University of Baghdad
College of Science
Department of Physics
Date: 18 / 7 / 2016

Qualifying Examination
for M.Sc Students
Year:2016-2017
Time: 3 Hours

نموذج 2

الامتحان التنافسي للمتقدمين للدراسات العليا (الماجستير) لقسم الفيزياء-كلية العلوم
جامعة بغداد للعام الدراسي 2016-2017

1-Multiple Choice Questions:

Q.1) The probability of finding a particle in differential region dx is:

a) $\psi(x,t)\,dx$

b) $\psi(x,t)/\psi^*(x,t)\,dx$

c) $\psi^*(x,t)\psi(x,t)\,dx$

d) $\psi(x,t)^2\,dx$

Q.2) the time independent Schrödinger equation is obtained from the full Schrödinger equation by:

a)colloquialism   b)solution for Eigen functions

c)separation of the x and y variables   d) separation of the space and times variables

Q.3) 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

Q.4) Following a reactor accident the radiation dose rate is 40 μSv h^{-1} at 500 m from the reactor. What is the dose rate at 2 km? a)1 μSv h^{-1} b)2.5 μSv h^{-1} c)10 μSv h^{-1} d) 20 μSv h^{-1}

Q.5) The atomic mass number is equivalent to which of the following?

A. The number of neutrons in the atom. B. The number of protons in the atom.

C. The number of nucleons in the atom D. The number of span style   E. None of the above

Q.6) The following reaction: $^{1}_{0}n + ^{235}_{92}U \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n$ is called:

a) Fusion b) Fission   c) alpha decay   d) beta decay   e) gamma decay

Q.7)The unit of relative permeability is

a)Henry /meter   b)Henery   c)Henery/m^2 d)it is dimensionless

Q.8)Which of the following is a vector quantity?

a)Relative permeability   b)Magnetic field intensity   c)flux density   d)magnetic potential
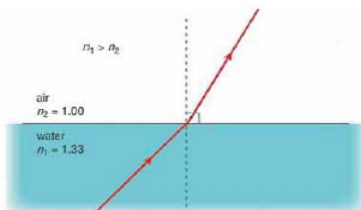
Q.9)The Biot- Savitr's law is a general modification of

a)Kirchhoffs law   b)Lenz's law   c)Ampere's law   d)Faraday's law

Q.10) The speed of light in vegetable oil is 2.04*10^8 m/s. What is the index of refraction of vegetable oil?

a) 1.47.   b) 2.42.   c) 2.01.

Q.11) what would you do to make this diagram more accurate?

a.   Redraw the refracted ray so it bends away from the normal.

b.   Reverse the values for n_1 and n_2.

c.   Redraw the refracted ray so it reflects back into the water.

Q.12) What is a normal line?

(a) A line that is perpendicular to the angle of incidence (b) A line that is perpendicular to the angle of reflection

(c)line that is perpendicular to the reflecting surface   (d) A line that is parallel to the angle of incidence

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Q.13) A simple cubic lattice consists of eight identical spheres of Radius R in contact, placed at the corners of the cube, what fraction of the total volume of cube is actually occupied by the cube?

a)74%   b)68%   c)52%   d)66%

Q.14)When a cation leaves its normal position in the crystal and moves to some interstitial space, the defect in the crystal is known as

a)Schottky defect   b)F-centre   c)Frenkel defect   d)Non-stochiometric defect.

Q.15)Sodium chloride, NaCl usually crystallizes in a face centred cubic lattice. How many ions are in contact with any single Na^+ ion?

a)8   b)6   c)4   d)1

Q.16) Two equations that can be drawn as same line on graph then these equations are considered as

a) constant equations b)solved equations   c)equivalent equations d)non-equivalent equations

Q.17) Value of determinant is computed by adding multiples of one column to

a) another column   b)another matrix   c)another dimension   d)another row

Q.18) Function written as y = -4x + 16 is general form of

a) slope 16, y-intercept(0,-4)   b)slope 4, y-intercept(0,-16)

c)slope 0, y-intercept(-4,16)   d)slope -4, y-intercept(0,16)

Q.19) In pulsed lasers:

(a) The output power is extremely change with time

(b) The output power is constant with time

(c) The output power is a slightly change with time

(d) The output power does not depend on time

Q.20) It's impossible to achieve lasing in:

(a) Steady-state condition b) Four level system   c) Three level system d) Both (b) and (c)

Q.21) In ruby laser, the activator atom is

(A) Aluminum   b) Cobalt   c) Oxygen   d)Chromium

Q.22) The equation of The Fermi – Dirac Statistics   a)$N_i = \dfrac{g_i}{e^{(E_i - E_F)/kT} - 1}$ b)$N_i = \dfrac{g_i}{e^{(-E_F)/kT} + 1}$

c) $N_i = \dfrac{g_i}{e^{(E_i - E_F)/kT}}$ d) $N_i = \dfrac{g_i}{e^{(E_i - E_F)/kT} + 1}$

Q.23) The Monatomic gases has degrees of freedom equal   f = 1   f = 2   f = 3   f = 4

Q.24) The average energy of a harmonic oscillator in 3-dimension is KT.   3 KT.   3/2 KT.   None of them.

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2.Short Note Questions

Q.1) 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.2) Hydrogen atom in the state $\psi(\vec{r},t)=\sqrt{\dfrac{3}{4}}\,\psi_{100}(\vec{r})\,e^{-iE_1t/\hbar}+\sqrt{\dfrac{1}{4}}\,\psi_{211}(\vec{r})\,e^{-iE_2/\hbar}$

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

Q.3) If a nucleus has a half-life of 1 year, does this mean that it will be completely decayed after 2 years? Explain

Q.4) Using the shell model to predicate the ground state of $_{10}$Ne-19 , $_{10}$Ne-20, $_{10}$Ne-21.

Q.5)What the first Maxwell's equation is called, and then explains its meaning.

Q.6)Write an expression describes the energy flow of electromagnetic wave, then what it is called?

Q.7) light travels from air into an optical fiber with an index of refraction of 1.44:
a) in which direction does the light bend?
b) if the angle of incidence on the end of the fiber is 22° . What is the angle of refraction inside the fiber?

Q.8) State the laws of reflection?

Q.9)Draw (110) plane and its directions for a cubic of lattice constant a

Q.10)A- The first peak of x-ray diffraction pattern (λ=1.54 A°) from a cubic crystal with lattice constant equal to 3.11 A° was observed at Bragg's angle equal to 20.5°. B-Determine the possible Miller indices of diffraction plans.

Q.11) Find the volume V of the parallelepiped with sides $\vec{A}=2\hat{i}+3\hat{j}+3\hat{k}$,

$\vec{B}=5\hat{i}+4\hat{j}+6\hat{k}$ and $\vec{C}=7\hat{i}+8\hat{j}+10\hat{k}$.

Q.12) Find the area of a parallelogram whose adjacent are $\hat{i}-2\hat{j}+3\hat{k}$ and $2\hat{i}+\hat{j}-4\hat{k}$.

Q.13) Defined the laser threshold condition? Write the mathematical expression of this condition?

Q.14)What are the advantages of N_2 and He_2 gases in CO_2 laser?

Q.15) the partition function of a system is given by :- $\ln Z$ = a T^4 V Where a is constant, T is the absolute

temperature and V is the volume. Calculate the internal energy and pressure?

Q.16) **In** FD- distribution derive the equation of the average energy of The Electron Gas (at T= 0 K) **.**

Q.17) A stone dropped from a bridge strikes the water 2.2 sec later. How high is the bridge above the water?

Q.18) A pendulum clock has a period of 0.65 sec on earth, it is taken to another planet and found to have a period of 0.862 sec. the change in the pendulum's length is negligible, find the gravitational field strength on the other planet?

Q.19) If an electron and a proton have the same de Broglie wavelength, which particle has greater speed?

Q.20) Photon A has twice the energy of photon B. What is the ratio of the momentum of A to that of B?

Q.21) **Compare between DC and AC**

Q.22)Explain briefly Faraday's law of inductance

Q.23) Find the velocity X^0 and the position x as function of the time t for a particle of mass m, which starts from rest at x=0 and t=0, subject to the force $F_x=F_0+ct$, where F_0 and c is positive constants?

Q.24) Is the force **F=ixy+jxz+kyz** conservative?