Assiut University
Faculty of Science
Department of Physics
Second semester 2019-2020
Time: 3 Hour

Course: *Atomic and Molecular Spectroscopy*
Code: P432
Final Exam (90%)
Oral Exam (10%)

The exam is written in twelve (12) pages

First: The Final Exam (90 Marks)

Choose the correct statement: (Every question 2 Marks)

Please write your selections (a or b or …) in the blank column to the right of the table.

رجاء كتابة إختياراتك (a أو b أو ...) بخط واضح في الخانة الفارغة يمين الجدول.

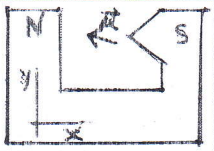
1-	If $\ell = 4$, which one of the following is a possible quantum number for n ?		
	a- 0	b- 1	
	c- 2	d- 4	
	e- 8		
2-	If $n = 5$, which one of the following is not an allowed magnetic quantum number m_ℓ ?		
	a- 0	b- 1	
	c- 2	d- 4	
	e- 5		
3-	If $n = 5$, which one of the following is not an allowed orbital quantum number ℓ?		
	a- 0	b- 1	
	c- 2	d- 4	
	e- 5		
4-	If $\ell = 5$, which one of the following is not an allowed magnetic quantum number m_ℓ?		
	a- 0	b- 2	
	c- 4	d- 6	
	e- -5		
5-	In the Bohr model of the hydrogen atom, by increasing the quantum number, the energy difference between any two successive levels in the atom …..		
	a- increasing	b- be equal	
	c- decreasing	d- all of the above	
	e- none of the above		

6-	In the Bohr model of the hydrogen atom, by increasing the quantum number, the distances between successive energy levels "the difference between the radius of the successive orbitals" in the atom …..		
	a- increasing	b- be equal	
	c- decreasing	d- all of the above	
	e- none of the above		
7-	In the Bohr model of the hydrogen atom, by increasing the quantum number, the potential energy of the electron …..		
	a- increasing	b- be equal	
	c- decreasing	d- all of the above	
	e- none of the above		
8-	In the Bohr model of the hydrogen atom, by increasing the quantum number, the velocity of the electron …..		
	a- increasing	b- be equal	
	c- decreasing	d- all of the above	
	e- none of the above		
9-	The wave equation for hydrogen has solutions only if the three quantum numbers n, ℓ, and m_ℓ meet certain conditions. One of these conditions specifies that ℓ		
	a- is either zero or $+1$.	b- is either equal to or less than $n-1$.	
	c- is an integer.	d- is a positive integer.	
	e- has an absolute value that is either equal to or less than n.		
10-	The wave equation for hydrogen has solutions only if the three quantum numbers n, ℓ, and m_ℓ meet certain conditions. One of these conditions specifies that m_ℓ		
	a- is equal to or less than n.	b- is equal to or greater than ℓ.	
	c- can be any integer.	d- can be any positive integer.	
	e- has an absolute value either equal to or less than ℓ .		
11-	According to the selection rule, when a photon is emitted or absorbed, transitions can only occur between state with values of ℓ that differ by		
	a- four units.	b- three units.	
	c- two units.	d- one unit.	
	e- zero unit.		

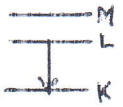
12-	Which of the following is required by the Pauli exclusion principle?	
	a- No electron in an atom can have the same set of quantum numbers as any other electron in that atom.	
	b- Each electron in an atom must have the same n value.	
	c- Each electron in an atom must have different m_ℓ values.	
	d- Only two electrons can be in any particular shell of an atom.	
	e- No two electrons in a collection of atoms can have the exact same set of quantum numbers.	
13-	In terms of an atom's electron configuration, the letters $K, L, M,$ and N refer to:	
	a- different shells with n equal to 1, 2, 3, or 4 respectively.	
	b- different sub shells with ℓ equal to 1, 2, 3, or 4 respectively.	
	c- different sub shells with m_ℓ equal to 1, 2, 3, or 4 respectively.	
	d- the four possible levels for the magnetic quantum number.	
	e- the four possible quantum numbers.	
14-	What is the maximum number of electrons that can occupy the g sub shell?	
	a- 6 / b- 10	
	c- 14 / d- 18	
	e- 22	
15-	A hydrogen atom is in the $6h$ sub shell. How many different quantum states are allowed in this sub shell?	
	a- 22 / b- 18	
	c- 14 / d- 10	
	e- 6	
16-	A neutral atom has an electron configuration of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$. What is its atomic number?	
	a- 5 / b- 11	
	c- 14 / d- 18	
	e- 25	

17-	A neutral atom has an electron configuration of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$. If a neutral atom holds one additional electron, what is the ground state configuration?	
	a- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$	b- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
	c- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$	d- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ 4s^1$
	e- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$	
18-	What is the shortest-wavelength X-ray photon emitted in an X-ray tube subject to 50 kV?	
	a- 0.025 nm	b- 0.25 nm
	c- 2.5 nm	d- 25 nm
	e- none of the given answers	
19-	The magnitude of the orbital angular momentum of an electron in an atom is what multiple of $\hbar$? (ℓ is a positive integer.)	
	a- ℓ	b- $\ell/2$
	c- $\sqrt{\ell(\ell+1)}$	d- $2\ell+1$
	e- ℓ^2	
20-	The magnetic quantum number m_ℓ is most closely associated with what property of an electron in an atom?	
	a- Magnitude of the orbital angular momentum	b- Energy
	c- z component of the spin angular momentum	d- Radius of the orbit
	e- z component of the orbital angular momentum	
21-	An electron is in a quantum state for which the magnitude of the orbital angular momentum is $6\sqrt{2}\ \hbar$. The value of the orbital quantum number ℓ is:	
	a- 4	b- 5
	c- 17	d- 8
	e- 9	
22-	An electron is in a quantum state for which there are seven allowed values of the z component of the angular momentum. The magnitude of the angular momentum is:	
	a- $\sqrt{3}\ \hbar$	b- $2\sqrt{3}\ \hbar$
	c- $\sqrt{7}\ \hbar$	d- $\sqrt{56}\ \hbar$
	e- $\sqrt{14}\ \hbar$	

23-	Space quantization means that:	
	a- space is quantized	
	b- L_z can have only certain discrete values	
	c- $\vec{L}$ and $\vec{\mu}$ are in the same direction	
	d- $\vec{L}$ and $\vec{\mu}$ are in opposite directions	
	e- an electron has a magnetic dipole moment	
24-	An electron in an atom is in a state with $\ell = 3$ and $m_\ell = 2$. The angle between $\vec{L}$ and the z axis is:	
	a- 48.2° / b- 60°	
	c- 30° / d- 35.3°	
	e- 54.7°	
25-	The electron states that constitute a single shell for an atom all have:	
	a- the same value of n and the same value of ℓ	
	b- the same value of n	
	c- the same value of ℓ and the same value of m_ℓ	
	d- the same value of ℓ	
	e- the same set of all four quantum numbers	
26-	The electron states that constitute a single subshell for an atom all have:	
	a- the same value of n and the same value of ℓ	
	b- the same value of n	
	c- the same value of ℓ and the same value of m_ℓ	
	d- the same value of ℓ	
	e- the same set of all four quantum numbers	
27-	The total number of electron states with $n = 2$ and $\ell = 1$ for an atom is:	
	a- 2 / b- 4	
	c- 6 / d- 8	
	e- 10	

28-	The magnetic field $\vec{B}$ is along the z axis in a Stern-Gerlach experiment. The force it exerts on a magnetic dipole with dipole moment $\vec{\mu}$ is proportional to:		
	a- μ_z^2	b- B^2	
	c- dB/dz	d- d^2B/dz^2	
	e- $\int B\, dz$		
29-	A magnetic dipole $\vec{\mu}$ is placed in a strong uniform magnetic field $\vec{B}$. The associated force exerted on the dipole is:		
	a- along $\vec{\mu}$	b- along $-\vec{\mu}$	
	c- along $\vec{B}$	d- along $\vec{\mu} \times \vec{B}$	
	e- Zero		
30-	A magnetic dipole is placed between the poles of a magnet as shown. The direction of the associated force exerted on the dipole is: 		
	a- positive x	b- positive y	
	c- negative x	d- negative y	
	e- into or out of the page		
31-	To observe the Zeeman effect one uses:		
	a- a strong uniform magnetic field	b- a strong non-uniform magnetic field	
	c- a strong uniform electric field	d- a strong non-uniform electric field	
	e- strong perpendicular electric and magnetic fields		
32-	Give the possible values of the total-angular-momentum quantum number J that result from the addition of angular momenta "orbital angular momentum and spin angular momentum" with quantum numbers 3/2 and 4 :		
	a- $11/2$	b- $11/2, 9/2, 7/2, 5/2$	
	c- $5/2$	d- $5, 4, 3, 2, 1$	
	e- $3/2, 1/2, 0, -1/2, -3/2$		
33-	Suppose a hydrogen atom in a $3d_{5/2}$ state is placed in an external magnetic field. Into how many sub states will it split?		
	a- 3	b- 4	
	c- 5	d- 6	
	e- None of the above		

34-	Why is it easier to analyze a mixture of gaseous atomic species by absorption spectroscopy than it is to analyze a mixture of molecular species?	
	a- atomic species do not have side reactions.	
	b- molecular species do not absorb light.	
	c- atomic spectra have simpler narrower lines that are easier to resolve than molecular spectra.	
	d- atomic species have a continuous spectrum.	
	e- atomic species have a discrete spectrum.	
35-	The probability of finding an electron in a hydrogen atom is directly proportional to its:	
	a- energy. / b- momentum.	
	c- potential energy. / d- wave function.	
	e- square of the wave function.	
36-	The most energetic photon in a continuous x-ray spectrum has an energy approximately equal to:	
	a- the energy of all the electrons in a target atom	
	b- the kinetic energy of an incident-beam electron	
	c- the kinetic energy of a K-electron in the target atom	
	d- the total energy of a K-electron in the target atom	
	e- the rest energy, mc^2 , of an electron	
37-	Two different electron beams are incident on two different targets and both produce x rays. The cutoff wavelength for target 1 is shorter than the cutoff wavelength for target 2. We can conclude that:	
	a- target 2 has a higher atomic number than target 1	
	b- target 2 has a lower atomic number than target 1	
	c- the electrons in beam 1 have greater kinetic energy than those in beam 2	
	d- the electrons in beam 1 have less kinetic energy than those in beam 2	
	e- target 1 is thicker than target 2	
38-	In connection with x-ray emission the symbol K_α refers to:	
	a- an alpha particle radiation	
	b- x-ray radiation from potassium	
	c- x-ray radiation associated with an electron going from $n = \infty$ to $n = 1$	
	d- an effect of the dielectric constant on energy levels	
	e- x-ray radiation associated with an electron going from $n = 2$ to $n = 1$	

39-	The transition shown gives rise to an x-ray. The correct label for this is: 	
	a- K_α	b- K_β
	c- L_α	d- L_β
	e- K_L	
40-	The Pauli exclusion principle is obeyed by:	
	a- all particles	b- all charged particles
	c- all particles with spin quantum numbers of 1/2	d- all particles with mass
	e- all particles with spin quantum numbers of 1	
41-	Which of the following transitions for quantum numbers (n, ℓ, m_ℓ, m_s) are allowed for the hydrogen atom:	
	a- $(2,0,0,1/2) \rightarrow (3,1,1,1/2)$	b- $(2,0,0,1/2) \rightarrow (3,0,0,1/2)$
	c- $(3,2,-2,-1/2) \rightarrow (3,1,1,1/2)$	d- $(3,1,-2,1/2) \rightarrow (3,1,-1,1/2)$
	e- $(1,0,0,-1/2) \rightarrow (3,2,1,1/2)$	
42-	A metastable state is important for the generation of a laser beam because it assures that:	
	a- spontaneous emission does not occur more often than stimulated emission	
	b- photons do not split too rapidly	
	c- more photons are emitted than are absorbed	
	d- photons do not collide with each other	
	e- photons do not make upward transitions	
43-	In a helium-neon laser, the laser light arises from a transition from a state to a state.	
	a- He, He	b- Ne, Ne
	c- He, Ne	d- Ne, He
	e- N, He	
44-	A laser must be pumped to achieve:	
	a- a metastable state	b- fast response
	c- stimulated emission	d- population inversion
	e- the same wavelength for all photons	

45-	Photons in a laser beam are produced by:		
	a- transitions from a metastable state	b- transitions to a metastable state	
	c- splitting of other photons	d- pumping	
	e- transitions from a state that decays rapidly		

Second: The Oral Exam **(10 Mark)**

Choose the correct statement: **(Every question 1 Mark)**

Please write your selections (a or b or ...) in the blank column to the right of the table.

رجاء كتابة إختياراتك (a أو b أو ...) بخط واضح في الخانة الفارغة يمين الجدول.

1-	**In the Bohr model of the hydrogen atom, by increasing the quantum number, the angular momentum of the electron .....**		
	a- increasing	**b- be equal**	
	c- decreasing	**d- all of the above**	
	e- none of the above		
2-	**In the Bohr model of the hydrogen atom, by increasing the quantum number, the total energy of the electron .....**		
	a- increasing	**b- be equal**	
	c- decreasing	**d- all of the above**	
	e- none of the above		
3-	**In the Bohr model of the hydrogen atom, by increasing the quantum number, the kinetic energy of the electron .....**		
	a- increasing	**b- be equal**	
	c- decreasing	**d- all of the above**	
	e- none of the above		
4-	**The wave equation for hydrogen has solutions only if the three quantum numbers n, ℓ, and m_ℓ meet certain conditions. One of these conditions specifies that n**		
	a- can be any real number.	**b- can be any integer.**	
	c- can be any non-negative integer.	**d- can be any negative integer.**	
	e- can be any positive integer.		

5-	**The Pauli exclusion principle:**	
	a- Any two electrons in an atom can occupy the same quantum state.	
	b- All electrons in an atom can occupy the same quantum state.	
	c- No two electrons in an atom can occupy the same quantum state.	
	d- The position and momentum of a particle can both be measured precisely at the same time.	
	e- The position and momentum of a particle cannot both be measured precisely at the same time.	
6-	**The quantum number m_s is most closely associated with what property of the electron in an atom?**	
	a- Magnitude of the orbital angular momentum / **b- Energy**	
	c- z component of the spin angular momentum / **d- Radius of the orbit**	
	e- z component of the orbital angular momentum	
7-	**An electron is in a quantum state for which the magnitude of the orbital angular momentum is $6\sqrt{2}\,\hbar$. How many allowed values of the z component of the angular momentum are there?**	
	a- 4 / **b- 5**	
	c- 17 / **d- 8**	
	e- 9	
8-	**An electron in an atom is in a state with $\ell = 5$. The minimum angle between $\vec{L}$ and the z axis is:**	
	a- 0° / **b- 155.9°**	
	c- 24.1° / **d- 36.7°**	
	e- 90.0°	
9-	**In the relation $\mu_z = -m_\ell\,\mu_B$, the quantity μ_B is:**	
	a- the component of the dipole moment along the magnetic field / **b- the Bohr magneton**	
	c- the permeability of the material / **d- a friction coefficient**	
	e- none of the above	

10-	How many electrons can be put in a subshell with quantum number n and ℓ :		
	a- $2n^2$	b- $2n$	
	c- $2(2\ell + 1)$	d- $2n + 1$	
	e- $2\ell + 1$		

Electron charge e	1.6×10^{-19} C		Plank's constant h	6.626×10^{-34} Joul.sec
Electron mass m_e	9.1×10^{-31} kg		Light velocity c	3×10^{8} m.sec^{-1}
Proton mass m_p	1.672×10^{-27} kg		Coulomb constant k	9×10^{9} J.m.C^{-2}
Bohr radius a_o	0.529×10^{-10} m		Rydberg constant R	1.097×10^{7} m^{-1}
Bohr magneton μ_B	9.274×10^{-24}J.T^{-1}		magnetic permeability μ_o	$4\pi\times10^{-7}$ T.m/A (H/m)
mass of a carbon atom	1.994×10^{-26}kg		mass of an oxygen atom	2.6567×10^{-26}kg
mass of a floor atom	31.55×10^{-27} kg		mass of a hydrogen atom	1.672×10^{-27} kg
The bond length of CO	1.3×10^{-10} m		Ionization energy of the hydrogen atom E_o	13.6 eV

Assuit University | Grade: Four

Faculty of Science | Course: 492 f

Physics Department | Time: 3 Hours

Second Term Exam 2020

Answer only five of the following questions:

(50 Marks: 10Each)

Question 1:

Write a short account on the following:

a) The specific heat of solids.
b) The thermal conductivity of solids.

Question 2:

Explain in detail the measurements of the thermal expansion of solids.

Question 3:

Discuss in detail the thermoelectric and thermomagnetic coefficients.

Question 4:

Write a short account on the following:

a) The conduction of heat in semiconductors.
b) Interatomic bonds and the crystal lattice.

Question 5:

Discuss in detail the free electron therapy of metal.

Question 6:

Explain in detail the vibration spectra and the specific heat of materials.

Course: General Entomology (240)
Time: hours
Year: 2020

Multiple Choice:

1- Insects that pass through the egg, larva, pupa, and adult stages in their life cycle have .....

A. Incomplete metamorphosis

B. No metamorphosis

C. Complete metamorphosis

D. Gradual metamorphosis

2- What order contains butterflies and moths?

A. Lepidoptera
C. Hymenoptera
B. Homoptera
D. Isoptera

3- Which insect order is most closely related to Diptera?

A. Hymenoptera
C. Plecoptera
B. Orthoptera
D. Zygentoma

4- The order Hemiptera contains:

A. Bed bugs and stink bugs
C. Chewing and sucking lice
B. Roaches and mantids
D. Crickets and grasshoppers

5- Which order is **NOT** holometabolous?

A. Siphonaptera
C. Thysanoptera
B. Hymenoptera
D. Neuroptera

6- What does the word "**bug**" refer to:

A. An insect in the Homoptera or Hemiptera order.

B. An insect in the Coleoptera order.

C. An insect in the Diptera order.

D. A creepy crawly thing.

7- Which order is exclusively herbivorous?

A. Trichoptera
C. Phasmatodea
B. Odonata
D. Thysanoptera

8- Which order is exclusively parasitic?

A. Diplura
C. Siphonaptera
B. Zoraptera
D. Diptera

9- Sucking mouthparts are **NOT** found in:

A. Fleas
C. Lice
B. Flies
D. Ants

10- All ametabolous insects are:

A. Predatory
C. Wingless
B. Endognathous
D. All of these

11- Immatures of the Neuroptera would be classified as:

A. Scavengers
C. Parasites
B. Herbivores
D. Predators

12- What do the orders Dermaptera and Isoptera have in common?

A. Winglessness
C. Chewing mouthparts
B. Herbivory
D. All of these

13- Chewing mouthparts **NEVER** occur in:

A. Fleas
C. Earwigs
B. Beetles
D. Bees

14- Which order is exclusively hematophagous (blood feeders)?

A. Siphonaptera
C. Thysanoptera
B. Neuroptera
D. Hymenoptera

15- Which insect order is **NEVER** associated with plants?

A. Hymenoptera
C. Thysanoptera
B. Hemiptera
D. Siphonaptera

16- Where does a baby dragon fly grow up?

A. In the ground
C. In trees
B. In water
D. On the ground

17- Hemiptera and Hymenoptera are similar because both have:

A. Holometabolous development
B. Piercing-sucking mouthparts
C. Neopterous wings
D. All of these

18- Which compound would be found in the exocuticle but **NOT** in the endocuticle?

A. Chitin
C. Protein
B. Quinone
D. Wax

19- To which body segment are the elytra attached?

A. Mesothorax
C. Prothorax
B. First abdominal
D. Metathorax

20- Which part of the exoskeleton lies between the exocuticle and the wax layer?

A. Procuticle
C. Cuticulin layer
B. Cement layer
D. Endocuticle

21- The shell of an insect's egg is called the:

A. Serosa
C. Chorion
B. Amnion
D. Periplasm

22- Which structure would NOT be found on an insect's leg?

A. Trochantin
B. Arolium
C. Coxa
D. Tarsomere

23- Which structures of insects are part of the ovipositor?

A. Paraprocts
B. Cerci
C. Aedeagus
D. Valvulae

24- Which part of an insect's antenna articulates with its head capsule?

A. Arista
B. Pedicel
C. Flagellum
D. Scape

25- The eyes of caterpillars are called……..

A. Tegmina
B. Ocelli
C. Hamuli
D. Stemmata

26- Which structure is unicellular?

A. Spine
B. Seta
C. Gland
D. Pile

27- Which mouthparts lie between the labrum and the maxillae?

A. Hypopharynx
B. Mandibles
C. Labium
D. Palps

28- A line of weakness between adjacent sclerites that breaks during molting is called a(n):

A. Apodeme
B. Apophysis
C. Ecdysial suture
D. Epistomal suture

29- Chitin is most abundant in which part of the exoskeleton?

A. Epicuticle
C. Cuticulin layer

B. Procuticle D. Epidermis

30- What is the function of the micropyle in an insect's egg?

A. Water balance C. Respiration

B. Nutrition D. Sperm entrance

31- What is the maximum number of ocelli that may be found in an adult insect?

A. Zero C. Five

B. Three D. Twenty

32- Chitin is a very important part of the insect's exoskeleton because:

A. It is impermeable to water.

B. It is rigid and inflexible.

C. It is not digested by common enzymes.

D. It is flexible and elastic.

33- Which structure lies below the frons and above the labrum?

A. Trochanter C. Clypeus

B. Furca D. Gena

34- A/an _____ is used by female insects to lay eggs.

A. Spermatheca C. Cerci

B. Ovum D. Ovipositor

35- _____ belong to the order Hymenoptera.

A. Grasshoppers and crickets

B. Beetles and weevils

C. Wasps and ants

D. Flies and mosquitos

36- The butterfly pupa is known as a _____.

A. Caterpillar
C. Cocoon
B. Chrysalis
D. Naiad

37- Which part of the exoskeleton lies between the wax layer and the cement layer?

A. Exocuticle
C. Cuticulin layer
B. Endocuticle
D. None of these

38- Which suture is **NOT** found on the head capsule?

A. Pleural suture
C. Subgenal suture
B. Epistomal suture
D. Frontal suture

39- In insects with chewing mouthparts, which structure lies between the mandibles and the maxillae?

A. Clypeus
C. Labium
B. Hypopharynx
D. Labrum

40- Which mouthparts bear palps?

A. Labrum and labium
C. Maxillae and mandibles
B. Labium and maxillae
D. Mandibles and labrum

41- The cibarium is best described as:

A. Thoracic muscles that move the wings.
B. A structure on the pretarsus.
C. The innermost layer of the epicuticle.
D. A muscular pump that sucks food into the mouth.

42- Which layer(s) of the exoskeleton is (are) secreted by the epidermis?

A. Endocuticle
C. Epicuticle

B. Exocuticle D. All of these

43- Elastic regions of the exoskeleton:

A. Are generally known as sclerites.

B. Are found only at the joints.

C. Lack a well-defined exocuticle.

D. Contain high concentrations of quinones.

44- The pedicel is the name for the:

A. 1st leg segment C. 1st antennal segment

B. 2nd leg segment D. 2nd antennal segment

45- Aquatic immatures of all holometabolous insects are known as:

A. Nymphs C. Larvae

B. Naiads D. Young

46- In an abdominal segment, the ventral sclerite is known as

A. Epimeron C. Epiproct

B. Notum D. Sternum

47- In an obtect pupa:

A. The insect is surrounded by a silken cocoon.

B. The larval exoskeleton becomes a puparium.

C. The insect's body forms a chrysalis.

D. All of these.

48- In insect, the first pair of post-oral appendages is called:

A. Maxillae C. Mandibles

B. Antennae D. Labrum

49- Which of these characteristics do insects and crustaceans have in common?

A. Mandibulate mouthparts
C. Jointed legs
B. Open circulatory system
D. All of these

50- A caterpillar does not have _____.

A. Mandibles
C. Prolegs
B. Compound eyes
D. Claws

True/False (Indicate "T" for true; "F" for false):

51- For insects, locomotory appendages are found on the thorax. (.....)

52- Insects in the Order Odonata (dragonflies) have aquatic larvae and undergo complete metamorphosis. (.....)

53- Beetle larvae are often called Grubs. (.....)

54- Honey bees are more closely related to ants than to butterflies and moths. (.....)

55- Diptera is the only orders with a single pair of membraneous wings. (.....)

56- Cerci are commonly found in ametabolous insects but **NOT** in holometabolous insects. (.....)

57- Aquatic immatures of holometabolous insects are known as larvae. (.....)

58- All hemipteroids have piercing-sucking mouthparts. (.....)

59- The exocuticle is the outermost layer of the exoskeleton. (.....)

60- Insects never have more than twelve abdominal segments. (.....)

Short answer: Give the correct Entomological term for:

61- The "**shell**" of an insect's egg. .....

62- The "**simple**" eyes .....

63- The "**egg case**" of a cockroach.....

64- The hardened "**plate**" of the exoskeleton.....

65- The "**hair**" on an insect's body.....

66- The "**front wings**" of the Orthoptera.....

67- The "**first thoracic segment**".....

List ONE function for each of the following:

68- Halteres.....

69- Epicuticle.....

70- Micropyle.....

Matching:

Which part of the exoskeleton is responsible for each of these functions?

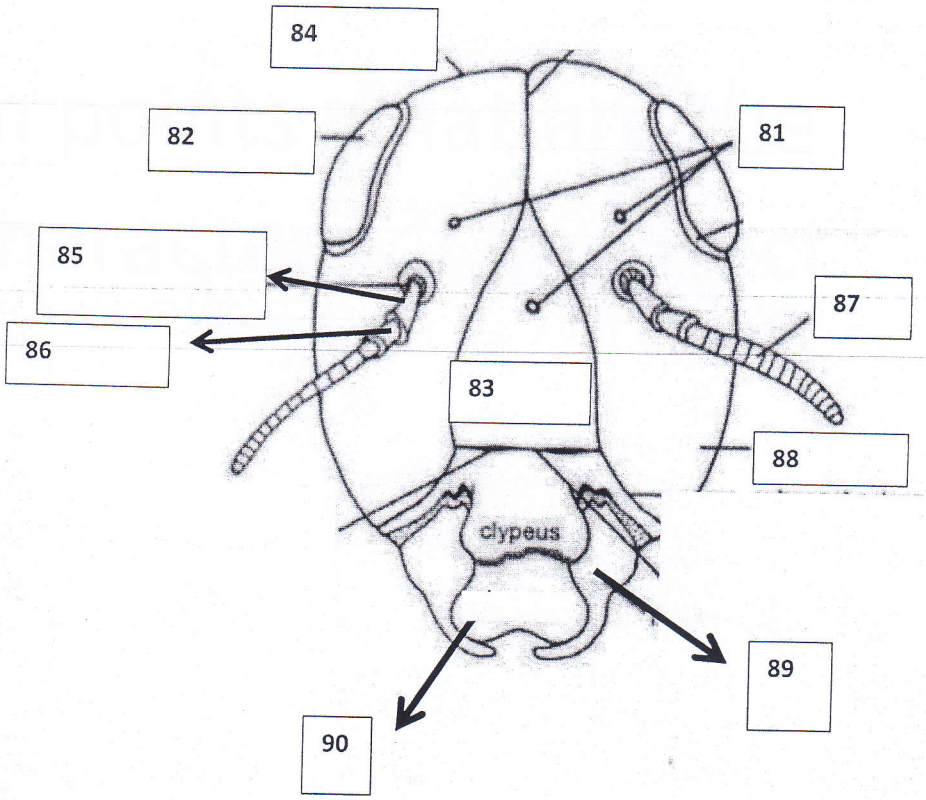
71- Resistance to abrasion
72- Armor and strength
73- Sensory perception
74- Muscle attachment
75- Flexibility

A. Sclerites
B. Apodemes
C. Membranes
D. Epidermis
E. Cuticulin layer
F. Wax layer
G. Setae
H. Sutures
I. Cement layer

Match the structure in the left column with its correct location in the right column.

Left column	**Right column**
67- Labrum	A. Antenna
77- Scape	B. Leg
78- Coxa	C. Ovipositor
79- Valvifer	D. Mouthparts
80- Tegmina	E. Wing

The diagram below illustrates an adult **head capsule**. Write the label from (A-J) of the following parts.



With best wishes,,,,,

Prof. Dr\ Amer Tawfik **Prof. Dr**\ Azza Awad

Oral question

In points what are the Characters of an insect

Faculty of Science
Department of Physics

Undergraduate
Final Exam
2nd semester 2019-2020
Course: Radiation Physics
Code:P444
Section: Phys. and Phys./Chem
Time:3 hours
Date: July-2020

Assiut University

Question (1): (60 Mark)

Put [√] or [x]for each of the statement.

1) The decay constant λ is defined as "the probability that a given nucleus will decay per unit time. ( )
2) The radioactive equilibrium occurs when the half-life of the parent nucleus is more short-lived than the daughter nucleus. ( )
3) Antineutrino is a neutral particle with zero rest mass. ( )
4) The annihilation process is a source of photons with energy 0.511Mev. ( )
5) The electromagnetic waves (EM) include the whole electromagnetic spectrum such as γ-rays, X-rays,α particles, ultraviolet, visible, infrared, microwave, radar and radio wave. ( )
6) In transient equilibrium, both number of atoms of parent N_1 and daughter N_2 decrease exponentially with time with the half-life of parent and the ratio N_1/N_2 remains constant. ( )
7) Becquerel is defined as one disintegration per second. ( )
8) β^+ decay is radioactive parent nucleus transforms a neutron into a proton. ( )
9) Absorbed dose is measured in units of Sievert. ( )
10) The atomic number identifies the chemical element ( )
11) Isotopes are nuclides that have same Z and different A and N. ( )
12) Bohr Theory works very well for one-electron structures. ( )
13) The condition for β^+ decay to be possible is $M(A,Z)-M(A,Z+1) > 0$, where $M(A,Z)$ and $M(A,Z+1)$ are the atomic masses of parent and product nuclei. ( )
14) In secular equilibrium, the number of parent nuclei remains unchanged. ( )
15) IC is a competing process of γ-rays. ( )
16) Radioactivity is the artificial disintegration of nuclei. ( )
17) The fission process is used as a source of neutrons. ( )
18) Condition for α-decay to be possible is: M(A, Z) > M(A,Z+l) + M(4,2) . ( )
19) The mass numbers of the nuclides in the $^{237}_{93}Np$- series can be represented as 4n+1. ( )
20) The atom is neutral, thus the number of positive charges (protons) in the nucleus is equal the number of negative charges (electrons) revolve around the nucleus. ( )
21) Negatively charged electrons revolve around the nucleus as a result of the attractive electrostatic Coulomb force between the positive and negative charges. ( )
22) The emitted photon has energy equals the difference in energy between the two atomic orbits. ( )

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Instructor: Dr. Ghada Salaheldin

23) Electrons occupy allowed shells, the number of electrons per shell is limited to $2n^2$. ( )

24) Nuclei consist of neutrons and protons, which are known as nucleons. ( )

25) Mean life is defined as the time interval over which the number N_0 of radioactive atoms initially present in sample is reduced to N_0/e. ( )

26) α- particle consists of two neutrons and two protons. ( )

27) The mass numbers of the nuclides in the $^{235}_{92}U$- series can be represented as 4n+3. ( )

28) Isomers are nuclides that have same Z, N and A but nucleons existing at different energy levels. ( )

29) Nuclear force is mutual attractive force between nucleons. ( )

30) Radioactivity is a statistical event, in that we cannot predict if or when a certain atom will decay but can predict how many events can occur in period of time. ( )

Question (2):
Multiple Choice Questions (MCQ)

(30 Mark)

1) The phenomenon which abound atomic electron may receive energy and move from a state of energy E_1 to another of higher energy E_2.

a) Excitation b) Ionization c) Binding energy

2) Nucleus spontaneously splits into two nearly equal fission fragments with emission of 2 to 4 neutrons.

a) Spontaneous fission b) Proton Emission c) Ionization

3) α-particle consists of.....

a) 2 neutrons and 2 protons b) 4 neutrons and 2 protons
c) 2 neutrons and 4 protons d) 4 neutrons and 4 protons

4) The energy required to completely break up the nucleus into well separated Z protons and N neutrons.

a) Binding energy b) Excitation c) Ionization

5) The average energy of the beta particles which is given practically in the form

a) $T_{\beta^-} = T_{max}/4$ b) $T_{\beta^-} = T_{max}/3$ c) $T_{\beta^-} = T_{max}/5$

6) Nuclear decay in which an unstable isotope nuclide (parent nucleus) spontaneously release excess energy with emission of particles and/or gamma-ray and that parent nucleus will transform into a new isotope nuclide (daughter nucleus) that may be stable or unstable.

a) Radioactivity b) Excitation c) Ionization

7) Nucleus capture orbital electron (usually K shell) and neutrino is emitted.
a) Electron Capture decay b) Internal conversion c) Proton Emission

8) The original positron and electron disappear and are replaced by two oppositely directed 0.511 MeV electromagnetic photons known as.
a) Annihilation b) Proton Emission c) Internal conversion

9) The energy that comes from a source and propagate through space or matter in the form of particles or electromagnetic waves.
a) Radiation b) Internal conversion c) Proton Emission

10) Neutrons are emitted during spontaneous fission or are artificially produced by bombarding nucleus with high energy radiation (particles or photons).
a) Neutron decay b) Radiation c) Internal conversion

11) The number of radioactive atoms is reduced to half in the time Known as …
a) Half-life time of decay b) Mean Life

12) When $\tau_1 > \tau_2$, both number of atoms of parent N_1 and daughter N_2 decrease exponentially with time with the half-life of parent and the ratio N_2/N_1 remains constant.
a) Secular equilibrium b) Transient equilibrium c) No equilibrium

13) ……decay is radioactive parent nucleus transforms a neutron into a proton.
a) β^- b) β^+ c) α

14) ……is a nuclear transformation in which unstable high atomic mass nucleus splits into two lighter nuclides and emits from two to four neutrons
a) Nuclear fission b) Proton Emission c) Internal conversion

15) 1Ci =……Bq.
a) 3.70×10^{10} b) 3.07×10^{10} c) 3.70×10^{9}

Question (3) [Oral]:

Put [√] or [x]for each of the statement. (10 Mark)

1) Cosmic ray is highly energetic sub-atomic particles, mostly protons and helium nuclei, which travel across space at close to the speed of light comes from sun and supernova stars ( )
2) The number of radioactive atoms is reduced to half in the time Known as the half-life time of decay ( )
3) The mass numbers of the nuclides in the $^{238}_{92}U$- series can be represented as 4n+2. ( )
4) Isobars are nuclides that have same A and different Z and N. ( )
5) α-decay is the nuclear transformation in which an energetic α- particle (helium-4 nucleus) is emitted. ( )

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كلية العلوم قسم الفيزياء الفصل الثانى 2019-2020 الدرجة الكلية (70تحريرى+10شفوى)		قياسات فيزيائية باستخدام الحاسب 462 ف 27/7/2020 الزمن ثلاث ساعات

Group I (42 degrees)

Put [T] or [F] in front of each statement (1.5 degrees for each statement):

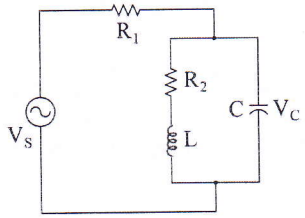
1. We find the roots of any polynomial with the **roots(p)** function where **p** is a row vector containing the polynomial coefficients in descending order.	[ ]
2. We can compute the coefficients of a polynomial from a given set of roots with the **poly(r)** function where **r** is a row vector containing the roots.	[ ]
3. The **polyconv(p,x)** function evaluates a polynomial at some specified value of the independent variable .	[ ]
4. The de**conv(a,b)** function multiplies the polynomials **a** and **b**.	[ ]
5. The **[q,r]=diconv(c,d)** function divides polynomial **c** by polynomial **d** and displays the quotient **q** and remainder **r**.	[ ]
6. The **polyde (p)** function produces the coefficients of the derivative of a polynomial **p**.	[ ]
7. We can write MATLAB statements in one line if we separate them by commas or semicolons. Commas will display the results whereas semicolons will suppress the display.	[ ]
8. We use the MATLAB command **plot(x,y)** to make two-dimensional plots. This command plots versus where **x** is the horizontal axis (abscissa), and **y** is the vertical axis (ordinate).	[ ]
9. If a statement, or a row vector is too long to fit in one line, it can be continued to the next line by typing three or more periods, then pressing <enter> to start a new line, and continue to enter data.	[ ]
10. We can make a two-dimensional plot more presentable with the commands **grid**, **box**, **title('string')**, **xlabel('string')**, and **ylabel('string')**. For a three-dimensional plot, we can also use the **zlabel('string')** command.	[ ]
11. The command **linspace(first_value, last_value, number_of_values)** specifies the number of data points but not the increments between data points. An alternate command uses the colon notation and has the format **x=first: increment: last.** This format specifies the increments between points but not the number of data points.	[ ]
12. Newton's (or Newton-Raphson) method can be used to approximate the roots of any linear only of any degree.	[ ]
13. We can't use a spreadsheet to approximate the real roots of linear and non-linear equations but to approximate all roots (real and complex conjugates) it is advisable to use MATLAB.	[ ]
14. The angular velocityω is commonly known as angular or radian frequency and $\omega T = 4\pi$	[ ]
15. To apply Newton's method, we must begin with a reasonable approximation of the root value. In all cases, this can best be done by plotting f(x) versus x.	[ ]
16. The frequency is denoted by the letter f and in terms of the period T, $f = 1/T$. The frequency f is often referred to as the cyclic frequency to distinguish it from the radian frequency ω.	[ ]

17. The cosine function leads (is ahead of) the sine function by $\pi/2$ radians or 90^0, and the sine function lags (is behind) the cosine function by $\pi/2$ radians or 90^0. Alternately, we say that the cosine and sine functions are out-of-phase by 90^0 , or there is a phase angle of 90^0between the cosine and sine functions.	[ ]
18. When we say that one sinusoid leads or lags another sinusoid, these are of the same frequency since two sinusoids of different frequencies can be in the phase.	[ ]
19. It is customary to express the phase angle in degrees rather than in radians in a sinusoidal function. For example, we write $$\mathrm{v}(t) = 100\sin\left(2000\pi t - \frac{\pi}{6}\right) \; as \; \mathrm{v}(t) = 100\sin(2000\pi t - 60)$$	[ ]
20. When two sinusoids are to be compared in terms of their phase difference, these must first be written either both as cosine functions, or both as sine functions, and should also be written with negative amplitudes.	[ ]
21. Two phasors A and B where $A = a + jb$ and $A = c + jd$, are equal if and only if their real parts are equal and also their imaginary parts are equal. Thus $A = B$ if and only if $a = c \; and \; b = d$	[ ]
22. If the dependent variable y is a function of only a single variable x, that is, if $y = f(x)$, the differential equation which relates y and x is said to be an ordinary differential equation and it is abbreviated as ODE.	[ ]
23. Generally, in engineering the solution of the homogeneous ODE, also known as the complementary solution, is referred to as the natural response, and is denoted as $y_N(t)$ or simply y_N.	[ ]
24. The particular solution of a non-homogeneous ODE is be referred to as the forced response, and is denoted as $y_F(t)$ or simply y_F.	[ ]
25. The total solution of the non-homogeneous ODE is the summation of the natural and forces responses, that is $y(t) = y_{Natural\ Response} - y_{Forced\ Response} = y_N - y_F$	[ ]
26. The most general solution of homogeneous ODE is the linear combination $$y_H(t) = k_1y_1(t) + k_2y_2(t) + \cdots + k_ny_n(t)$$ where H is used to denote homogeneous and $k_1, k_2, \ldots\ldots, k_n$ are arbitrary constants.	[ ]
27. For nth order homogeneous differential equation, the solutions are $$y_1 = k_1e^{s_1t}, y_2 = k_2e^{s_2t}, \ldots, y_n = k_ne^{s_nt}$$ where $s_1, s_2, \ldots\ldots, s_n$ are the solutions of the characteristic equation $$a_ns^n + a_{n-1}s^{n-1} + \cdots + a_1s^1 + a_0 = y_H(t)$$ and $a_n, a_{n-1}, \ldots, a_1, a_0$ are constant coefficients of the ODE	[ ]
28. The ODE $$a_n\frac{d^ny}{dt^n} + a_{n-1}\frac{d^{n-1}y}{dt^{n-1}} + \cdots + a_1\frac{dy}{dt} + a_0y = b_m\frac{d^mx}{dt^m} + b_{m-1}\frac{d^{m-1}x}{dt^{m-1}} + \cdots + b_1\frac{dx}{dt} + b_0x$$ is non-homogeneous differential equation if the right side, known as forcing function, is zero	[ ]

Group II (28 degrees)

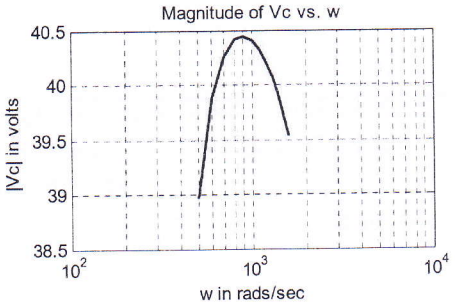
Put [T] or [F] in front of each statement to complete the task:
If the statement is incorrect, modify it and write the full script for solving the problem.

A. In the electric circuit below, the applied voltage V_s was kept constant and the voltage V_c across the capacitor was measured and recorded at several frequencies as shown on the table below



Capacitor voltage versus radian frequency						
ω	500	600	700	800	900	1000
V_C	88.9	98.5	103.0	104.9	105.3	104.8
ω	1100	1200	1300	1400	1500	1600
V_C	103.8	102.4	100.7	98.9	96.5	94.9

To answer the question: Plot Vc (in dB scale) versus ω (in common log scale) and label the axes appropriately and the resulting graph is shown as.



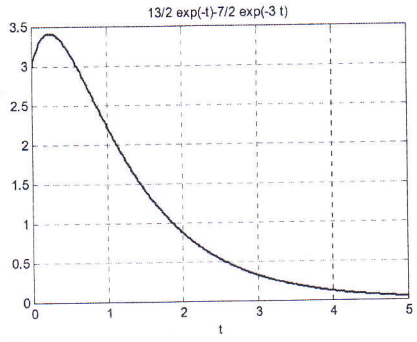
Please, check the following points **(8 degrees)**:

1. w=[5 6 7 8 9 10 11 12 13 14 15 16]*10;	[ ]
2. Vc=[88.9 98.5 103 104.9 105.3 104.8 103.8 102.4 100.7 98.9 96.5 94.9];	[ ]
3. dB=20*log10(Vc); semilogx(w,dB); grid; title(Vc vs. w');	[ ]
4. xlabel('w in rads/sec'); ylabel('|Vc| in volts')	[ ]

B. To find the total solution of ODE

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = 0$$

subject to the initial conditions $y(0) = 3$ and $y'(0) = 4$ where $y' = dy/dt$
The resulting graph is shown as



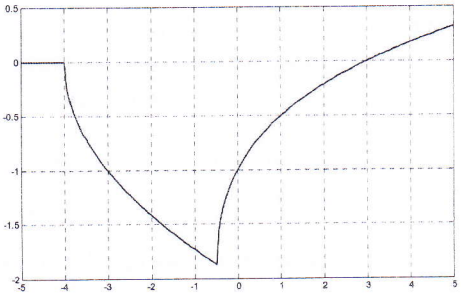
Please, check the following points **(12 degrees)**:

1. This is a non-homogeneous ODE and the total solution is just the natural response found from the characteristic equation $s^2 + 4s + 3 = 0$ whose roots are $s_1 = -1$ and $s_1 = -3$.	[ ]
2. The total response is: $y(t) = y_N = k_1 e^{-t} + k_2 e^{-3t}$	[ ]
3. The constant $k_1 and\ k_2$ are evaluated from the given initial conditions. So, in that case $y(0) = 3 = k_1 e^0 + k_2 e^0$ Or $k_1 + k_2 = 5$	[ ]
4. And $y'(0) = 4 = \frac{dy}{dt}\Big\|_{t=0} = -k_1 e^{-t} - 3k_2 e^{-3t}$ Or $-k_1 - 3k_2 = 4$ $k_1 = 6.5$ and $k_2 = -3.5$	[ ]
5. $y(t) = y_N = 6.5e^{-t} + 3.5k_2 e^{-3t}$	[ ]
6. With MATLAB y=solve ('D2y+4*Dy+3*y=0', 'y(0)=3', 'Dy(0)=4'); ezplot(y,[0 5])	[ ]

C. By using MATLAB to sketch the graph y=f(x), and verify from the graph that f(a) and f(b), where a and b defined below, have opposite signs. Then, use Newton's method to estimate the root of f(x) = 0 that lies between a and b.

$f(x) = \sqrt{2x+1} - \sqrt{x+4}$ $a = 2\ and\ b = 4$ Hint: Start with $x_0 = (a+b)/2$

The resulting graph is shown as



Please, check the following points **(8 degrees)**:

1. x=-5:0.05:5; fx=sqrt (2. *x+1)-sqrt(x+4); plot(x,f1x); grid Warning: Imaginary parts of complex X and/or Y arguments ignored.	[ ]
2. From the plot above we see that the positive root is very close to $x = 3$ so we take $x_0 = -3$ as our first approximation	[ ]
3. The next value x_1 is -3	[ ]
4. Checking by MATLAB: syms x; fx=sqrt(2.*x+1)-sqrt(x+4); dsolve(fx) ans = 3	[ ]

Oral part (10 degrees)

Choose the Correct answer (1 degree for each statement)

1. The statement z=3-4j displays in MATLAB as, z=

   3.0000 - 4.0000i 3.0000 - 4.0000*i both of them none of them

2. The statement z=3- cos(x)j displays in MATLAB as, z=

   3.0000- cos(x)j 3.0000 - cos(x)*j both of them none of them

3. MATLAB displays the polynomial coefficients as a ..... vector, and the roots as a ..... vector.

   row, column row, row column, column column, row

4. The polynomial

   $$p = x^5 - 7x^4 + 16x^2 + 25x + 52$$

   the polynomial coefficients display in MATLAB as

   p= [1 -7 0 16 25 52] p= [1 -7 16 25 52]

   p= [1; -7; 0; 16; 25; 52] p= [1; -7; 16; 25; 52]

5. The polynomial roots of polynomial ***p*** display as

   roots_ p=root(p) root_ p=roots(p)

   roots_ p=roots(p) root_ p=root(p)

6. MATLAB functions used with polynomials are the following: multiplies two polynomials a and b

   conv(a,b) der(a,b) **de**conv(a,b) none of them

7. MATLAB functions used with polynomials are the following: divides polynomial c by polynomial d and displays the quotient q and remainder r.

   [q,r]=conv(c,d) [q,r]=deconv(c,d) [q,r]=der(c,d) none of them

8. ..... produces the coefficients of the derivative of a polynomial p

   deconv(p) conv(p) polyder(p) der(p)

9. Newton's (or Newton-Raphson) method uses the formula

   $x_{n-1} = x_n - \frac{f(x_n)}{f'(x_n)}$ $x_n = x_{n+1} - \frac{f(x_n)}{f'(x_n)}$

   $x_n = x_{n-1} - \frac{f(x_n)}{f'(x_n)}$ $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

10. If the dependent variable y is a function of two or more variables such as $y = f(x,t)$, where x and t are independent variables, the differential equation that relates y, x and t is said to be

    Ordinary Differential Equation Partial Differential Equation

    Simple Differential Equation None of them

Best Wishes

Dr. Sayed Soliman

جامعة أسيوط	إختبار فيزياء أشباه الموصلات والأغشية الرقيقة (451 فيز)	التاريخ: 2020/7/25
كلية العلوم - الفيزياء	الفصل الدراسى الثانى - (2020- 2019)	النهاية العظمى:(100 درجة)

Answer the following questions:

Section (A): Choose the correct answer from the following:

1- Temperature dependence of charge carrier mobility in semiconductor is: (a) $\mu \alpha T^{3/2}$ (b) $\mu \alpha 1/T$ (c) $\mu \alpha T^{-3/2}$	
2- Einstein showed that the relation between diffusion coefficient (D) and mobility (μ) of the charge carriers (holes) can be expressed as: (a) $D_p = \mu_p \frac{K_B T^2}{e}$ (b) $D_p = \mu_p \frac{K_B T}{e}$	
3- 10- For an intrinsic semiconductor with energy gap, E_g= 0.7 eV, $m^*_p = 6\ m^*_e$ at 300 °K and C=4.83x10^{21} the position of Fermi level is equal to: (a) E_f = 0.385 eV (b) E_f = 0.185 eV	
4- If the conductivity of intrinsic Ge at 300 K is 2.12 $\Omega^{-1}m^{-1}$, electronic charge e = 1.6 x 10^{-19} C and electron and hole mobility μ_n = 0.36 $m^2V^{-1}S^{-1}$ and μ_p 0.17 $m^2V^{-1}S^{-1}$respectively.Thus the intrinsic concentration ($\mathbf{n_i}$) of charge carriers is: (a) n_i = 2.5 x $10^{19}/m^3$ (b) n_i = 5.2 x $10^{19}/m^3$	
5- The general expression for Fermi energy level in an intrinsic semiconductor is (a) $E_f = \frac{E_c+E_v}{2} + \frac{4}{3K_B T} \ln[\frac{m_p^*}{m_e^*}]$ (b) $E_f = \frac{E_c+E_v}{2} + \frac{3K_B T}{4} \ln[\frac{m_p^*}{m_e^*}]$	
6- When the complex refractive index of a semiconductor is given by a relation $n^* = n + ik$ at a certain wavelength λ, hence the absorption coefficient α is: (a) $\alpha = \frac{4\pi k}{\lambda}$ (b) $\alpha = \frac{2\pi k}{\lambda}$ (c) $\alpha = \frac{4\pi}{\lambda k}$	
7- If the complex dielectric constant of nano-semiconductor compound of particle size 3 nm is given by $\varepsilon^* = \varepsilon_1 + i\varepsilon_2$, then real refractive index n is: (a) $n = \frac{1}{\sqrt{2}}[\{\varepsilon_1 + (\varepsilon_1^2 + \varepsilon_2^2)^{1/2}\}]^{1/2}$ (b) $n = \frac{1}{\sqrt{2}}[\{\varepsilon_1 + (\varepsilon_1^2 - \varepsilon_2^2)^{1/2}\}]^{1/2}$	
8- 3- When the complex refractive index of a semiconductor is given by the relation $n^* = n + ik$ at a certain wavelength λ, hence the reflectivity (R) is given by: (a) $R = \frac{(n-1)^2+(k+1)^2}{(n+1)^2+(k+1)^2}$ (b) $R = \frac{(n-1)^2+(k)^2}{(n+1)^2+(k)^2}$	
9- 18- 27- The general expression for the density electrons in an intrinsic semiconductor with an energy gap E_g and C = 4.83x10^{21} is: (a) $n_i = CT^{2/3} \exp[-\frac{E_g}{2K_B T}]$ (b) $n_i = CT^{2/3} \exp[-\frac{2E_g}{K_B T}]$	
10- If excess carriers are injected into a semiconductor, they diffuse away from the point of injection (i.e., at x = 0) and recombine at a rate described by their	

lifetime where their density falls exponentially with a distance by the equation: (a) $(\Delta n)_x = (\Delta n)_{x0} \exp[-\frac{x}{\sqrt{D_n \tau_N}}]$ (b) $(\Delta n)_x = (\Delta n)_{x0} \exp[-\frac{\sqrt{D_n \tau_N}}{x}]$ Where, $L_n = \sqrt{D_n \tau_N}$ is the electron diffusion length.	
11-When the band gap of an alloy semiconductor GaAs is1.98eV, a wavelength (λ) of the emitted photons due to the direct recombination process of electron from the conduction band with hole in the valence is: (a) $\lambda = 526\ nm$ (b) $\lambda = 256\ nm$ (c) $\lambda = 625\ nm$	
1 2- The diffusion current in semiconductor at constant temperature is directly proportional to: (a) Square of the electric field (E^2). (b) The electric field intensity (E).	
13- Donor impurities in n-type semiconductor introduce localized defect states within the energy band gap: (a) Near the conduction band edge. (b) At the midpoint of the band gap.	
14- In **n-type** semiconductor the optical absorption process is ascribed to: (a) Optical excitation of electron from a donor level to the conduction band. (b) Optical excitation of electron from the valence band to a conduction band.	
15- Illumination of CdS nanosemiconductor with photons of energy $h\nu \geq E_g$, results in: (a) Generation of free electron-hole pairs via optical excitation process. (b) Recombination of electron-hole pairs via optical excitation process.	
16- Direct inter-band optical transition occurs: (a).When minimum of the conduction band and maximum of valence band exist at different points in k-space (i.e., $k_i \neq k_f$). (b) When minimum of the conduction band and maximum of the valence band exist at the same points in k-space (i.e., $k_i = k_f$).	
17- Doping process of semiconductor via incorporation of some impurities into the crystal lattice sites results in: (a) A decrease in electrical conductivity due to the decrease in the concentration of free charge carrier. (b) An increase in electrical conductivity due to the increase in the concentration of free charge carrier. (c) No change in electrical conductivity.	
18- The enhancement of the optical, electronic and photoelectric properties in the nanosemiconductor is attributed to: (a) The decrease in the nanoparticle size (D) accompanied by an increase in the surface to volume ratio (S/V) of atoms at the nanoparticle surface. (b) The increase in the nanoparticle size (D) accompanied by a decrease in the surface to volume ratio (S/V) of atoms at the nanoparticle surface.	
19- The observed, broadening, reduction and red shift of the exciton absorption peak with increasing temperature in GaAs can be attributed to:	

(a) Exciton-phonon scattering. (b) Exciton - electron scattering. (c) Exciton - exciton interaction. (d) both (a) and (b)	
20- Increase in the nanoparticle size due to improvement in the degree of crystallization via thermal annealing process of the polycrystalline ZnS nanosemiconductor results in: (a) An increase in the optical band gap and enhancement in the PL intensity. (b) A decrease (i.e., red shift) in the optical band gap associated with a decrease in the PL intensity.	
21- Metal resistance increases with increasing temperature due to: (a) A decrease in the concentration of free charge carriers. (b) The different types of scattering process of charge carriers.	
22- Free Exciton (Van-Mott Exciton) is characterized by: (a) Large radius and weak binding energy. (b) Small radius and strong binding energy. (c) It usually occurs at room temperature;	
23- One of the most important properties of semiconducting material is: (a) The negative temperature coefficient of its resistivity (i.e., $\rho \alpha 1/T$). (b) The positive temperature coefficient of its resistivity (i.e., $\rho \alpha T$).	

SECTION B: *Put a sing (√)in the front of the right sentence and a sign (x) for the wrong sentence:*

24- Electrical conductivity of semiconductor increases exponentially with temperature according to the Arrhenius equation: $\sigma_i = \sigma_0 \exp\left[-\frac{E_g}{2K_BT}\right]$.	
25- To have high performance efficiency for the photovoltaic cells and photodiodes, it is preferable to use direct band gap semiconductor materials like GaAs, ZnO, ZnS and CdS etc..	
26- Increasing in the degree of crystallization and a nanoparticle size as a result of thermal annealing process leads to increase in the optical energy gap and the photoluminescence of (PL) intensity.	
27- Photovoltaic energy conversion depends on the number of photons striking earth surface which have energy larger than the band gap of the semiconductor. Such photons are absorbed and promote an electron from the valence band to the conduction band.	
28- The enhancement and spectral Blue shift of PL emission spectrum towards the short wavelength region is attributed to the reduction in a semiconductor nanoparticle size (quantum size effect).	
29- The mobility of charge carriers in semiconductors is slightly increases with increasing temperature as a result of scattering processes.	

30- Intrinsic photoconductivity can be occurred due to optical absorption by the host atoms accompanied by photo-generation of a free electron-hole pair for each absorbed photon.	
31- Impurity photoconductivity occurs in n-type semiconductor as a result of the optical absorption by localized donor atom, accompanied by the creation of a free electron in the valence band and positive ion bounded to the donor atom for each absorbed photon.	
32- Presence of non radiative surface defect states in CdS nanostructure results in enhancement and blue shift of both the forbidden energy gap and the PL emission spectrum.	
33- The efficiency of amorphous silicon solar cell is higher than that of defect free mono-crystalline silicon cell.	
34- Increase in the temperature of GaAS semiconductor leads to broadening, reduction in the intensity and red shift of the Exciton absorption peak towards the long wavelength side of the optical absorption spectrum.	
35-The optical band gap of pure semiconductor increases with increasing temperature due to electron-electron and electron -phonon interaction (scattering process).	
36- Under the forward-biased of n-p light-emitting diode (LED), the electrons from conduction band of n-region recombine with the holes exist in the valence band of p-region.	
37- A localize center is assigned as trapping center, if the captured carriers has high probability of thermal re-excitation to the free state at a near allowed band than its recombination with a carrier of opposite sign.	
38- Free carrier life time can be defined as the time that an excited electron or hole spends in the conduction or the valence band respectively before its recombination with a carrier of opposite sign..	
39- The gain of photoconductive can be defined as the ratio of the minority carrier life time (τ_c) and the transit time (t).	
40- When CdS semiconductor absorbed light with photons energy $h\nu \geq E_g$ at the absence of the external electric field, then the photo-generated electrons and holes will contribute to the photoelectric conduction.	
41- In the manufacture of photo-detectors and photodiodes, it is preferable to use semiconductors with high photosensitive and have a high photoelectric gain and photo response speed.	
42- Photodiods can't be used in street light control, optically activated switches and information storage.	
43- At steady state value of a photo-conductivity (where $n_{st}= G\tau$), the rise curve of the photocurrent is described by: $\Delta\sigma = \Delta\sigma_{st}[-\exp(-t/\tau]$, whereas the	

decay curve is given by: $\Delta\sigma = \Delta\sigma_{st}[1 - \exp(-t/\tau]$.	
44- When an electron is captured by an excited center in the band gap containing a hole, or a hole being captured by an excited center containing electron. Then PL emission can be assigned as defect related- PL emission.	
45- The optical and optoelectronic properties of the semiconductors are not affected by the structural native defects such as vacancies and interstitial in the crystal lattice.	
46- In direct band gap semiconducting such as CdS and GaAs, the optical band gap can be determined by the extrapolation of straight line portion of Tauc's plots $[(\alpha h\nu)^2 vs\ h\nu]$ to $(\alpha h\nu)^2 = 0$, and the intercept with $h\nu$-axis gives $h\nu = E_g$.	
47- In direct band gap semiconductor after optical excitation with photon energy$h\nu > E_g$, PL emission occurs after relaxation process of both the photo generated electrons to the bottom of the conduction and holes to the top of valence band before recombination process.	
48- The light-emitting diode (LED), is a p–n junction diode, which emits light, since electrons recombine with holes within the energy gap of the device under the influence of an external electric field.	
49- Incorporation of impurities in photoconductor leads to reduction in its photosensitivity and speed of photo-response, along with extend of the photo-conductivity spectral curve to a long wavelength side of the absorption edge due to impurity absorption process.	
50- The LEDs can have a relatively long useful lifetime, however its efficiency decreases due to heating effect with the increase in the electric current, associated with reduction in the lifetime of a LEDs.	

With best regards

Prof.Dr.Mohamed Abd-elhamed Osman

جامعة أسيوط - كلية العلوم – قسم الفيزياء
جمهورية مصر العربية – أسيوط - ت : ٠٠٢٠٨٨٢٣٣٣٨٣٧ فاكس : ٠٠٢٠٨٨٢٣٤٢٧٠٨

Final Exam – Second Term: 2019/2020 - Course Title: Physics of low temperature
Code P 422- Time: 3 h - Teaching Staff: Prof. Dr. Ahmed Sedky

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Q1(16 marks): Put line under the correct answer :

1- The critical magnetic field is the field required for;

Quenching superconductivity - Improving magnetization - zero resistance

2-Thickness of superconductor for optimum order parameter is defined as;

Coherence length - London depth - G-L parameter

3- Meissner effect occurs when the material becomes;

Superconductor - Diamagnetic - Paramagnetic

4- The surface sheath of type (I) superconductor occurs when;

$\kappa_{GL} \geq 0.419$ - $\kappa_{GL} < 0.419$ - $\kappa_{GL} > 0.419$

5- The G-L parameter of type (II) superconductors is;

$\kappa_{GL} \geq 0.707$ - $\kappa_{GL} \leq 0.707$ - $\kappa_{GL} = 0.707$

6- The sign of TEP for a superconductor is usually

Positive - Negative – Neither negative nor positive

7- Onset of diamagnetism occurs when;

χ' is zero - χ'' is maximum - χ' is maximum

8- The value of specific heat of a superconductor at T_c is;

$\approx$ 3Cen - Zero - < 3Cen

9- According to London equation, the field at λ equal;

(1/e)B(a) - B (a) - Zero

10- The specific heat coefficient β is inversely proportional with;

Debye temperature - Gas constant - London depth

11- Condensation energy of each flux line is given by;

$\frac{H_c^2 \xi h}{8}$ $\frac{H_c^2 \xi^2 h}{8}$ $\frac{H_c^2}{8\pi}$

12- Electron pairs formation occurs as a result of ;

Electron-lattice interaction - Electron-Electron interaction - Both of them

13- A rapid change of C_{en} at T_c is ascribed to;

Electron energy - Energy gap - Phonon energy

14- The activation energy E_a due to flux creep can be obtained by plot the relation between;

ln f and T_p - ln f and $1/T_p$ - f and ln$1/T_p$

15- Superconductivity can be consider as ;

Good conductor - Perfect conductor- Both of them

16- Nb_2Ge superconductor can be considered as;

Non-superconductor - Conventional superconductor - high T_c superconductor

Q2(44 marks): Put line under the correct answer :

1-The energy gap at 0 K for T_c = 100 K superconductor equals;
4.86×10^{-21} J - 4.16×10^{-23} J - 12.16×10^{-20} J

2-If n(0) = 12.16×10^{21} /cm^3, T_c = 150 K , then n (100) equals;
9.758×10^{21} /cm^3- 9.558×10^{21} /cm^3 - 9.798×10^{21} /cm^3

3-If T_c = 150 K, λ (0) = 0.51 μm, then λ (100) equals;
0.569 μm - 0.549 μm - 0.559 μm

4- If E_c = 0.112 J and f_s(T) = 0.958 J , then f_n(T) equals;
1.081 J - 1.061 J - 1.07 J - 1.081 J

5- If Hc_2 = 20 T , $\rho_n = 5 \times 10^{-5}$ (Ω.m), then γ for Hg:1211 equals;
1.011×10^{-3} (J/Kg.K) - 0.988×10^{-3} (J/Kg.K) - 1.211×10^{-3} (J/Kg.K)

6- The condensation energy at a critical field of 12 T equals;
5.732 J - 5.732 J - 5.732 J

7- If H_c (0) = 5 T , T_c = 150 K, then H_c (100 K) equals;
2.778 T - 2.877 T - 2.768 T

8- If $\lambda(0)$ = 5.1 μm, then H_{c1} equals;
1.267×10^{-5}T - 1.207×10^{-5} T - 1.246×10^{-5} T

9- If $\xi(0)$ = 2.1 μm, then H_{c2} equals;
7.474×10^{-5}T - 7.407×10^{-5} - 7.496×10^{-5}

10- If ξ = 0.81 μm and λ = 0.6 μm, then δ_{ns} equals;
$8.36H_c$ - $8.66H_c$ - $8.96H_c$

11- If G-L parameter κ_{GL} = 0.511 and H_c = 0.21 T, then Hc_2 equals;
0.149 T - 0.137 T - 0.152 T

12- If G-L parameter κ_{GL} = 0.511 and H_c = 0.21 T, then Hc_3 equals;
0.247 T - 0.237 T - 0.257 T

13- If r = 0.45 μm and H_c = 0.125 T, then I_c equals;
0.025×10^{-6} (Å) - 0.031×10^{-6} (Å) - 0.028×10^{-6} (Å)

14- If $v_f = 10^6$ m/s, $E_B = 10^{-2}$ eV, then BCS cooper size equals;
638.4^5 Å - 629.42 Å - 634.38 Å

15- If the electron radius = 2.82Å, then the inter-pair distance equals;
5.61 Å - 5.66 Å - 5.64 Å

16- If the atomic weight of Pb superconductors is 207, then T_c equals;
0.065 K - 0.712 K - 0.069 K

17- If T_c = 110 K for a superconductor, γ = 0.0125, then H_c(0) of BCS equals;
14.569 T - 14.780 T - 14.699 T

18- If a = 3.883 Å and b = 3.891 for Y:123, the orthorhombic distortion OD equals;
0.0020 - 0.0023 - 0.0021

19- If n (0) = 12.16 x 10^{21} /cm^3, condensation energy = 337 T, then Δ_o equals;
1.366×10^{-20} J - 1.406×10^{-20} J - 1.386×10^{-20} J

20- The value of flux quantum in SS as compared to NS is;

Twice its value - similar value - half its value

21- If H_{c2} = 4.1 T, then Hc_3 equals;

6.937 T - 6.967 T- 6.949 T

22- If Hc_3 = 7 T and H_c = 4 T, then K_{GL} equals;

0.756 - 0.7115 - 0.732

Q3(30 marks): Put √ or X :

1- Surface energy is the difference of free energies between NS and SS. ( )

2- Condensation energy is the energy required to break the Cooper pairs. ( )

3- The formula of BCS energy gap invalid when T_c goes above 40 K. ( )

4- When $I > I_c$, a voltage appears and linearly increases with the passing I. ( )

5- The slope (dV/dI) defines the flow of flux resistance R_f. ( )

6-The entropy of electrons in the NS is higher than SS. ( )

7- In normal core of mixed state, ψ(r) increases over a length equal ξ . ( )

8- In normal core, the field partially penetrates in the form of vortex line. ( )

9- When $F_L > F_p$, the vortex lines will move as flux flow. ( )

10- When $F_L = F_p$, the vortex will localized at the top of the well as flux free ( )

11- Superconductivity is quenched when the flux is flow starts. ( )

12- London equation can be written as; $\vec{B}_x = \vec{B}_a \exp(\frac{-x}{\lambda})$. ( )

13- The peak of χ'' is due to current penetration up to the center of the sample. ( )

14- According to Messiner effect, M=-H and $\chi = -1$ ( )

15- Is the relation; $\frac{\rho_f}{\rho_n} = \frac{H_a}{H_{c2}} = \frac{\xi^2}{d^2}$ correct ( )

16- Type (I) has defects which tend to pin the bundles of vortices lines ( )

17- Type (II) has no defects and the flux can move easily at Hc_1 ( )

18- The super-train is made to enhance the friction between the train and its tracks. ( )

19-Supercond. are used in radar to increase the noise of external electromagnetic field. ( )

20- The sign of thermoelectric power (TEP) is usually negative for a superconductor. ( )

21- Zero-field cooling can be done by heating superconductor to T_c at ($H < H_c$). ( )

22- Field cooling can be done by applying field ($H > H_c$) on a superconductor. ( )

23- The current of normal metal generates a voltage and causes no dissipation. ( )

24- The Cooper pairs carries move as a super-current with highly dissipation. ( )

25- The breaking of pairs requires energy less than the binding energy of them. ( )

26- In superconductors, the energy gap is caused by electron-lattice interaction. ( )

27- In an insulator, the energy gap is caused by the electron-electron interaction. ( )

28- The T_c of Y : 123 is about 38 K ( )

29- The T_c of Bi:2223 is about 89 K ( )

30- Flux quantum in superconductor equal 14.14×10^{-14} (Web) ( )

Oral Exam (10 marks):

Q1(6 marks): Put line under the correct answer :

1- Flux flow resistance R_f depends upon;

Applied fields - Current and temperature - Both of them

2- If $(\Delta f)_{T=0} = 0.11$ J, then coefficient of specific heat γ for Ti:2223 equals;

2.928×10^{-5} (J/Kg.K) - 2.528×10^{-5} (J/Kg.K) - 2.728×10^{-5} (J/Kg.K)

3- If the applied field is inclined by 90^{o} to the surface, then;

$H_s = H_{c2}$ - $H_s = H_{c1}$ - $H_s = H_{c3}$

4- When $F_L = 0$, the flux vortex will localized in the well as;

Flux creep - Flux flow - Flux pinning

5- MgB_2 system can be considered as;

Type I superconductor - Conventional superconductor - high T_c superconductor

6- The pinning radius is usually in the order of;

Coherence length - Mean free path - London depth

Q2(4 marks): Put √ or X :

1- The highest value of T_c for Hg:1223 is about 134 K ( )

2- When $F_L < F_p$, the flux bundles will flow from their potential well. ( )

3- The peak temperature is taken against the peak of χ' ( )

4- The center of each bundle is called the creep center ( )

اختبار نهاية الفصل الدراسي الثاني

2020/2019

في

مقرر " فيزياء الليزر وتطبيقاته" 472 ف

ملاحظات هامة:(أ) أي شطب أوتغيير يلغي الدرجة (ب) لكل فقرة درجتان

أولا: الجزء التحريري

أجب عن **45 فقط** من الفقرات التالية – بوضع علامة صح (√) أو خطأ (X) بين القوسين أمام كل فقرة:

1) من أهم عمليات الحصول علي الليزرهي حدوث مايعرف "بقلب التعداد", والتي تعني زيادة تعداد المستوي السفلي للطاقة بالمقارنة مع تعداد المستوي العلوي. ( ) ( ).

2) التوازن الحراري لنظام ليزري يعني ان الطاقة الكلية له يجب ان تبقي ثابتة. ( ) ( ).

3) من أهم مراحل انتاج الليزر أن يكون الانبعاث التلقائي أفضل من المحفز. ( ) ( ).

4) في الأنبعاث التلقائي تبعث الذرة بفوتون واحد,بينما في المحفز بفوتونين.( ) ( ).

5) في الضخ الليزري يتم نقل طاقة الذرات من مستوي طاقةأعلي الي اخر أقل.( )( )

6) الليزرات المصنعة من الغاز يصلح لها الضخ الضوئي. ( ) ( ).

7) الليزرات المصنعة من مادة شبه موصلة أنسب لها الضخ الكهربائي. ( ) ( ).

8) الليزرات المصنعة من مادة صلبة أو سائلية أنسب لها الطيف الضوئي. ( ) ( ).

9) الليزرات المتعددة مستويات الطاقة افضلها ذلك ذو الثلاث مستويات. ( ) ( ).

10) الليزرات ذات الاربعة مستويات طاقة لها قلب تعداد بطيئ عن غيرها. ( ) ( ).

11) تبدأ فكرة عمل الليزر عندما تكون هناك حالة من الاتزان الحراري للنظام. ( ) ( ).

12) قلب التعداد يمكن تحقيقه تحت شروط انعدام الاتزان الحراري للنظام. ( ) ( ).

13) اذا كان تردد الانتقالات في المنطقة المايكروية فيسمي المضخم ميزر. ( ) ( ).

14) اذا كان تردد الانتقالات في المنطقة المرئية فيسمي المضخم ليزر. ( ) ( ).

15) ضمن شروط انعدام الاتزان ان لا ينطبق عليها قانون بولتزمان. ( ) ( ).

16) التوازن الحراري لنظام ليزري أي ان عدد الفوتونات الممتصة تساوي تلك المنبعثة.

( ) ( ).

17) التوازن الحراري عدد الفوتونات الممتصة تساوي تلك من الانبعاث التلقائي فقط.( )

( ).

18) لا يحدث شعاع الليزر بين مستويي الطاقة الاكثر استقرارا في الليزر الرباعي. ( )

( ).

19) مستوي الطاقة الاكثر استقرارا تمكث فيه الحالات المستثارة اطول وقت عن غيره.

( ) ( ).

20) ثابت استيفان – بولتزمان للاشعاع ثابت هام بالفيزياء ,وحدة قياسه(K^4.وات)/ $م^3$.

( ) ( ).

21) تعداد المستوي الثاني للطاقة اكبرمن غيره فان احتمالية المستحث اعلي من الامتصاص فلن نحصل علي ليزر.( ) ( ).

22) تعداد المستوي الاول للطاقة اكبرمن غيره فان احتمالية الامتصاص اعلي من المستحث فنحصل علي ليزر.( ) ( ).

23) تعداد المستوي الاول للطاقة مساويا لغيره فان احتمالية الامتصاص مساوية للمستحث فلن نحصل علي ليزر.( ) ( ).

24) للحصول علي شعاع الليزر , لابد من توافر رنان, يجب أن تكون مرأته محدبة .
( ) ( ).

25) في حالة الانبعاث التلقائي تبعث الذرة بفوتونين متشابهين تماما في خصائصهما الفيزيائية. ( ) ( ).

26) في حالة الانبعاث المحفز تبعث الذرة بفوتونين متشابهين تماما في خصائصهما الفيزيائية. ( ) ( ).

27) في حالة الامتصاص تتم استثارة ذرات المادة , ولشروط خاصة , تنتقل الالكترونات بداخلها لمستويات طاقة مختلفة. ( ) ( ).

28) ينبعث فوتونات ضوئية من الذرات المستثارة في صورة اطياف أما خطية أو شريطية طبقا للعمليات الانتقالية للالكترونات بداخلها. ( ) ( )

29) من أهم خصائص شعاع الليزر انبعاث حرارة عالية. ( ) ( ).

30) يعتبر ليزر الياقوت رباعي المستوي للطاقة. ( ) ( ).

31) نوع المادة الشائبة المستخدمة بالمادة الفعالة هي اكسيد النحاس. ( ) ( ).

32) الرمز الكيميائي لليزر الياقوت هو: Al_2O_3 . ( ) ( ).

33) مصدر الضخ في ليزر الياقوت هو" القوس الزئبقي" . ( ) ( ).

34) الطول الموجي لأشعة ليزر الياقوت هو 8850Å. ( ) ( ).

35) من أمثلة الليزرات الثنائية المستوي للطاقة هو : جاليوم – أرزنك أي (Ga As).
( ) ( ).

36) ينشأ عن أستخدام مصدر الضخ لليزر الياقوت نوعين من الأطوال الموجية, أي منهما له مواصفات شعاع ليزر, الأكبر شدة منهما ذات اللون البنفسجي. ( ) ( ).

37) ينشأ عن أستخدام غازات معينة مثل الارجون كمصدر ضخ لليزر الياقوت أفضل من غيرها. ( ) ( ).

38) الذي وضع النظرية الكمية للضوء (جسيم , موجة) هو العالم سير أسحق نيوتن.
( ) ( ).

39) كلمة ليزر لا تستخدم فقط ضمن ترددات الضوء المرئي, ولكن أيضا في أي الترددات القريبة أو البعيدة من تحت الحمراء. ( ) ( ).

40) بمفهوم الفوتونات, فأن طاقة المتذبذب الضوئي تأخذ كمات محددة مضاعفة للمقدار (hv), كان ذلك بفضل العالم جيمس هوك. ( ) ( ).

41) في عمليةالانبعاث التلقائي, فأن طور الموجة المنبعثة من ذرة يتوافق مع طور الموجة المنبعثة من ذرة اخري في اي اتجاه. ( ) ( ).

42) المقصود بعملية الضخ هو خفض المستوي الأعلي للطاقة للمادة الفعالة الي المستوي الاقل فيها. ( ) ( ).

43) تتم عملية الضخ الكيمائي للمواد الزجاجية والبلورية. ( ) ( ).

44) تستخدم عملية الضخ الضوئي للمواد ذات التركيب الكيمائي. ( ) ( ).

45) يتم الضخ بأستخدام أشعة أكس الناتجة من أنبوبة كولدج. ( ) ( ).

46) من خصائص مستوي الطاقة الأكثر أستقرارا (الشبه مستقر Metastable state), في الليزر الثلاثي , انه يتواجد في منتصف مستويات الطاقة الأخري. ( ) ( ).

47) من خصائص مستويي الطاقة الأكثر أستقرارا (الشبه مستقر Metastable stat), في الليزر الرباعي تواجدهما بالقرب من مستوي الطاقة الرابع.( ) ( ).

48) تردد الفوتون من عملية أنحلال ذرة بواسطة الأنبعاث التلقائي يتوافق مع ذلك الناتج من أنحلال ذرة أخري. ( ) ( ).

49) فوتونات الأنبعاث المحفز لها نفس طور وتردد واتجاه الفوتونات الساقطة علي المادة المادة الفعالة من عملية الضخ. ( ) ( ).

50) في عمليات تضخيم شعاع الليزر, تستخدم مرنانات, وهي عبارة عن بلورات زجاجية شفافة. ( ) ( ).

51) في عمليات الحصول علي شعاع الليزر, يكون الأنبعاث التلقائي هو المصدر الرئيسي لذلك. ( ) ( ).

52) في عمليات الحصول علي شعاع الليزر, يمكن حدوث أنبعاث تلقائي وأخر محفز في وقت واحد. ( ) ( ).

53) في عمليات الحصول علي شعاع الليزر, تسمي المادة الفعالة بالمادة الشفافة عندما يتساوي تعداد مستوين للطاقة بها. ( ) ( ).

54) في عمليات الحصول علي شعاع الليزر, أذا تساوت أحتمالية الأمتصاص مع تلك للأنبعاث المحفز, تكون المادة الفعالة شفافة. ( ) ( ).

55) في عمليات الحصول علي شعاع الليزر, أذا كانت أحتمالية الأنبعاث المحفز أكبر من أحتمالية الأمتصاص تسمي المادة الفعالة بالمادة النشطة. ( ) ( ).

56) تردد الفوتون من عملية أنحلال ذرة بواسطة الأنبعاث التلقائي يتوافق مع ذلك الناتج من أنحلال ذرة أخري. ( ) ( ).

57) فوتونات الأنبعاث المحفز لها نفس طور وتردد واتجاه الفوتونات الساقطة علي المادة المادة الفعالة من عملية الضخ. ( ) ( ).

58) من خصائص مستوي الطاقة الأكثر أستقرارا (الشبه مستقر Metastable state), في الليزر الثلاثي , انه يتواجد في منتصف مستويات الطاقة الأخري. ( ) ( ).

59) من خصائص مستويي الطاقة الأكثر أستقرارا (الشبه مستقر Metastable state), في الليزر الرباعي تواجدهما بالقرب من مستوي الطاقة الرابع. ( ) ( ).

60) في عمليات الضخ للحصول علي اشعة الليزر, يتم أستثارة ذرات المادة الفعالة ثم تأينها. ( ) ( ).

ثانيا: الجزء الشفوي:

أجب عن **5 فقط** من الفقرات التالية – بوضع علامة صح (√) أو خطأ (X) بين القوسين أمام كل فقرة:

(1) تعتبر أشعة الليزر موجات كهرومغناطيسية طولية ( ) ( ).

(2) الضوء , اشعاع كهرومغناطيسي, يسير في الفراغ بسرعة 340 مترلكل ثانيه.( ) ( ).

(3) وضع اينشتاين معادلة مشهورة لطاقة الفوتون الضوئي هي ثابت بلانك مقسوما علي تردد الفوتون. ( ) ( ).

(4) تم اختراع الليزر في العام 1880م ( ) ( ).

(5) يتم توليد أشعة الليزر في الانابيب الزجاجية المفتوحة الطرفين ( ) ( ).

(6) لا تتفاعل موجات اشعة الليزر مع المادة ( ) ( ).

(7) يعتبر ثابت بلانك من الثوابت الهامة بالفيزياء .وحدة قياسه المتر لكل سم^3 ( ) ( ).

(8) تتعين سرعة الضوء في الوسط المادي من علاقة ماكسويل المشهورة:

$c = \sqrt{\frac{1}{\mu\varepsilon}}$ ( ) ( ).[μ,ε ثابتي السماحية الكهربية والنفاذية المغناطيسية للوسط المادي, علي الترتيب]

انتهت اسئلة الاختبار

مع خالص الأمنيات الطيبة بالتوفيق,,,,,,