\left(e^{\left(-\frac{r^2}{a^2}\right)} - 1\right)$$

Assume the density obeys the electron Boltzmann relation

$$n = n_0 \exp\left(e\phi/KT_e\right)$$

(a) Calculate the maximum v_E if $a = 1\ cm$.

(b) Compare this with v_g due to the earth's gravitational field.

(c) To what value can B be lowered before the ions of potassium $(A = 39, Z = 1)$ have a Larmor radius equal to a?

Good Luck

Dr. Hadeer El-Hawary

3- If the thermodynamic equation of state relating p to n:

$$p = C\rho^{\gamma}$$

(a) Prove that,

$$pn^{-\gamma} = const.$$

(b) For adiabatic process, find the relation between the ratio of specific heats and the number of degrees of freedom.

Good Luck

Dr. Hadeer El-Hawary

4- When the fluid drifts perpendicular to uniform B (for drifts slow compared with the time scale) and (ϕ and p are in the same direction),

(a) Find the velocity in the plane perpendicular to the magnetic field B.

(b) Prove that we can write the diamagnetic drift as

$$v_D = \pm \frac{\gamma KT}{qB} \frac{\hat{z} \times \nabla n}{n}$$

Good Luck

Dr. Hadeer El-Hawary

5- (a) Consider an oscillating quantity in the wave, say the electric field E. If we have chosen the phase of n to be zero, and E have a phase δ:

$$\mathrm{E} = \bar{\mathrm{E}} e^{i(kx-\omega t+\delta)}$$

Prove that

$$\delta = \tan^{-1}\left(\frac{\mathrm{Im}(\bar{\mathrm{E}}_c)}{\mathrm{Re}(\bar{\mathrm{E}}_c)}\right)$$

while $\bar{\mathrm{E}}_c$ is a complex amplitude.

(b) The plasma density in the lower ionosphere has been measured during satellite reentry to be about 10^{17} at $70\ km$. What are the plasma frequencies?

Good Luck

Dr. Hadeer El-Hawary

6- **Find the frequency of electron plasmas wave relation and plot the dispersion relation, in the plot show the plasma frequency, the group velocity, the phase velocity and the thermal velocity (one-dimensional problem).**

Electron charge (e)	$1.6 \times 10^{-19} C$	Boltzmann's constant (k_B)	$1.38 \times 10^{-23} JK^{-1}$
Electron mass (m_e)	$9.1 \times 10^{-31} kg$	Universal gas constant (R)	$8.314 J/mol.K$
Avogadro's number	6.022×10^{23}	Proton mass (m_p)	$1.67 \times 10^{-27} kg$

Good Luck

Dr. Hadeer El-Hawary

Assiut University

Final Exam: Condensed Matter
Code: 353P

Teaching Staff: Dr. M. A. Sabet
Date: 6/9/2022
Time: 3 hours

Faculty of Science
Physics Department

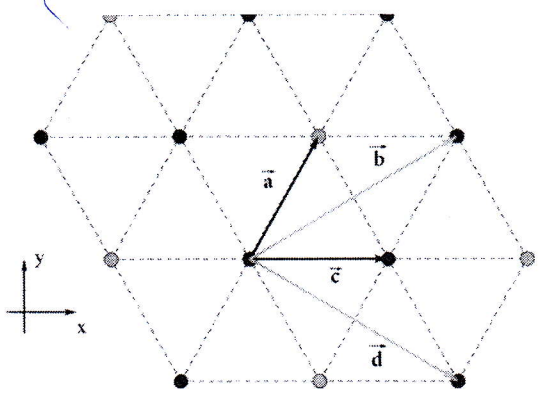
لاحظ :

- **في حالة اختيار أكثر من إجابة للنقطة الواحدة سيتم احتساب الإجابة خاطئة**
- **يجب أن يكون التظليل واضح ومعتم للدائرة**
- **لا يمكن تعديل الإجابة بعد تظليل الدائرة ومن حق الطالب/ة ورقة إجابة واحدة فقط**
- **لن يلتفت إلى أي إجابات خارج الجدول في صفحة الإجابة في آخر ورقة**
- بعض الثوابت التي قد تحتاج اليها

- e : electron charge 1.6×10^{-19} C,
- c : speed of light $=3\times10^{8}$ m/s
- h : Planck's constant $=6.6\times10^{-34}$ J.s
- m_n: neutron mass $=1.67\times10^{-27}$ kg

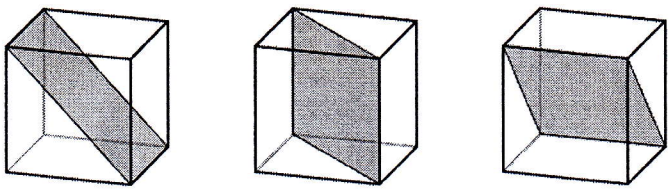
Choose the correct option True (T) or False (F), 1.25 Mark each:

1. In crystalline solids, the atoms are arranged in a highly ordered manner relative to each other while in amorphous solids, the atoms are randomly arranged.
2. A real crystal doesn't have any imperfections while the perfect crystal maintains its periodicity in all directions from $-\infty$ to $+\infty$.
3. A crystal that possesses a transitional symmetry remains invariant under such transition.
4. In Bravais lattice, atoms in the crystal are of different kinds.
5. A non-Bravais lattice may be considered as a combination of two (or more than two) interpenetrating Bravais lattices with fixed orientation relative to each other.
6. Assuming a 2D-lattice as shown, any pair of the vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ and $\vec{d}$, can be assumed as basis vectors.



7. The best choice of the unit cell in the above Fig. is the area of the parallelogram with the sides $\vec{a}$ and $\vec{b}$.
8. A unit cell that contains only one lattice point is called a primitive unit cell.

9. In 3D, there are 7 crystal systems and 14 Bravais lattices while in 2D, there are only 5 Bravais lattices.
10. The cubic crystal system has the characteristics $a = b = c$ and $\alpha = \beta = \gamma = 90$ while the triclinic crystal system has the characteristics $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90$.
11. The monoclinic system is characterized by $a \neq b \neq c$ and $\alpha = 90$ while $\beta \neq \gamma \neq 90$.
12. The cubic crystal system has the Bravais lattices in the form of simple, body-centered, face-centered, and base-centered unit cells.
13. The triclinic crystal system doesn't have any symmetry elements.
14. The cubic crystal system has the maximum number of symmetry elements among all other crystal systems in the form of 1 center of symmetry, 9 planes of symmetry, and 13 axes of symmetry.
15. The symmetry of the basis is called point group symmetry and refers to all possible rotations, inversions, and reflections that leave the basis invariant, providing that one point in the basis must remain fixed.
16. Miller indices describe the area of a plane in a lattice.
17. All cube faces can be denoted as $\{100\}$.
18. All the shown planes can be denoted as $\{110\}$.



19. D-spacing (interplanar distance) is generally related to Miller indices (hkl) and lattice parameters (abc) by

$$\frac{1}{d^2} = \frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}$$

20. For a cubic lattice with lattice constant **a=4.04 Å**, the interplanar distance between the **220** planes is **2.02 Å**.
21. Assuming the lattice constant is **a**, and the atomic radius is **r**, then for a face-centered cubic Bravais cell $r = \frac{a\sqrt{2}}{4}$.
22. For a body-centered cubic Bravais cell, with a lattice constant **a=4.619 Å**, the atomic radius is about **2 Å**.
23. The packing fraction is defined as the fraction of the total volume of the unit cell that is occupied by atoms.
24. For a face-centered cubic Bravais cell, the packing fraction is 0.74.
25. A collection of free atoms are more stable than their crystal.
26. Binding energy is the energy that must be added to the crystal to separate it into neutral free atoms at rest at infinite separation.
27. To have an x-ray beam of wavelength λ (~ 0.205 Å), its energy has to be E (~ 20 keV).

28. The emitted x-ray radiation from the target as a result of bombarding it by high-energy electrons has a wide continuous spectrum and some discrete lines.
29. The generated x-ray continuous spectrum is due to transitions by excited atoms in the target.
30. The attenuation of the beam intensity is due to scattering and absorption of the beam energy by the atoms of the medium according to the relation, $I = I_0 e^{-\alpha x}$, where x is the distance traveled in the medium, I_0 is the initial intensity and α is the absorption coefficient.
31. Bragg's law is used to obtain the interplanar distance if the beam wavelength $\boldsymbol{\lambda}$ and the scattering angle $\boldsymbol{2\theta}$ are known, according to $\boldsymbol{d = \frac{n\lambda}{2 \sin\theta}}$ where $\boldsymbol{n}$ is the reflection order.
32. In the rotating crystal method, a white x-ray beam is used while in the Laue method a monochromatic x-ray beam is used.
33. The powder method is used to study polycrystalline materials.
34. Using Bragg's law, the diffraction angle (2θ), for the (111) line for Al which is an fcc metal of lattice constant $a = 4.04$ Å and using an x-ray beam with $\lambda = 1.542$Å, is 38.6°.
35. Neutrons and electrons have wave-like properties, the wavelengths $(\boldsymbol{\lambda})$ are related to their kinetic energies $(\boldsymbol{E})$ as, $\boldsymbol{\lambda = \frac{h}{\sqrt{2mE}}}$, where $\boldsymbol{h}$ is Planck's constant and $\boldsymbol{m}$ is the mass.
36. Neutron diffraction is restricted to studying small depths near the surface, while electron diffraction can distinguish between different isotopes and study the structure of magnetic materials.
37. The physical properties of crystalline solids are controlled by both the nature of the host crystal and the crystal imperfections.
38. In the Schottky defect, an atom is transferred from an original lattice site and resides at an interstitial position, in a position not normally occupied by an atom.
39. For an edge dislocation, the Burgers vector is at an angle of 90° to the dislocation line while for a screw dislocation, the Burgers vector is parallel to the dislocation line.
40. Mixed dislocations are more common than pure edge and screw dislocations, and are characterized by the bend dislocation line.

END OF QUESTIONS

Answer Sheet

1	2	3	4	5	6	7	8	9	10
T	T	T	T	T	T	T	T	T	T
F	F	F	F	F	F	F	F	F	F

11	12	13	14	15	16	17	18	19	20
T	T	T	T	T	T	T	T	T	T
F	F	F	F	F	F	F	F	F	F

21	22	23	24	25	26	27	28	29	30
T	T	T	T	T	T	T	T	T	T
F	F	F	F	F	F	F	F	F	F

31	32	33	34	35	36	37	38	39	40
T	T	T	T	T	T	T	T	T	T
F	F	F	F	F	F	F	F	F	F

GOOD LUCK