Assiut University	**The final Exam**	**Second Level**
faculty of Science	**Introduction to physics of metals,**	**Phys& Phys-Chem.**
Physics Department	**Alloys and Ceramics (p256)**	**Time:3 h**
	2nd term, May 2017	**Date:25-5-2017**

Answer only five questions from following. Question No.1 must be included "50 Marks"

- **All questions are of equal marks (10 marks)**
- **Use these constants when you need :**
- **$K_B = 1.38x10^{-23}$ J/K , $e=1.6x10^{-19}$ C**
- **$R=8.31x10^{3}$ J/mole , $N_A=6.02x10^{23}$/mole.**

Q.1: Complete the following sentences: (10 Marks)

1- **In a cubic unit cell, the indices of the direction has the projections a/2, b/2, -c is .....**

2- **In an FCC unit cell, the linear density (L.D) in the [111] in terms of the atomic radius (R) is .....**

3- **X-ray diffraction can take place for BCC crystal structure from the planes ....., ..., ...**

4- **The atomic packing factor (APF) for hcp crystal structure is given by the relation : .....**

5- **Fick,s first low of diffusion in solids states that J=.....**

6- **The ductility of metal sample in tensile test can be determined by the relation .....**

7- **The mold constant C_m in Chvorinov,s Rule for total solidification time depends on.....,....., ...**

8- **The Gibbs phase rule state that .....**

9- **The bonds type in crystalline ceramic materials are .....**

10- **The coordination number for a crystalline ceramic has a cesium chloride structure is .....**

Q.2: **(10 marks)**

2(a)- Discuss briefly the different techniques that generally used for microscopic examination of metallic samples. What are the main features that can be obtained from each technique?

2(b)- The metal iridium has an FCC crystal structure . If the angle of diffraction for the (220) set of planes occurs at 69 22° (first order reflection) when mono chromatic x-ray having a wavelength of 0.1542 nm is used. Compute:

i) The interplanar spacing for this set of planes

ii) The atomic radius for an iridium atom.

Q.3: **(10 marks)**

3-a)- Compare between homogenous and heterogeneous nucleation during solidification of metals and alloys.

3-b)- At 300 C^o, the diffusion coefficient (D) and the activation energy(Q_d) for diffusion of Cu in Si are:-

D (300 C^o) =7.8x10^{-11} m^2/s, **Q_d=41.5 KJ/mole**

Calculate the diffusion coefficient at 350 C^o .

Q.4: **(10 marks)**

4-a)- Write a short account on:-

i) **Diffusion mechanism in solids and factors affect diffusion.**

ii) **The classification of metals according to the (σ - ε) curve shape during plastic deformation in tensile test.**

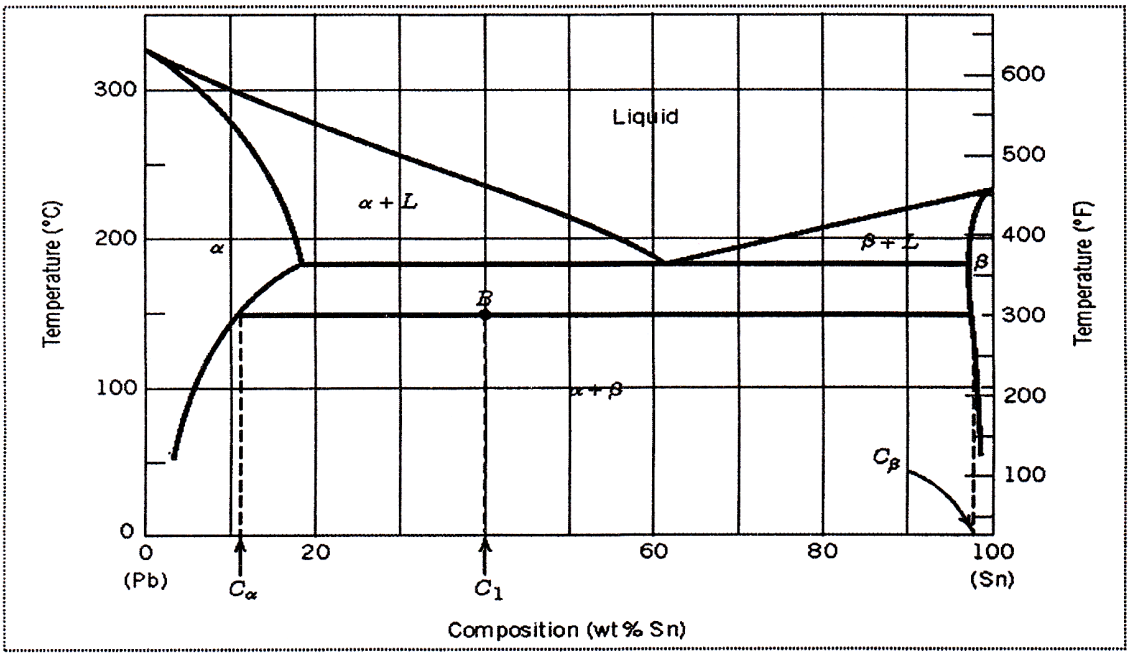
4-b)- a Tensile stress is applied along the long axis of a cylindrical metallic rod that has a diameter of 10 mm. Determine the magnitude of the load required to produce a 2.5×10^{-3} mm change in diameter if the deformation is entirely elastic

[Consider: $\nu = 0.34$, $E = 97 \times 10^3$ MPa]

Q.5: **(10 marks)**

5-a)- Explain the Vickers micro-hardness (MHV) test method, why this method is considered to be more advanced than Brnnel hardness test (HB).

5-b)- For a 40 wt% Sn-60 wt% Pb alloy at 150 C° shown in the figure below.



i) **What phase (s) is (are) present?**

ii) **What is (are) the composition (s) of the Phase(s)?**

iii) **Using the liver rule, calculate the relative amount of each phase present in terms of mass fraction.**

iv) **Apply the Gibbs phase rule at this point to find the number of degrees of freedom.**

Q.6: **(10 marks)**

6-a)- Imperfections play an important rule in the properties of ceramic materials. Discuss the main types of these imperfections. Are they, different from that in metals and alloys?

6-b)- The MgO is ionic ceramic has NaCl crystal structure. Calculate the theoretical density (ρ) for this ceramic, considering the following parameters:-

- **The number of formula unit n=4, in FCC lattice**
- $\sum A_C = \sum A_{Mg} = 24.31\ g/mole$
- $\sum A_A = \sum A_O = 16\ g/mole$
- $rM_g^{2+} = 0.72\ nm$, $rO^{-2} = 0.14\ nm$
- **N_A=6.023x10^{23} formula unit /mole.**

With my best wishes Prof. Dr. Atta . Y. Abdel-latief

FINAL EXAM
(50 MARKS)

Academic Year	2016/2017 G
Semester	☐ First ☑ Second ☐ Summer
Course Title	Electricity &Ac Current– code (P226)
Exam duration	2 hours **Time:**(9 - 11) **Date:**17/5/2017

PART I : Circle the correct answer for the following questions (15 marks)

1- Which of the following are the units of a henery and a farad respectively?

a- J.s/C^2 and C/J
b- V.s/A and C/V
c- V/(A.s) and C/V
d- N.m/A^2 and 1/J

2- When a capacitor is fully charged, the current through the capacitors is:

a- zero
b- smaller than the current in a resistor
c- greater than the current in a resistor
d- at its maximum value

3- A current may be induced in a coil by:

a- Moving one end of a bar magnet through the coil
b- Moving the coil toward one end of the bar magnet
c- Holding the coil near a second coil while the electric current in the coil increasing
d- All of the above

4- An Alternating current circuit has resistance R, inductance L and capacitor c in series with a voltage source ,which statement is correct:

a- The voltage across the capacitor leads the voltage across the inductor by 90°
b- The voltage across the inductor leads the voltage across the capacitor by 90°
c- The voltage across the inductor leads the voltage across the capacitor by 180°
d- The voltage across the inductor leads the voltage across the resistor by 180°

5- If both the resistance and the inductor in an LR series circuit are doubled, the new inductive time constant will be :

a- Twice the old
b- Four times the old
c- Half the old
d- unchanged

6- In a purely capacitive circuit, the current.....

a- Leads the voltage by one-quarter of a cycle
b- Leads the voltage by one-half of a cycle
c- Lags the voltage by one-quarter of a cycle
d- Lags the voltage by one-half of a cycle

7- The Ohm (Ω) is the unit of all of the following except:

a- Inductive reactance (X_L)
b- Capacitive reactance (X_C)
c-Total impedance (Z)
d- Capacitance (C)

Please follow questions in the next pages

8- If a sinusoidal wave has frequency of 50 Hz with r.m.s voltage 30 V, which of the following equation represents this wave?

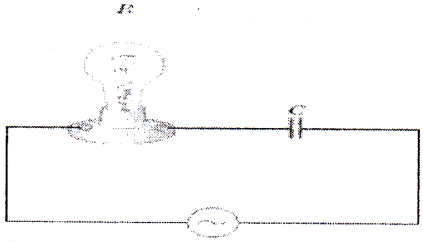
a- 42.4 sin 314 t b- 60 sin 25t c- 30 sin 50 t d- 84.8 sin 25 t

9- At resonance, the impedance Z of the RLC circuit is:

a- Capacitive reactance only b- Inductive reactance only

c- Ohmic resistance only d- All the above

10-Consider the AC circuit in the following figure. The frequency of the AC source is adjusted while its voltage amplitude is held constant. When does the light bulb glow the brightest?



a- It glows brightest at high frequencies.

b- It glows brightest at low frequencies.

c-The brightness is the same at all frequencies.

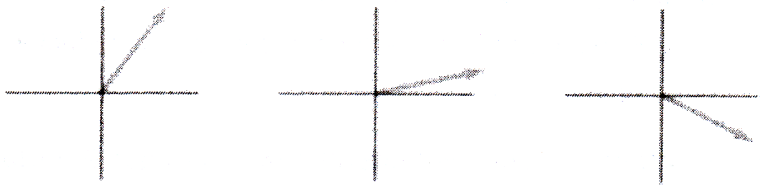
11- Consider the voltage phasor in the next figure , choose the plotting that represents the largest magnitude of the instantaneous value of the voltage for instant time

a- Plotting 2

b- plotting 3

c- plotting 1

d- plotting 1 and 3



1 2 3

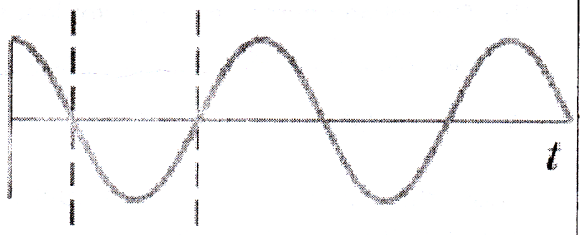
12-The corresponding figures (1,2 and 3) represents the instantaneous voltage across the elements of the RLC circuit respectively

a- Resistor, capacitor and inductor

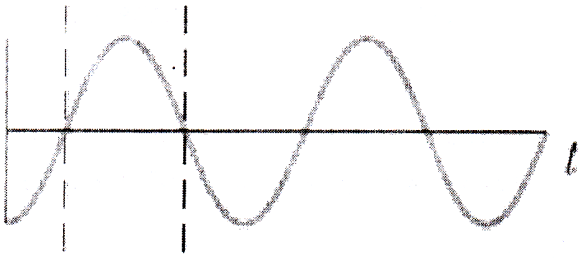
b- Capacitor, inductor and resistor

c- Inductor, resistor and capacitor

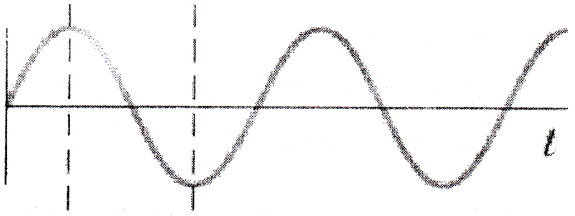
d- Capacitor, resistor and inductor



(1)



(3)



(2)

PART II : Solve the following problems and choose the correct answer

(20 marks)

1- **The reactance in ohms of 0.35 μF capacitor connected to a 400 Hz generator is:**

a- Zero b- 0.014 c- 0.088 d- 11

2- **An RLC series circuit has L= 100mH and c = 1μF,it is connected to a 1000 Hz source and the source e.m.f is found to lead the current by 75°, the value of R is:**

a- 12.6 Ω b- 175 Ω c- 126Ω d- 1750Ω

3- **A 6.0 mH inductor in a circuit, At the instant the current is 5 Amp and its rate of change is 200A/s, the rate with which the energy stored in the inductor is increasing is:**

a- 120 Watt b- 240 Watt c- 3 Watt d- 6 Watt

Please follow questions in the next pages

4- A charged capacitor is being discharged through a resistor, at the end of the two time constants, the charge has been reduced by what percent of its initial value?

a- 82% b-86% c- 100% d- zero%

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5- A 10 turn ideal solenoid has an inductance of 3.5 mH and carries a current of 2 A, the magnetic flux through each turn is:

a- Zero b- 3.5×10^{-4} Wb c- 7×10^{-4} Wb d- 7×10^{-2} Wb

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6- When a switch is closed ,completing an LR series circuit, the time needed for the current to reach three-quarters its maximum value is .....time constant.

a- 0.5 b- 0.693 c- 0.725 d- 1.38

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7- A 45 mH inductor is, connected to a source of sinusoidal e.m.f with a frequency of 400Hz and a maximum e.m.f of 20V .The maximum current is :

a- 2300A b- 0.18 A c- 1.1 A d- 360A

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8- A certain capacitor in series with a 720 Ω resistor is being charged, At the end of 10 ms its charge is half the final value, the capacitance is about :

a- 7.2 μF b- 9.6 μF c- 14 μF d- 20μF

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9- An ac generator produces 10 V(r.m.s) at 400 s^{-1}.It is connected to a series RL circuit (R = 17.3Ω, L= 0.025H), the r.m.s current is:

a- 0.5A and leads the voltage by 30° b- 0.71A and lags the voltage by 30°

c- 0.5A and lags the voltage by30° d- 1.4A and lags the voltage by 60°.

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Please follow questions in the next pages

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PART III: Solve the following problems (15 marks)

1- Two solenoids A and B, spaced close to each other and sharing the same cylindrical axis, have 400 and 700 turns, respectively. A current of 3.50 A in coil A produces an average flux of 300 μ Wb through each turn of A and a flux of 90.0 μ Wb through each turn of B.

a- Calculate the mutual inductance of the two solenoids.

b- What is the self-inductance of A?

c- What emf is induced in ***B*** when the current in ***A*** increases at the rate of 0.500 A/s?

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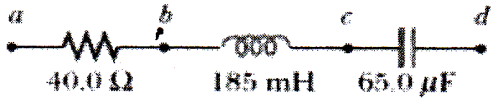
2- An RLC circuit connected with Ac source with ΔV_{max} =150V and f = 50Hz as in the next figure. Calculate:



a- The maximum current in the circuit

b- The maximum voltage between points b and c

c- The power factor

d- The resonance frequency

e- The average power delivered to the circuit

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Questions Finished

With my best wishes

Assiut University
Faculty of Science
Department of Physics

Undergraduate
Final Exam (50%)

Second semester 2016-2017

Course : Modern Physics
Code : P215
Section : Phys. and Phys./Chem.
Time : 3 Hours
Date : 18/5/2017

Answer the following question:

Question (1): (10 Mark)

Write number of each statement and put [√] or [×], then discuss your answer (if √ or ×):

1- By increasing atomic number of the atom Z, radius of certain level decreases by factor of Z than the same level in Hydrogen atom.

2- By increasing atomic number of the atom Z, the total energy of certain level increases by factor of Z than the same level in Hydrogen atom.

3- Galilean transformation is a set of equations connecting space coordinates of an event in two different inertial frames.

4- Bohr considered that nucleus has a finite mass M and the electron and nucleus actually revolve about their center of mass.

5- Proper time between two events can be considered as spacelike interval.

6- According to EM classical theory, emission of electrons from metal doesn't depend on intensity of incident light.

7- Classical and quantum theories could agree by smaller quantum number n.

8- According to Einstein relativity, the quantity $E^2 - p^2 c^2$ is not invariant.

9- Sommerfeld assumed that the change of speed of the electron revolving in an elliptical orbit around the nucleus is the reason of fine structure of the energy levels.

10- The Bohr model may be applied to ${}^{6}_{3}Li^{++}$.

Answer four (4) only of the following questions:

Question (2): (10 Mark)

a) How fast should a rocket move to be contracted to 99% of its rest length? (2 points)

b) As the outlaws escape in their gateway car, which goes 3/4c, the police officer fires a bullet from the pursuit car, which only goes 1/2c. The muzzle velocity of the bullet (relative to the gun) is 1/3c. Does the bullet reach its target:
(i) according to Galileo, (ii) according to Einstein? (5 points)

c) Verify that law of conservation of linear momentum is invariant under Galilean transformation. (3 points)

Question (3): (10 Mark)

a) Starting from equation $T = (m - m_0)\, c^2$, derive an expression for the relation between total energy and kinetic energy. (4 points).

b) Show that T can be reduced to classical form at small velocities and draw a figure to represent relativistic and classical T ? (4 points)

c) If the total energy of a particle is n times its rest energy, what is its momentum? (2 points)

Question (4): (10 Mark)

a) Derive the total energy of the electron E_n in the Hydrogen like atom according to Bohr Model. (note that $r_n = \dfrac{h^2 \varepsilon_0}{\pi m e^2} n^2$ for Hydrogen atom) (6 points)

b) If the total energy of the electron in its lowest state in Hydrogen atom is $E_1 = -13.6$ eV, calculate the total energy of the electron at n=1, 2, 3 in ${}^4_2He^+$. (4 points)

Question (5): (10 Mark)

a) Write equation of spacetime interval in X- axis and Show (with draw) how spacetime interval can determine the causality between two events. (8 points)

b) In frame S, event B occurs 2×10^{-6} s after event A and at $\Delta x = 1.5\times10^3$ m from event A.

(i) Compute the spacetime interval between the events. (1 point)

(ii) Can two events be causally connected? Why? (1 point)

Question (6): (10 Mark)

a) An electron of rest energy 0.511 MeV moves with respect to the laboratory at speed $u = 0.6c$. Find: (5 points)

(1) electron relativistic mass
(2) electron relativistic momentum in units of MeV/c
(3) total energy
(4) electron relativistic kinetic energy

b) The mean life-time of muons at rest is 2.2×10^{-6} s. The observed mean lifetime of muons as measured in the laboratory is 6.6×10^{-6} s. Find: (5 points)

(1) relativistic mass of a muon. (2) its kinetic energy. (3) its momentum

Constants: the rest mass of muon is $m_{u0} = 207\, m_{e0}$ (m_{e0}=0.511 MeV)

1 eV ≡ 1.602×10^{-19} J , $h = 6.6261\times10^{-34}$ J.s , $c = 3\times10^8$ m/s, $e = 1.6 \times10^{-19}$ C

BEST WISHES

Instructor: Dr. Sherif Rashad MOKHTAR

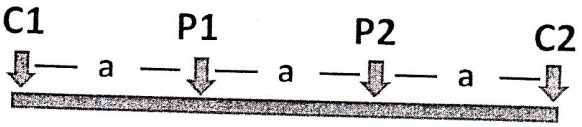
FACULTY OF SCIENCE
ASSIUT UNIVERSITY

Final Exam on Principals of Geophysics (G250)
(Two Pages – 50 marks total)

January: 2017 Time: 2 hours

1) Answer the following questions: (*two and half mark each*)

a) Derive the general expression for ρa for the electrode array sketched below.



b) Discuss with drawing two problems associated with the interpretation of seismic refraction data.

c) What is the following expression? Define all terms.

$$\rho a = a\, \varphi^{-m}\, S^{-n}_{w}\, \rho_{w}$$

d) With the help of drawing explain the Sato and Mooney (1960) model for electrochemical potential of sulfide ore deposits

2) Define *only five* of the following: (*two marks each*)

Apparent resistivity	Critical angle of refraction	The geoid
Magnetic susceptibility	Inclination	Isostasy
Bouguer anomaly	Shear modulus	Declination

3) Mark *onlyTen* of the following statements with True or False: (*one mark each*)

1) Magnetic field survey should be carried out even if there is a magnetic storm
2) The gravity acceleration varies from the equator to the pole by almost 0.5%
3) As water content increases, earth electrical resistivity increases

4) The sign of the self-potential is an important diagnostic factor in the interpretation of SP anomalies
5) The higher the value of the modulus, the stronger the material, and the smaller the strain produced by a given stress
6) Sedimentary rocks are higher in gravity acceleration "g" and magnetic susceptibilities than igneous rocks
7) Velocity of seismic waves in sedimentary rocks is higher than igneous rocks
8) By increasing the electrode spacing, more of the injected current will flow to shallower depths
9) Primary seismic waves are slower than secondary seismic waves
10) 99% of the Earth's magnetic field originates from the interaction of the Earth's ionosphere with the solar wind.
11) Electrokinetic potentials result from the flowing of fluid through a capillary or porous medium
12) Self-Potential is classified as an active electrical method whereas the resistivity method is passive
13) The self-potentials are almost invariably positive over the top of the sulfide deposit and are quite stable in time
14) Secondary seismic waves can travel through liquids
15) The interpretation of SP is mostly quantitative

16) **Write brief notes on *only ten* of the followings: (*two marks each*)**

1. Advantages and limitations of resistivity method
2. The field techniques for measuring the self-potential
3. Two problems associated with the interpretation of seismic refraction data
4. List the source of changes in the earth's magnetic field
5. List the different corrections applied to gravity data
6. Pratt's model of isostasy
7. Causes of variations of gravity acceleration "g" over the earth's surface
8. Common modes/techniques of electrical resistivity field survey
9. The different component of non-polarizable electrode
10. Characteristics of pure ferromagnetic materials
11. Type of electrical current conductions in subsurface earth materials
12. The source mechanisms of self-potentials
13. The three components of earth's magnetic field
14. Instrumentation used for seismic refraction field survey

Good Luck..... *Prof. Dr. Gamal Zidan AbdelAal*

Assiut University **Faculty of Science** **Physics Department**		**Date: 01.06.2017** **Allowed time: Two hours** **Division: Petroleum geology**
Final exam, 2nd term 2016-2017	**Course code: P225**	**Course title: Principles of Modern Physics**

Some possibly useful constants can be found in the table below

$e = 1.6\times10^{-19}$ C	$m_e = 9.1\times10^{-31}$ Kg	$c = 3\times10^{8}$ m.s^{-1}	$R_h = 1.097\times10^{7}$ m^{-1}	$m_p = 1.0072766$ u
$h = 6.62\times10^{-34}$ J.s	$m_p = 1.67\times10^{-27}$ Kg	$1\,\text{eV} = 1.6\times10^{-19}$ J	$m_H = 1.007825$ u	$m_n = 1.008665$ u

Question one: choose the correct answer [2 points each]

1) The Lorentz transformation tells you how to write primed coordinates in terms of unprimed. If we wanted to write x in terms of the primed coordinates, which would be the correct formula?

A. $x = \gamma(t' - vx')$

B. $x = \gamma(t' + vx')$

C. $x = \gamma(x' - vt')$

D. $x = \gamma(x' + vt')$

2) Max K.E of photo electrons depend upon light's

A. intensity B. frequency C. wavelength D. energy

3) Which types of objects, under appropriate circumstances, can sometimes act like waves and sometimes like particles?

A. Photons (only).

B. Electrons (only).

C. Atoms (only).

D. Photons, electrons, and atoms.

4) When the speed of the electrons that strike a metal surface is increased, the result is an increase in

A. The number of x-rays emitted.

B. The frequency of the x-rays emitted.

C. The speed of the x-rays emitted.

D. The size of the x-rays emitted.

5) The only type of radioactive decay that changes neither Z nor A is

A. α decay. B. β^+ decay. C. β^- decay. D. γ decay

Question Two: **Discuss the following topics shortly (4-5 sentences) [5 points each].**

a) Photoelectric effect.

b) The Davisson-Germer Experiment.

Question Three: Perform the indicated calculations [10 points each]

1) An experimenter is scattering X-rays of unknown wavelength λ of electrons, and measuring the wavelength λ' when they scatter to an arbitrary angle θ. At an angle of $\theta = 90°$, the observed wavelength $\lambda' = 1.083 \times 10^{-11}$ m.

a) What is the incoming wavelength λ?

b) At what angle would the observed scattered wavelength be $\lambda' = 1.204 \times 10^{-11}$ m?

c) What is the frequency for the incoming X-rays? What is the energy in eV?

2) An electron has a de Broglie wavelength of 2 pm (= 2.0×10^{-12} m). Find its kinetic energy and the group velocity of its de Broglie waves.

3) Find the binding energy per nucleon (in MeV) for helium-4. (m_D = 0.030377 u)

Good Luck

Dr. Ahmed Tamer AlMotasem

Assiut University Faculty of Science Physics Department		Date: 29.05.2017 Allowed time: Two hours Course code: P225
Final exam, 2nd term 2016-2017		Course title: Principles of Modern Physics

Some possibly useful constants can be found in the table below

$e = 1.6\times10^{-19}$ C	$m_e = 9.1\times10^{-31}$ Kg	$c = 3\times10^{8}$ m.s^{-1}	$R_h = 1.097\times10^{7}$ m^{-1}	$m_p = 1.0072766$ u
$h = 6.62\times10^{-34}$ J.s	$m_p = 1.67\times10^{-27}$ Kg	$1\,\text{eV} = 1.6\times10^{-19}$ J	$m_H = 1.007825\,u$	$m_n = 1.008665$ u

Question one: choose the correct answer [2 points each]

1) In special relativity, why are the Galilean transformations ($x' = x - vt,\ t' = t$) not "good"?

A. They imply the wrong formula for conservation of energy.
B. They imply the wrong formula for conservation of momentum.
C. They don't preserve the time formula.
D. They are for physical objects, not light.

2) Which hypothesis is attributed to de Broglie?

A. Electrons have wave-like properties
B. Electrons must satisfy Schrödinger's equation
C. Electrons orbit the nucleus on circular paths
D. Electrons have angular momentum that is a multiple of $\hbar$.

3) Which experiment is credited with establishing that light carries momentum?

A. Photoelectric effect.
B. Davisson-Germer Experiment.
C. Compton effect.
D. Michelson–Morley experiment.

4) When an X-ray scatters from an electron at rest in an atom, the final photon will have a ..... wavelength and a ..... frequency.

A. longer, lower.
B. longer, higher.
C. shorter, lower.
D. shorter, higher.

5) The only type of radioactive decay that changes neither Z nor A is

A. α decay. B. β^+ decay. C. β^- decay. D. γ decay.

Question Two: **Discuss the following topics shortly (4-5 sentences) [5 points each].**

a) Heisenberg's uncertainty principle.

b) Radioactive decay

Question Three: Perform the indicated calculations [10 points each]

1) When gold is illuminated by light with wavelength **139** nm, electrons are emitted which can move against a potential of up to max V = **3.80** Volt .
   a) Find the work function for gold.
   b) What is the minimum frequency which can eject electrons from gold?
   c) Suppose the frequency is changed until the electrons only can reach max V = **2.10** Volt . What is the frequency now?

2) Calculate in Angstroms the longest and shortest wave length of the Lyman series of the hydrogen atom.

3) Find the mass defect for the nucleus of helium-4. (M = 4.002603 u)

Good Luck

Dr. Ahmed Tamer AlMotasem