University of Baghdad
College of Science
Department of Physics
Date: 2 / 9 / 2015

Qualifying Examination
for Ph.D Students
Year:2015-2016
Time: 3 Hours

الامتحان التنافسي للمتقدمين للدراسات العليا (الدكتوراه) المحاولة الثانية لقسم الفيزياء-كلية العلوم / جامعة بغداد للعام الدراسي ٢٠١٥-٢٠١٦

الاختصاص:فيزياء البلازما

اولاً:الورقة العامة ٢٠%

1-Multiple Choice Questions:

Q.1) 120 Pa is equal to

(a) 1.2×10^4 atm,   (b) 1.2×10^{-4} atm,   (c) 1.2×10^3 atm,   (d) 1.2×10^{-3} atm.

Q.2) While you are sitting on your chair, the earth is exerting you a gravitational force and you are exerting the earth --------force.

(a) Same   (b) greater   (c) smaller   (d) no

Q.3) Hamilton's principle is an example of a:

a) Hamiltonian   b) Lagrange multiplier   c) stationary point   (d) vibrational principle.

Q.4) The bulk superconductor is

(a) Perfect paramagnetic   (b) Perfect piezomagnetic   (c) Perfect diamagnetic.

Q.5) Hall coefficient determines:

(a)the concentration of charge carriers. (b)the concentration and type of charge carriers. (c)the magnetic field.

Q.6) The conventional unit cube of the diamond structure contains :

(a)4 atoms.   (b)8 molecules   (c)8 atoms

Q.7) For cross products,
(a) the commutative and associative laws are valid
(b) the commutative and associative laws are not valid
(c) the commutative law is not valid while the associative law is valid
(d) the commutative law is valid while the associative law is not valid.

Q.8) The necessary and sufficient condition that the field $\vec{F}$ be a conservative is that
(a) $\operatorname{div} \vec{F} = 0$,   (b) $\operatorname{grad} \vec{F} = 0$,   (c) $\operatorname{curl} \vec{F} = 0$,   (d) $\operatorname{div} \operatorname{grad} \vec{F} = 0$.

Q.9) The following equation: $\oint_C M\,dx + N\,dy = \iint_R \left(\dfrac{\partial N}{\partial x} - \dfrac{\partial M}{\partial y} \right) dx\,dy$ is the definition of

(a) Green's theorem in the plane   (b) Stoke's theorem   (c) divergence theorem of Gauss

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Q.10) The expectations value of a function $f(x)$ when the wave function depends only on x is given by $<f(x)> =$

(a) $\int_{-\infty}^{\infty} \psi^*(x) f(x) \psi(x)\, dx$

(b) $\int_{-\infty}^{\infty} f(x) \psi(x)\, dx$

(c) $\int_{-\infty}^{\infty} f(x) \psi^*(x)\, dx$

(d) $\int_{-\infty}^{\infty} \sqrt{f(x)}\, \psi(x)\, dx$

Q.11) The coupling of two angular moment, j_1 and j_2 gives the following umber of substates:

(a) $j_1 + j_2$ (b) Values from j_1 to j_2 , in integer steps.

(c) Values from $\left| j_1 - j_2 \right|$ to $\left| j_1 + j_2 \right|$, in integer steps.

Q.12) A particle has a total energy that is less than that of a potential barrier. When the particle penetrates the barrier, its wave function is

(a) A positive constant.   (b) Oscillatory.

(c) Exponentially increasing.   (d) Exponentially decreasing

2- Short Note Questions

Q.1) What is the meaning of simple harmonic motion?

Q.2) What is the magnitude of the resultant sum of the following three displacement vectors?
$\vec{D_1}=(20,5)$m, $\vec{D_2}=(-12,-28)$m, $\vec{D_3}=(-3,7)$m

Q.3) 1-Discuss briefly 3 ways to measure the binding energy of the excitons.

Q.4) By plotting the temperature dependence of the heat capacity ,show how to differentiate between metals and dielectric materials in general.

Q.5) Convert $2\left(\cos\dfrac{\pi}{6} + i\sin\dfrac{\pi}{6}\right)$ into the rectangular form.

Q.6) Find $\vec{A} \times \vec{B}$, where $\vec{A} = 2\vec{i} - 3\vec{j} - \vec{k}$ and $\vec{B} = \vec{i} + 4\vec{j} - 2\vec{k}$.

Q.7) The wave function of a particle at given time is given by $\psi(x) = \dfrac{e^{ikx}}{\sqrt{x^2 + a^2}}$, where k and a are constants. Is $\psi(x)$ normalized? If not, find the normalization constant.

Q.8) Hydrogen atom in the state $\psi(\vec{r}, t) = \sqrt{\dfrac{3}{4}}\, \psi_{100}(\vec{r})\, e^{-iE_1 t/\hbar} + \sqrt{\dfrac{1}{4}}\, \psi_{211}(\vec{r})\, e^{-iE_2/\hbar}$

What is the probability of measurements which give $E = E_1$?

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2 Multiple Choice Question:

Q.1) The percentage of the plasma in the universe is

(a) 1%, (b) 25% (c) 50% (d) 99%.

Q.2) All matter exist in plasma form above

(a)100 Kelvin (b) 1000 Kelvin (c) 10000 Kelvin (d) 100000 Kelvin.

Q.3) The one, of various regions in glow discharge, represents plasma is
(a) Aston dark space (b) cathode glow (c) negative glow (d) positive column

Q.4) The trajectory of charged particle in uniform B field is
(a) straight line (b) circle (c) helix (d) not of them.

Q.5) The magnetic mirror is a plasma confinement scheme based on the
(a) variant of (b) invariant of (c) variant of (d) invariant of .

Q.6) A mixed of two fully ionized gases plasma must be treated as
(a) one fluid (b) two fluids (c) three fluids (d) five fluids.

Q.7) In high frequency electron waves, the plasma approximation is
(a) not valid (b) valid (c) sometime not valid (d) almost valid.

Q.8) In any finite system, plasma oscillation will
(a) not propagate (b) propagate (c) be local (d) not of them.

Q.9) The condition for a plasma to be ideal is
(a)$\Gamma<1$ (b)$\Gamma>1$ (c)$\Gamma<<1$ (d)$\Gamma>>1$

Q.10) Ionization of atoms, by a chain of collisions with electrons, is called
(a) stepwise ionization, (b) direct ionization

(c) collisional ionization (d) chain ionization.

Q.11) Electromagnetic waves will propagate through plasma if their frequencies are ----------
the frequency of plasma oscillations.
(a) less than, (b) greater than, (c) equal to, (d) more greater than

Q.12) Q-machine produces a plasma by
(a) thermal ionization, (b) Collision ionization,

(c) Photo ionization, (d) electric field ionization.

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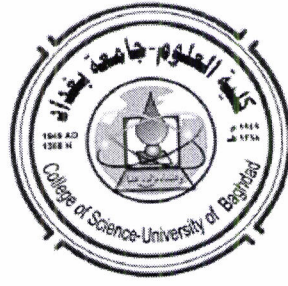
2 Short Note Questions

Q.1) What is plasma (briefly)?

Q.2) Prove that, plasma does not occur naturally in our environment.

Q.3) Although electron temperature inside a fluorescent light bulb is about 2000°K it doesn't feel that hot. Explain that.

Q.4) What is the main difference between local and remote plasma diagnostics?

Q.5) What is the meaning of the self- maintaining discharge?

Q.6) An ion engine has a 1 -T magnetic field, and hydrogen plasma is to be shot out at E×B velocity of 1000 km/sec. How much internal electric field must be present in the plasma?

Q.7) Give a brief over view for plasma applications

Q.8) Lightning is a powerful electrical breakdown between a cloud and the Earth, between two clouds, or within one cloud. How it occurs?