Assiut University
Faculty of Science
Physics Department

Solid State (P 350) Exam
June 22, 2022
2 Hrs. Exam

===

Choose the Correct Answer

1- Energy released from the reaction $H^+ + Cl^- \rightarrow HCl$ is called the …. energy.
a)- cohesive   *b*)- ionization   *c*)- kinetic   *d*)-electron affinity

2- The maximum numbers of electrons fill the $5p$ shell is ………..
a)- 4 electrons   *b*)- 6 electrons   *c*)- 8 electrons   *d*)- 10 electrons

3- Which of the following shells can be filled by 10 electrons ?
a)- $5s$ *b*)- $4p$ *a*)- $3s$ *b*)- $3d$

4- The maximum numbers of electrons fill the $4s$ shell is ………..
a)- 2 electrons   *b*)- 6 electrons   *c*)- 8 electrons   *d*)- 10 electrons

5- Bonds between carbon and hydrogen atoms inside one CH_4 molecule is ..
a)- van der Waals   *b*)- covalent   *c*)- ionic   *d*)- hydrogenic

6- The bond between two hydrogen atoms inside one H_2 molecule is ….
a)- hydrogenic   *b*)- ionic   *c*)- metallic   *d*)- covalent

7- The electronic configuration of the oxygen atom is written as ……
a)- $1s^2 2s^1 2p^6$ *b*)- $1s^2 2s^2 2p^4$ *c*)- $1s^2 2s^2 2p^5$ *d*)- $1s^2 2s^2 2p^3$

8- Which of the following shells do not exist ?
a)- $3d$ *b*)- $2d$ *c*)- $2s$ *d*)- $2p$

9- Electric and magnetic (E, B) fields are in opposite directions. An electron moves perpendicular to the fields with velocity (v), the electric force is …..
a)- evE *b*)- $evE/2$ *c*)- eE *d*)- $eE/2$

10- Referring to Question # **9**, the magnetic force acting on the electron is…
a)- evB *b*)- eB *c*)- vB *d*)- $eB/2$

①

11- In Drude' equation, the drag force is given by ....

a)- p/τ b)- τ/p c)- $p\,\tau$ d)- p^2/τ

12- The total spins of the electrons exist in nitrogen (N^7) atom are equal to ...

a)- 0.5 b)- 1.5 c)- 2.0 d)- 2.5

13- The total spins of the electrons exist in an inert gas atom is equal to...

a)- 0 b)- 0.5 c)- 1.0 d)- 1.5

14- The velocity of sound waves (v) inside one-dimensional lattice with atomic mass (m), atomic spacing (a) and spring constant (κ) is given by

a)- $v = a\sqrt{m/\kappa}$ b)- $v = a\sqrt{\kappa/m}$ c)- $v = a\sqrt{m.\kappa}$ d)- $v = \sqrt{m/a.\kappa}$

15- A magnetic susceptibility $\chi < 0$ of any material means it is ....

a)- paramagnetic b)- diamagnetic c)- ferromagnetic d)- non-magnetic

16- A magnetic susceptibility $\chi = 0$ of any material means it is ....

a)- paramagnetic b)- diamagnetic c)- ferromagnetic d)- non-magnetic

17- In tetragonal crystal structure, the primitive lattice vectors are ....

a)- $a = b = c$ b)- $a = b \neq c$ c)- $a \neq b \neq c$ d)- $a + b = c$

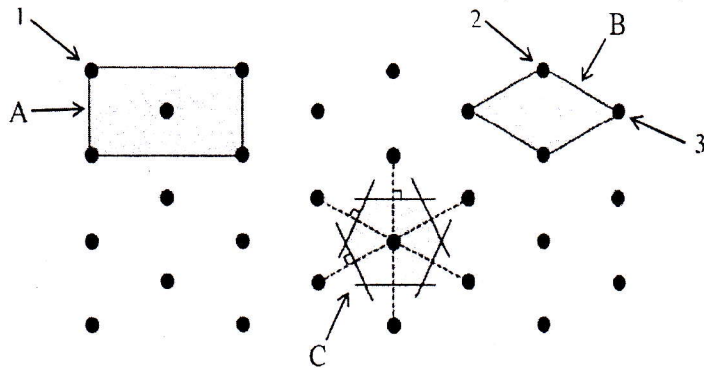18- In orthorhombic crystal structure, the primitive lattice vectors are ....

a)- $a = b = c$ b)- $a = b \neq c$ c)- $a \neq b \neq c$ d)- $a + b = c$

19- In simple cubic structure, the relation between the cube edge (a) and the atomic radius (R) is...

a)- $a = R$ b)- $a = 2R$ c)- $a = \sqrt{2}\,R$ d)- $a = 2\sqrt{2}\,R$

20- In simple cubic lattice structure, the nearest neighbors are equal to ......

a)- 12 points b)- 10 points c)- 8 points d)- 6 points

21- For a body centered cubic, the number of lattice points in one unit cell is…

a)- 1 point   b)- 2 points   c)- 3 points   d)- 4 points

22- For a face centered cubic, the number of lattice points in one unit cell is…

a)- 1 point   b)- 2 points   c)- 3 points   d)- 4 points

23- For a face centered cubic structure, the nearest neighbors are equal to ….

a)- 12 points   b)- 10 points   c)- 8 points   d)- 6 points

24- The chemical bonds between two water molecules inside ice is called ……

a)- hydrogenic   b)- ionic   c)- metallic   d)- covalent

25- The electronic configuration of a neutral sodium atom is ………

a)- $1s^2 2s^2 2p^5 3s^1$ b)- $1s^2 2s^1 2p^5 3s^1$ c)- $1s^2 2s^2 2p^6 3s^1$ d)- $1s^2 2s^2 2p^4 3s^1$

26- In the figure below, three different unit cells (A, B and C) are drawn.

the unit cell A is called as ……

a)- primitive   b)- conventional   c)- Wigner-Seitz   d)-non- primitive

27- Referring to Question # 26, the unit cell C is called as …..

a)- primitive   b)- conventional   c)- Wigner-Seitz   d)-non- primitive

28- Referring to Question # 26, the lattice point # 2 shares the unit cell B by ..

a)- 1/4   b)- 1/3   c)- 1/2   d)- 1/6

29- The smallest portion of a crystal which when repeated in different directions generates the entire crystal is called the ………..

a)- lattice points   b)- unit cell   c)- crystal lattice   d)- none of these

30- When a free electron moves with velocity (v) into a magnetic field (B), the magnetic force will be zero if the angle (θ) between v and B equals to ....

a)- π b)- $\pi/2$ c)- $\pi/3$ d)- $\pi/4$

31- The volume of one atom in terms of its radius (R) is given by ....

a)- $(4/3)\pi R$ b)- $(3/4)\pi R^2$ c)- $4\pi R^2$ d)- $(4/3)\pi R^3$

32- Elements in which the electrons move as gas molecules are called ....

a)- metals   b)- diamagnetics   c)- insulators   d)- paramagnetic

33- In terms of the atomic radius (R), the length of the *fcc* cube (a) equals....

a)- $a = 2\sqrt{2}\,R$ b)- $a = \sqrt{2}\,R$ c)- $a = 2R$ d)- $a = R/\sqrt{2}$

34- In terms of the atomic radius (R), the length of the *bcc* cube is given by ...

a)- $a\sqrt{3}/4$ b)- $4a/\sqrt{3}$ c)- $a/2\sqrt{3}$ d)- $a/2$

35- A chain of identical atoms of mass (m), atomic spacing (a) and a displacement (u), the force per unit mass is defined by .....

a)- d^2u/dx^2 b)- du/dx c)- d^2u/dt^2 d)- du/dt

36- "A system which is periodic in real space with a periodicity (a) will be periodic in reciprocal space with periodicity ....

a)- $2a/\pi$ b)- $\pi/2a$ c)- $2\pi/a$ d)- π/a

37- When atoms are placed at the corners of all 12 edges of a cubic structure, the number of atoms present per unit cell equals ....

a)- 0   b)- 0.5   c)- 1.0   d)- 2.0

38- When packing the atoms as hard spheres, the highest value of atomic packing in metals will be .....

a)- 0.68   b)- 0.74   c)- 0.84   d)- 0.98

39- In *fcc* arrangement of A and B atoms, A atoms occupy the corners and B atoms occupy the face centers of the unit cell. The formula of the compound is..

a)- AB_4 b)- AB_3 c)- AB_2 d)- AB

40- A solid has cubic unit cell structure in which A atoms are present at the corners, B atoms at the edges and C atoms at the centers. The formula of the compound is ……..

a)- ABC b)- AB_2C c)- AB_3C d)- AB_4C

41- Gold (atomic radius 0.144 nm) crystallizes in face center cubic cell. The length of the cubic unit cell equals …….

a)- 0.41 nm   b)- 0.31 nm   c)- 0.21 nm   d)- 0.11 nm

42- In body center cubic arrangement of A and B atoms, A atoms occupy only 6 corners and B atoms occupy the centers of the unit cells. The formula of the compound is …….

a)- AB_2 b)- A_3B_4 c)- A_2B d)- A_4B_3

43- Tungsten has atomic mass184 u, crystallizes in **bcc** lattice. The number of unit cells in 0.184 g of tungsten (Avagadro`s number = 6.02×10^{23}) equals ….

a)- 3.01×10^{20} b)- 6.02×10^{20} c)- 9.03×10^{20} d)- 1.01×10^{20}

44- Carbon atom does not form ionic bonds because it has … valence electrons.

a)- one   b)- two   c)- three   d)- four

45- According to Drude theory, electrons in metal have a scattering time (τ). The probability of scattering through two second equals to ……

a)- dt/τ b)- 2τ c)- $2/\tau$ d)- $1/2\tau$

46- The number of protons exist in the sodium (Na_{11}^{23}) atom equals ……

a)- 12   b)- 23   c)- 11   d)- 13

47- The electrical conductivity (σ) of a metal is given by ………..

a)- $\sigma = m e^2 / n\tau$ b)- $\sigma = m\tau / n e^2$ c)- $\sigma = n e^2 / m$ d)- $\sigma = n e^2 \tau / m$

48- A unit cell is called Wigner-Seitz unit cell when it has ……… lattice point.

a)- 0. 5   b)- 1.5   c)- 1.0   d)- 2.0

49- The maximum number of electrons for the energy level $n = 3$ are equal to..

a)- 9   b)- 12   c)- 18   d)- 6

50- For a body centered cubic lattice, the nearest neighbors are equal to …..

a)- 12   b)- 10   c)- 8   d)- 6

Assiut University	Physic Department- Faculty of Science	
Faculty of Engineering	Course: Power Electronics	
Dep. of Electrical Eng.	3rd year	
Final Year Exam	Time allowed 3 hours	
2022	Total Marks: 50 points	

Important remarks	• *This exam measures ILOS no.: a.1 & b.1 & b.3 & c.1 & d.4* • *No. of pages: 9 - No. of question: 6*

Answer the following questions

Question (1) True or False   (3 points)

1) Currently, B_2/B_6 diode rectifiers are the most commonly used rectifiers in industry.   (   )
2) In order to get a smooth current from rectifier circuits, a large capacitor should be connected in parallel with the resistive load.   (   )
3) In diode rectifiers, it is possible to control the value of the output DC voltage by adjusting the firing angle.   (   )
4) In switching power supply circuits, the efficiency is higher than that of linear power supplies.   (   )
5) In the boost DC-DC power converter, the output voltage is lower than the input voltage.   (   )
6) The Ćuk DC-DC converter is preferred than the buck-boost one.   (   )

Question (2) Cross the correct answers (one or more selections are possible).
                                                                 (7 points)

1) For diode rectifiers, a one-way circuit
[ ]   A. needs less switching components than a two-way circuit.
[ ]   B. needs a more complex transformer than a two-way circuit.
[ ]   C. has higher energy efficiency than a two-way circuit.
[ ]   D. generates less electromagnetic interferences than a two-way circuit.

2) Compared with a B_2 rectifier circuit using diodes, an M_2 rectifier circuit under the same condition will output (ignoring the diode voltage drop)
[ ]   A. more stable voltage.
[ ]   B. the same voltage.
[ ]   C. a higher voltage.
[ ]   D. a lower voltage.

3) In B$_2$ thyristor rectifier circuit, in order to get the same output voltage like B$_2$ diode rectifier, the firing angle should adjust to
[ ]   A. 30 degree.
[ ]   B. 60 degree.
[ ]   C. 90 degree.
[ ]   D. zero degree.

4) Compared to linear power supplies, switching power supplies usually have the following characteristics:
[ ]   A. Higher efficiency.
[ ]   B. Lower efficiency.
[ ]   C. Lower ripple.
[ ]   D. Higher ripple.

5) In a linear power supply as shown in the following figure, the keys to keep the output voltage, V$_A$, stable are that
[ ]   A. the input voltage V$_0$ is stable.
[ ]   B. the zener diode V$_z$ provides a stable voltage.
[ ]   C. the transistor operates in amplifying region.
[ ]   D. the switching frequency is very high.
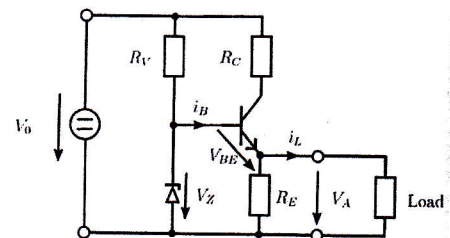
6) A buck converter can
[ ] A. convert a DC voltage to a lower DC voltage.
[ ] B. generate a higher voltage than the input voltage.
[ ] C. generate a sinusoidal voltage without DC component.
[ ] D. operate without switching components.

7) The following current and voltage curves are measured at the load of a rectifier circuit. The following conclusions are true:
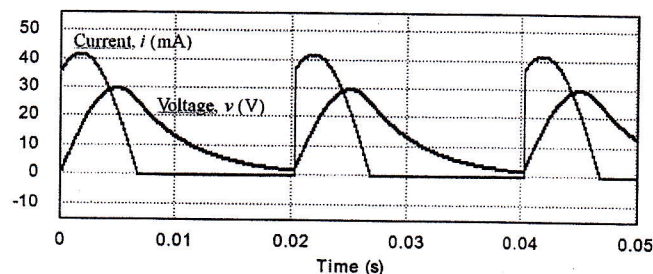
[ ] A. This is an M1 circuit.
[ ] B. This is a B2 circuit.
[ ] C. The load is capacitive (RC load).
[ ] D. The load is inductive (RL load).

Question (3) (6 points)

a) A buck converter is shown in the following figure with $V_0 = 150$ V, $L = 100$ mH, $C = 200$ uF, and $R = 20$ Ω. The switching sequence is given on the right side of the circuit with $T_{on} = 1$ ms and $T_{off} = 2$ ms. The system already operates in stable state.
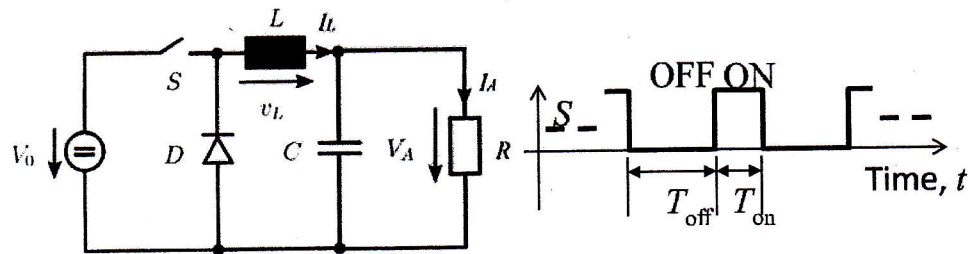
1- Calculate the average output voltage V_A.

2- Calculate the average inductor current I_L.

3- Calculate the maximum and minimum values of the inductor current I_L. Suppose the change of the inductor current is approximately linear.

b) An B2 circuit with Thyristors. The load is a DC motor with large inductance so that the load current keeps almost constant. For the given input voltage as shown below, please draw the load voltage waveform for the firing angle of α = 45 and 135 degree, respectively. <u>What you can observe from the load voltage waveforms?</u>
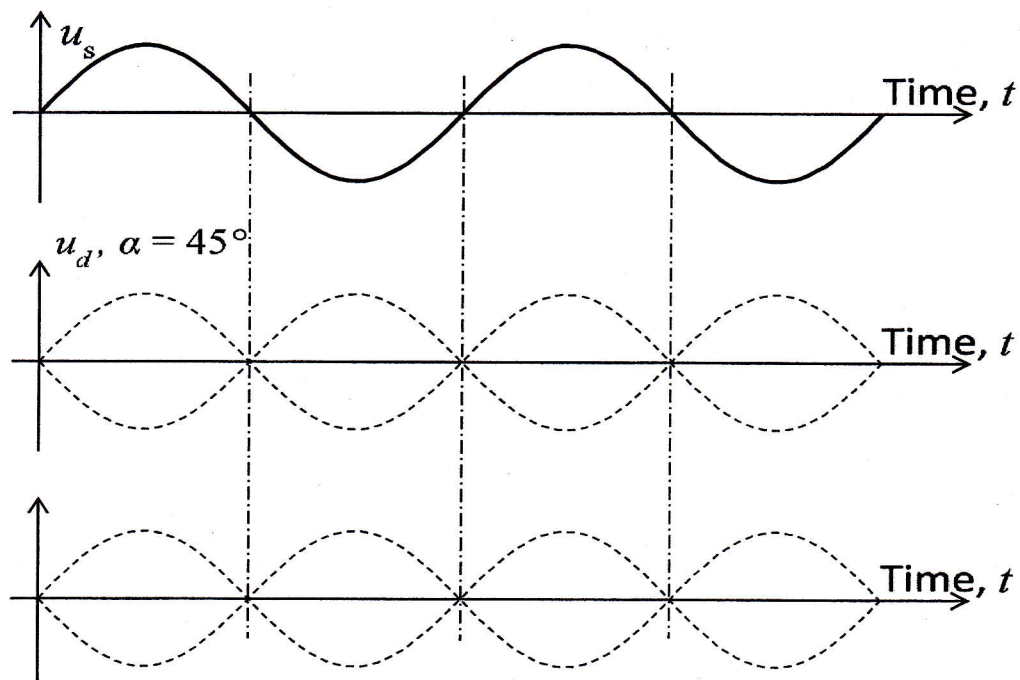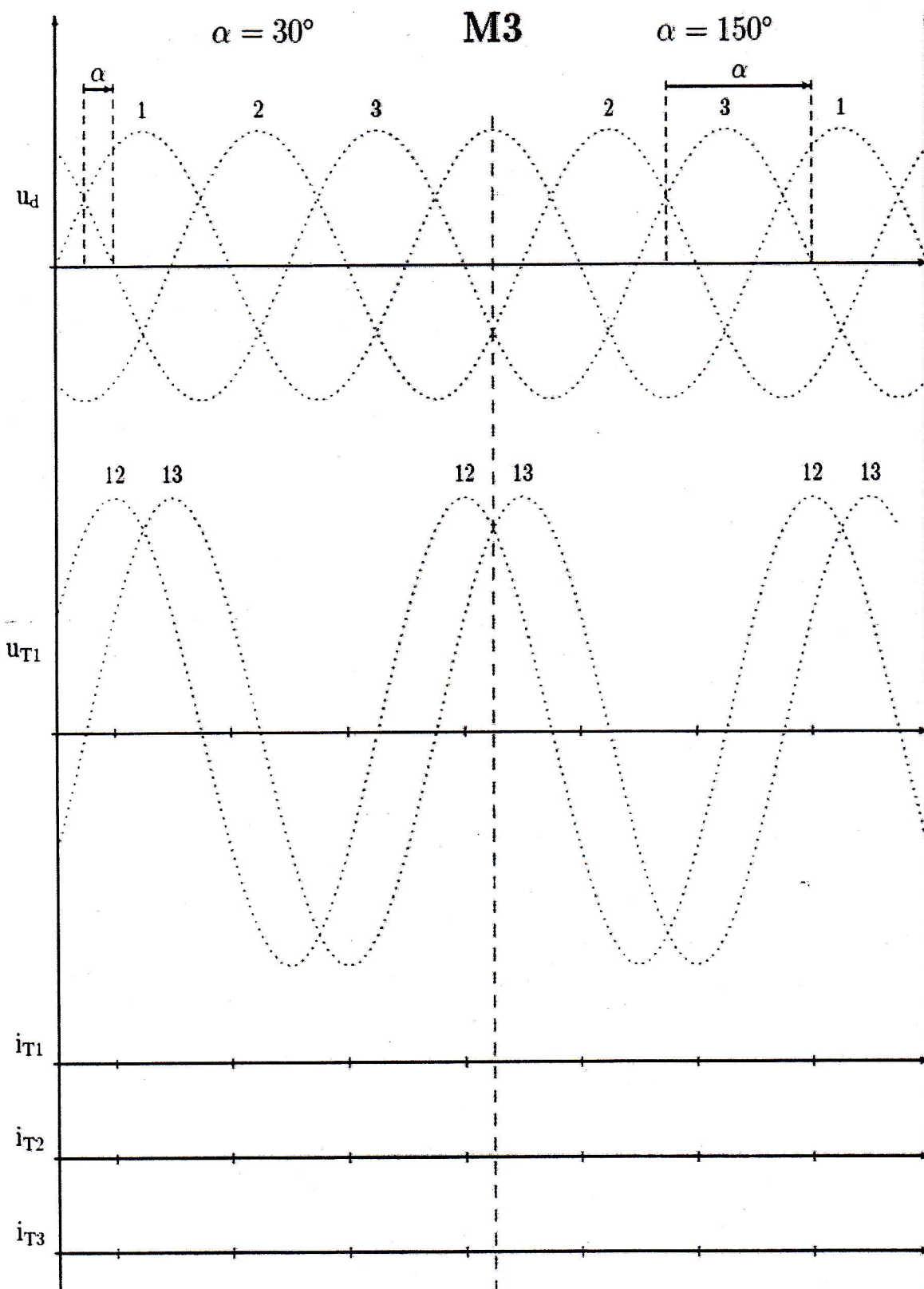

Question (4) (10 points)

For M_3 circuit with Thyristors, draw the load voltage trajectory $u_d(t)$, the voltage drop $u_{T1}(t)$ across thyristor 1 and the semicondutor current trajectories $i_{Ti}(t)$ for α= 30° and α= 150°. In this case the load current $i_d(t)$ can be assumed to be constant, i. e. $i_d(t) = I_d$ = const. Commutation losses can also be neglected.

α = 30°   **M3**   α = 150°
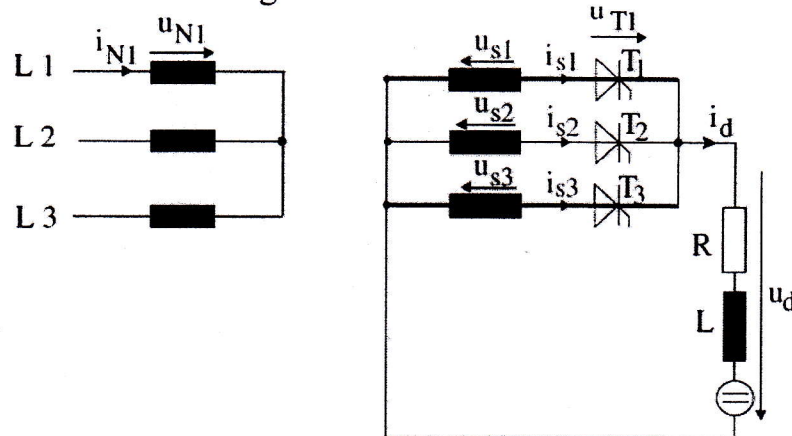
## Question (5)   (12 points)

a) Explain How the linear regulator can keep the output voltage constant when the load resistor R_L becomes bigger.
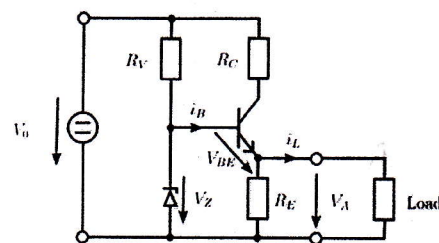
b) An inverter with a three-phase symmetric load is shown below. The switching status of the three inverter arms based on time are also illustrated below. Please calculate the voltage values in different switching status and draw the curves of the following voltages:
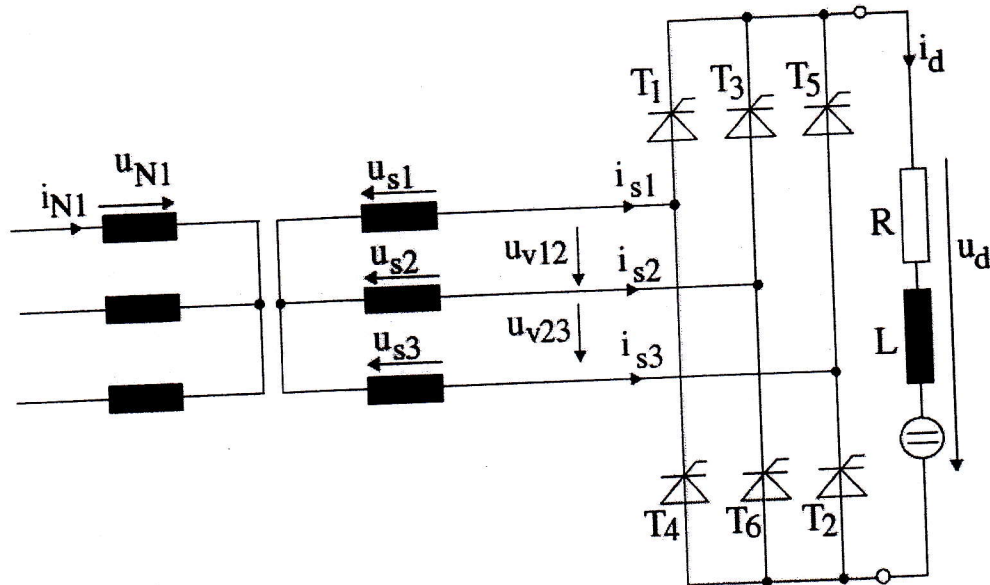
1. u_{u0} (between winding u input point and DC middle point 0)
2. u_{v0} (between winding v input point and DC middle point 0)
3. u_{w0} (between winding w input point and DC middle point 0)
4. u_{uv} (between winding input points u and v, line voltage)
5. u_{uN} (between winding u input point and neutral point, phase voltage of winding u)
6. u_{vN} (between winding v input point and neutral point, phase voltage of winding v)
7. u_{wN} (between winding w input point and neutral point, phase voltage of winding w)
8. u_{N0} (between neutral point N and DC middle point 0)

Arm status:

u_{uo}

u_{vo}

u_{wo}

u_{uv}

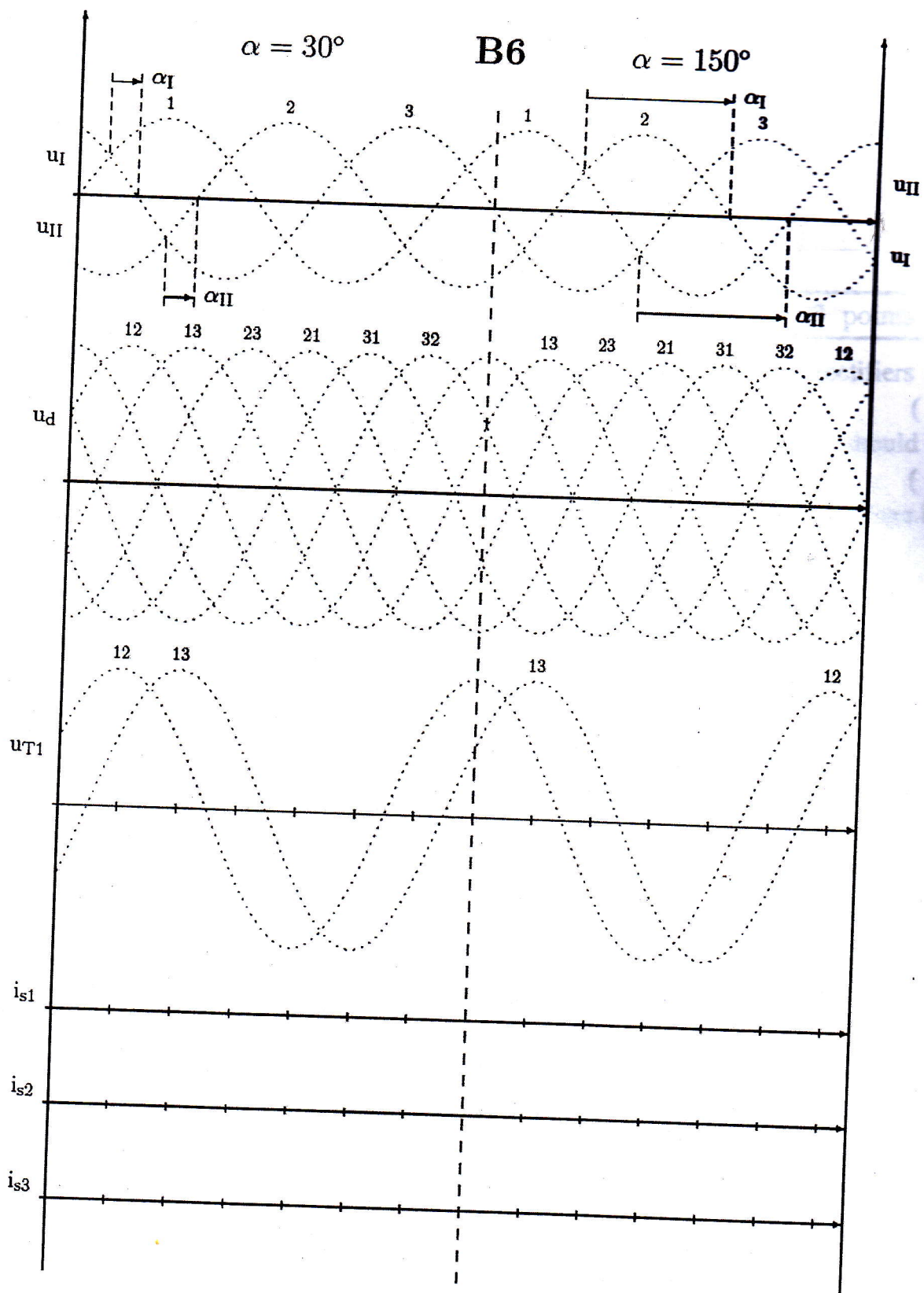u_{uN}

u_{vN}

u_{wN}

u_{N0}
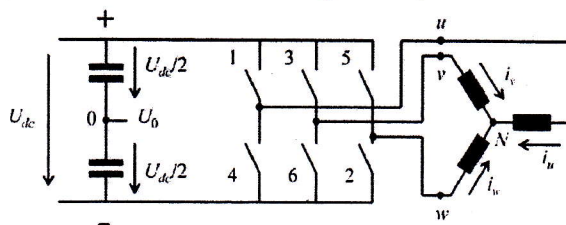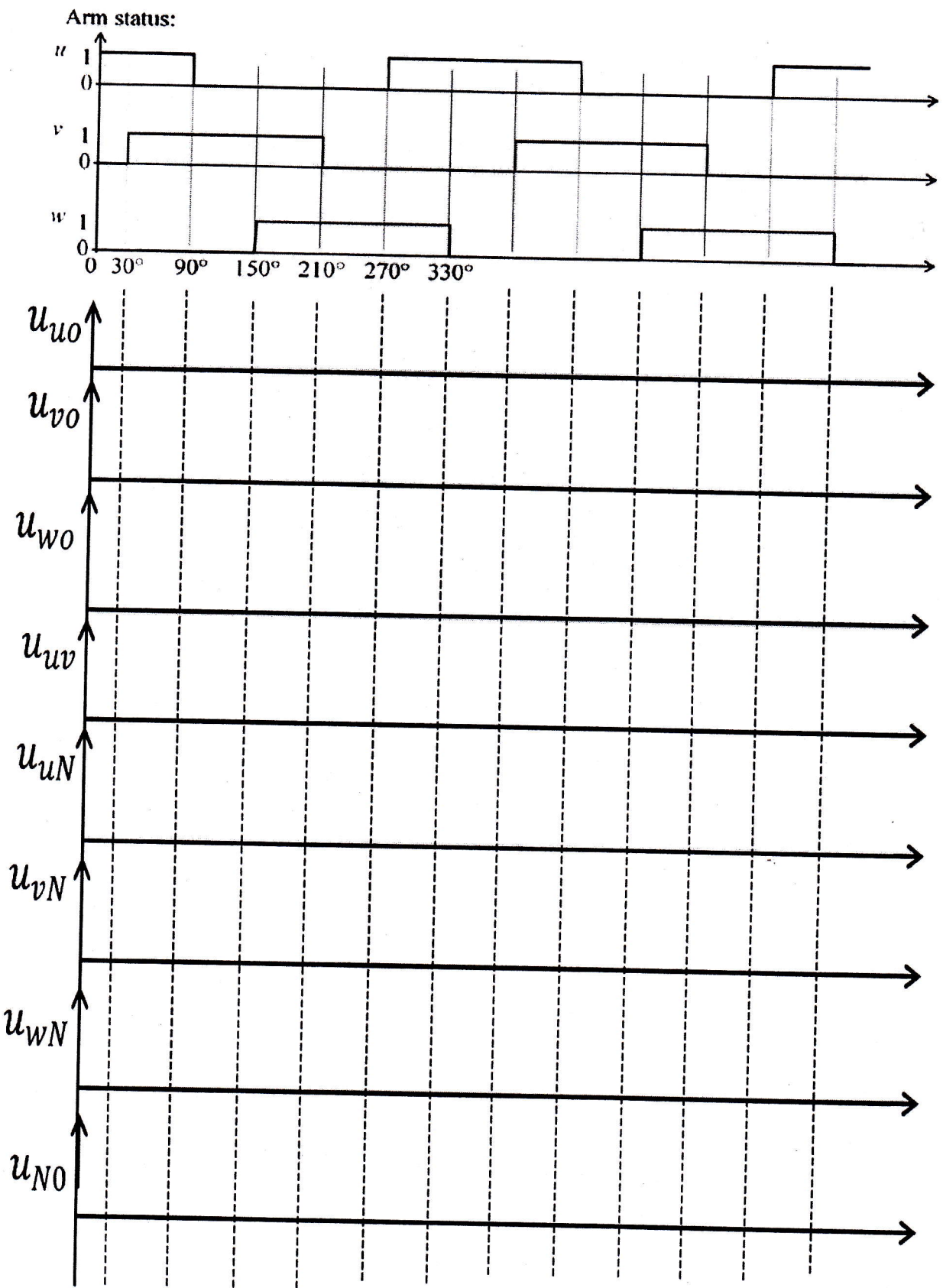
Question (6)

For M$_3$ circuit with Thyristors, draw the load voltage trajectory u$_d$(t), the voltage drop u$_{T1}$(t) across thyristor 1 and the semicondutor current trajectories i$_{Ti}$(t) for α= 30° and α= 150°. In this case the load current i$_d$(t) can be assumed to be constant, i. e. i$_d$(t) = I$_d$ = const. Commutation losses can also be neglected.

α = 30°   B6   α = 150°

With my best wishes
Dr. Mohamed Abdelsater

Assiut University		Term: Spring 2021- 2022
Faculty of Science		Date: Monday 20 June, 2022
Department of Physics		Time: 3 Hours

Course Title: Nuclear Physics 1 – Code P342 – Final Exam. (50%)

Constants: $R_o = 1.3$ fm, $e^2 = 1.44$ MeV – fm, $m_e = 0.511$ MeV, $c^2 = 931.5$ MeV

Part I: Circle the correct answer for the following questions: ………….. (26 points)

1- Which of the following does not obey inverse square law force:
    a) electrostatic force   *b)* magnetic force between two poles
    c) gravitational force   *d)* nuclear force

2- When $^9_4 Be$ is bombarded with α-particle, one of the products of nuclear transmutations is $_6 C^{12}$. The other is
    a) $_0 n^1$ *b)* $_1 H^2$ *c)* $_1 H^1$ *d)* $_{-1} e^0$

3- The end product of the radioactive element $^{232}_{90} Th$ is an isotope of lead $^{208}_{82} Pb$. The number of alpha and beta particles emitted are:
    a) $\alpha = 4$ and $\beta = 6$ *b)* $\alpha = 6$ and $\beta = 0$ *c)* $\alpha = 6$ and $\beta = 4$ *d)* $\alpha = 3$ and $\beta = 3$

4- Consider a nuclear reaction $^{200}X \rightarrow {}^{110}A + {}^{90}B + Q$. If the binding energy per nucleon for *X, A* and *B* is *7.4 MeV, 8.2 MeV* and *8.2 MeV* respectively, what is the energy released
    a) 90 MeV   *b)* 160 MeV   *c)* 110 MeV   *d)* 200 MeV

5- The decay in sequence are $^A_Z X \rightarrow {}^{A-4}_{Z-2}Y \rightarrow {}^{A-4}_{Z-2}Y \rightarrow {}^{A-4}_{Z-1}Y$. In the reaction represented by
    a) α, γ, β *b)* γ, α, β *c)* β, γ, α *d)* α, β, γ

6- If you know that the radius of the nucleus of an unknown element is equal 2.977 *fm*, the mass number is equal to:
    a) 16   *b)* 12   *c)* 14   *d)* 9

7- What atoms are the most likely to emit an electron from the nucleus?
    a) atoms with too few electrons   *b)* atoms with too many electrons
    c) atoms with too few neutrons   *d)* atoms with too many neutrons

8- The radius of a ^{64}Cu nucleus is measured to be 4.8×10^{-13} cm. The radius of a ^{27}Mg nucleus can be estimated to be:
    a) 2.86×10^{-13} cm   *b)* 5.2×10^{-13} cm   *c)* 3.6×10^{-13} cm   *d)* 8.6×10^{-13} cm

9- An α-particle of energy 6 MeV is projected toward a nucleus of atomic number 50. The distance of closest approach is
    a) 2.4×10^{-10} m   *b)* 2.4×10^{-12} m   *c)* 2.4×10^{-14} m   *d)* 2.4×10^{-15} m

10- The ratio of the surface energy term per nucleon for ^{40}Ca to that of ^{208}Pb is:
    a) 0.58   *b)* 1.73   *c)* 0.19   *d)* 5.2

11- The antiparticle of electron is
    a) meson   *b)* neutrino   *c)* proton   *d)* positron

12- What is the missing element from the following reaction $^{14}_6 C \rightarrow ? + \beta^-$?
    a) $^{13}_7 N$ *b)* $^{13}_6 C$ *c)* $^{15}_8 O$ *d)* $^{14}_7 N$

13- The minimum energy required to separate a proton from $^{40}_{20}Ca$ is:

$$(^{40}_{20}Ca = 39.9 \text{ amu}, \ ^{39}_{19}K = 38.9 \text{ amu}, \ m_p = 1.007825 \text{ amu})$$

 a) 1870 MeV   *b)* 7.29 MeV   *c)* 23.28 MeV   *d)* 931.5 MeV

Part II: Answer the following questions: (24 points)

Question #1   ....(8 points)

 a. In a scattering experiment it was found that ^{12}C has a nuclear radius of 2.7 fm. The experiment is then repeated with another, unknown element and it is found the nuclear radius is twice as big. *What is* the mass number of this unknown element?

 b. The Q value for the reaction $^9Be + p \to {}^8Be + {}^2H$ is 559.5 KeV. Using the masses of ^9Be=9.01218u and ^2H=2.014u to *find* the mass of ^8Be in MeV.

 c. *Suggest a simple reason why* the $^{12}_{6}C$ nuclide has a higher binding energy (more stable) than $^{12}_{7}N$, even though they are isobars?

 d. The maximum kinetic energy of the positron spectrum emitted in the decay $^{11}_{6}C \to {}^{11}_{5}B$ is Q_{β^+}=1.983 MeV. Use this information and the known mass of ^{11}B to *calculate* the mass of ^{11}C (*where* $^{11}_{5}B$=11.009305u).

Question #2   ....…..…(6 points)

 1- Show that the electric quadrupole moment of a nucleus vanishes for:
  a. spherically symmetric charge distribution.
  b. nuclear spin $I = 0$ *or* $I = \frac{1}{2}$.

 2- Show that the nucleons are not elementary particles but have an internal structure.

Question #3   ....…..…(6 points)

 The following are atomic masses in units of amu (1 amu = 931.5 MeV/c²).

Electron	0.000549	$^{152}_{62}Sm$	151.919756
Neutron	1.008665	$^{152}_{63}Eu$	151.921749
^1_1H	1.007825	$^{152}_{64}Gd$	151.919794

 a) What is the Q-value of the reaction $^{152}Eu(n,p)$?

 b) What types of weak-interaction decay can occur for ^{152}Eu?
 c) What is the maximum energy of the particles emitted in each of the processes given in *(b* ?

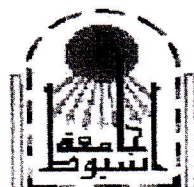### Question #4   ....…..…(4 points)

 The various terms in the Semi-Empirical Mass Formula.
   [NB: detailed mathematical expressio2ns and values of constants are not required].

************** *Good Luck* ***************

Prof. Dr. Ahmed A. Ebrahim

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Exam in 5 pages

Section A

Choose the correct answer for the following 40 questions (40 marks):

1. The .... field basically deals with understanding the underlying mechanisms involved in the crystallization process and the technology to produce a single crystal from some medium in a controlled fashion

   a- melt growth   b- liquid growth   c- crystal growth   d- vapour growth

2. The crystal growth field depends upon the .... principal scientific pillars

   a. thermodynamics   b. statics   c. kinetics   d. a and c

3. The Kinetic factors control ....

   a. the crystal growth rate   b. the degree of perfection of the crystal

   c. both a and b   d. none of the above

4. Before initiating the crystal growth process, one should know whether the compound

   a. melts congruently   b. has a phase transformation below its melting temperature

   c. has a high vapour pressure   d. all of the above

5. A compositional variation parallel to the growth interface, usually caused by poor temperature control and melt oscillations, is called

   a. striation   b. dislocation   c. saturation   d. combination

6. In .... method, when the furnace temperature decrease, the gradient across the remaining melt decrease

   a. the gradient freeze   b. Bridgman-Stockbarger's

   c. the flame fusion   d. Czochralski's

7. ....is/are between the most useful methods in melt growth

   a. Czochralski method   b. Verneuil method

   c. Kyropoulos method   d. all of the above

8. The flame fusion method was first developed to produce

   a. Large diamond   b. Large ruby

   c. Large glass crystal   d. Large emerald

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9. In Czochralski's method, the crystal grows on/in

a. glass rod   b. capillary   c. iron rod   d. both b and c

10. Czochralski's method is applied to a wide variety of commercial materials such as

a. insulators   b. ceramics   c. semiconductors   d. none of the above

11. Bridgman-Stockbarger's first experiments were done using:

a. copper melts   b. zinc melts   c. iron melts   d. bismuth melts

12. In Bridgman-Stockbarger's method, a better control of the thermal gradient at the growth interface was due to the use of a .... furnace

a. one-zone   b. two-zone   c. three-zone   d. four-zone

13. KDP is an important .... material for modulating lasers

a. linear optical   b. nonlinear optical   c. thermal   d. electrical

14. Phosphorene belongs to .... crystal class

a. Cubic   b. Tetragonal   c. Orthorhombic   d. Hexagonal

15. .... is the most stable allotrope of phosphorus

a. White Phosphorus   b. Black Phosphorus   c. Red phosphorus   d. Phosphorene

16. Black phosphorus is formed when red phosphorus is subjected to ... treatment

a. High pressure, low temperature   b. Low pressure, low temperature

c. Low pressure, High temperature   d. High pressure, high temperature

17. .... is a 2D materials that can be produced by mechanical exfoliation technique

a. Phosphorene   b. Boron Nitride   c. TMDCs   d. Both a and b

18. Which of the following switches have the higher on/off ratio

a. Graphene-based switches   b. Phosphorene based switches

c. Graphene is as high as phosphorene   d. Both have very low on/off ratio

19. .... is the IUPAC name of the phosphorene

a. 2D phophane   b. h-phosphorus   c. phophoryne   d. phophorene

20. What factors affect the electronic properties of the phophorene

a. External Field   b. Doping   c. both of them   d. None of them

21. Which of the following facts about the phosphorene is right

a. The Seebeck coefficient of phosphorene is relatively high.

b. Phosphorene has high electrical conductivity.

c. Phosphorene has poor thermal conductivity.   d. All of the above.

2

22. Phosphorene is more ……….. than graphene Which is more flexible:

a. flexible

b. rigid

c. They have the same Young's modulus.

d. None of the above

23. Poisson ratio is defined as :

a. The slope of the linear part of the stress-strain curve for a material under tension or compression.

b. A measure of the deformation (expansion or contraction) of a material in directions perpendicular to the specific direction of loading.

c. A measure of how resistant to compression a substance is.

d. None of the above

24. Mechanical exfoliation is a reasonable technique for producing phosphorene due to

a. Strong van der Waal interaction between layers of phosphorene.

b. Week Van der Wall interactions between the layers.

c. Delocalized electrons between the bonds of the phosphorene.

d. The electrostatic repulsion between layers of phophorene.

25. The layers of phosphorene can be exfoliated by:

a. Ionic solvent working as a glue.

b. Blue Laser

c. Scotch tape

d. Microwave

26. After isolating few layers of phosphorene, these layers would be cleaned by:

a. Acetone.   b. Methanol.   c. Isopropyl alcohol.   d. any of them

27. To remove the rest of the remnants of the cleaning agents, one would use

a. Post backing

b. Microwave

c. Vacuum chamber

d. High pressure container

28. To produce a single layer of phosphorene, one can use:

a. Millimeter-resolution Ar+ Plasma

b. Micro-meter resolution Ar+ plasma

c. High intensity plasma gun

d. None of the above

29. Liquid phase method of producing phophorene is a:

a. Top-down approach.

b. Down-Up approach

c. Produces phophorene flakes of smaller size.

d. None of the above

30. ………….. is a stable solvent for producing phophorene.

a. Polar solvents

b. Aprotic solvents

c. Dimethyl sulfoxide (DMSO).   d. All of the above.

31. The lithiation method of producing phosphorene is a/an:

a. Electromechanical method.   b. Electromagnetic method

c. Electrochemical method   d. Quantum chromodynamical method.

32. Example/s of 2D materials produced by the lithiation method is/are:

a. MoS_2 b. Graphene   c. Boron nitride   d. All of the above.

33. Which of the following is a bottom-up technique of producing phosphorene:

a. Chemical vapor deposition   b. Melt growth.

c. Mechanical exfoliation   d. Heat ablation

34. The epitaxial growth methods of phosphorene should be on:

a. Metal substrate.   b. Insulating substrate.

c. Any of the Above choices would work.   d. None of the above choices

35. .... is a method of characterization of phophorene

a. Raman spectroscopy.   b. Atomic Force Microscopy (AFM).

c. Transmission Electron Microscopy (TEM).   d. All of the above.

36. .... is a method for phophorene characterization

a. X-ray Photoelectron Spectroscopy (XPS).

b. Energy Dispersive X-ray Analysis (EDX).

c. Both of the above   d. None of the above.

37. What are the promising impacts of using graphene instead of silicon in electronics chips:

a. Countless transistors could be positioned onto a microchip.

b. faster and more powerful processors for electronics applications.

c. Both of the above.   d. None of the above.

38. Phosphorene is being used as:

a. AM demodulators.   b. Gas sensors.   c. FET transistors.   d. All of the above

39. Dichroism is defined as:

a. Light rays with different polarization are absorbed at different rates.

b. The optical property of a material having a refractive index that depends on the polarization and propagation direction of light.

c. An optical phenomenon in which a substance has different colors when observed at different angles.

4

d. A phenomenon where a material or solution's hue is dependent on both the concentration of the absorbing substance and the depth or thickness of the medium traversed.

40. Scotch tape is used in the exfoliation of which of the following materials:

a. Graphene   b. TMDCs   c. Phosphorene   d. All of the above.

Section B

Choose True or False for the following 10 sentences (10 marks):

1. Removal of one defect can lead to the redistribution of other defects to lower the overall energy of the system

2. When a material has low-temperature destructive phase transformations, it is usually desirable to prepare a single crystal directly from its melt

3. Mechanical exfoliation is a technique that requires mechanical energy to remove (exfoliate) upper layer of a bulk material to form 2D materials

4. 2D graphene can not be produced by mechanical exfoliation technique

5. Phosphorene can exchange between insulating and conductive states by tuning its band gap

6. Mechanical exfoliation is the adhesion of a new layer to an existing bulk material

7. Phosphorene is equally ductile/ stiff in all directions

8. The AFM characterization technique can be used to clearly determine the thickness of phosphorene using optical contrast route

9. An aprotic solvent is a solvent that has O-H or N-H bonds

10. Phosphorene has relatively large carrier mobility

Best Wishes, Prof. Mohamed Almokhtar

اختر الإجابة الصحيحة (لكل جملة درجة واحدة)

1. SI unit of flux density is :   A) $NA^{-1}m^{-1}$ B) NAm^{-1} C) NmA^{-1} D) NmA^{-2}

2. Magnetic flux φ_B and flux density B are related by

1)φ_B= B / area   2)φ_B= B x area   3)B = φ_B /area   4)B = φ_B x area

3. The standard vector symbol for flux density is :

A) M   B) L   C) H   D) B

4. The charged particle enters the uniform magnetic field in such a way that its initial velocity is not perpendicular to the field the orbit will be :

A) A circle   B) A spiral   C) An ellipse   D) Helix

5. An electron enters a region where the electric field E is perpendicular to the magnetic field B. It will suffer no deflection if :

A) E = B e V   B) B = e E / V   C) E = BV   D) E = B e V /2

6. Value of permeability of free space in SI units is :

A. $4\pi x10^{-9}$ $WbA^{-1}m^{-1}$ B. $4\pi x10^{-7}$ $WbA^{-1}m^{-1}$

C. $4\pi x10^{-10}$ $WbA^{-1}m^{-1}$ D. $4\pi x10^{-8}$ $WbA^{-1}m^{-1}$

7- Magnetic field can be produced by using

1 .permanent magnet   2. electric current

3 .temporary magnet   4 . both A and B

8- Whenever there is force on magnetic pole, there exists

  1-magnetic field   2- electric field   3- current   4 - voltage

9- If the magnetic flux density and current are at right angles, then component of force acting on the conductor is

  1-BIL $\cos\theta$ 2- BIL $\sin\theta$ 3 - BIL $\tan\theta$ 4 - BL $\sin\theta$

10- Unraveling an electromagnetic gives

  1-stronger field   2- weaker field   3- moderate field   4- wider field

11- Force per meter on two wires carrying a current of 1 A placed 1 m apart is equal to

  1)6.7×10^{-11}N   2)9.0×10^{9} N   3)2.0×10^{-7} N   4) 3.0×10^{-4} N

12- F = BIL can only be used if the magnetic field and electric current are

  1-at right angles to each other   2- in same direction

  3-anti-parallel to each other   4- anti-perpendicular to each other

13- Derived unit Tesla is related to

  1)A   2)kg   3)s   4)all of above

14- If we reverse the direction of electric current, the direction of magnetic field will be :

  1)reversed   2)remains same   3)becomes tangent   4)becomes normal

15- 1 Tesla is equal to

  1)50 N A^{-1} m^{-1} 2)100 N A^{-1} m^{-1} 3) 1 N A^{-1} m^{-1} 4) 1000 N A^{-1} m^{-1}

16- Field which does not have magnetic poles is

  1)straight lined   2)normal to the wire   3) tangent to the wire   4) circular

17- A flat coil and solenoid has

1)different fields   2)same physical properties

3) same fields   4)same chemical properties

18- Flux density is defined by

     1)FIL   2) F/(IL)   3) IL   4) I/FL

19- Strength of magnetic field of solenoid can be increased by adding core made of

     1)copper   2) ferrous   3) silver   4) aluminum

20- In Fleming's left hand rule, thumb shows direction of

     1)current   2) field   3) motion   4) charge

21- The strength of an electromagnet can be increased by

     1)Increasing the cross-sectional area   2) Increasing the number of turns

     3)Increasing current supply   4) All of the above

22- Which of the following is a vector quantity?

     1)Relative permeability   2) Flux density

     3)Magnetic field intensity   4) Magnetic potential

23- The magnetism of a magnet can be destroyed by

     1)Hammering   2) Heating   3) By Alternating current   4)By all the above

24- One Maxwell is equal to

     1)10^{-8} webers   2) 10^{-4} webers   3) 10^{8} webers   4) 10^{4} webers

25- What will be the magnetic potential difference across the air gap of 2 cm length in the magnetic field of 200 AT/m?

     1)10 AT   2) 6 AT   3) 4 AT   4) 2 AT

26- A magnetic field exists around

  1)Moving charges   2)Copper   3)Iron   4)Aluminum

27- Temporary magnets are used in

  1)Electric-bell   2) Generators   3)Motors   4) All of the above

28- The magnetism left in the iron after the exciting field has been removed is known as

  1)Susceptance   2) Residual magnetism   3) Permetance   4) Reluctance

29- Which of the following is not a unit of flux?

  1)Maxwell   2) Tesla   3) Weber   4) None of the above

30- A coil of wire is placed in a changing magnetic field. If the number of turns in the coil is decreased, the voltage induced across the coil will

  1)Decrease   2) Increase   3)Remain constant   4) Be excessive

31- Two infinitely long parallel conductors in a vacuum and separated 1 meter between centers with one-ampere current flowing in each of the two infinitely long parallel conductors current produce on each other a force of

  1)2×10^{-5} 2) 2×10^{7} 3)3×10^{-5} 4) 2×10^{-7}

32- A permanent magnet

  5. Attracts all paramagnetic substances and repels others
  6. Attracts some substances and repels others
  7. Attracts only ferromagnetic substances
  8. Attracts ferromagnetic substances and repels all others

33- For which of the following materials the net magnetic moment should be zero?

  1)Diamagnetic materials   2)Ferromagnetic materials

  3)Anti ferromagnetic materials   4) Anti ferromagnetic materials

34- Substances that have permeability less than permeability of free space are known as:

1)Diamagnetic   2) Ferromagnetic   3) Paramagnetic   4) Bipolar

35- When a low flying aircraft passes overhead, we sometimes notice a slight shaking of the picture on our TV screen. This is due to

5. Diffraction of the signal received from the antenna
6. Interference of signal by antenna with signal reflected by passing aircraft
7. Change of magnetic flux occurring due to the passage of aircraft
8. Vibration created by the passage of aircraft

36- According to Lenz's law of electromagnetic induction

5. The induced emf is not in the direction opposing the change in magnetic flux
6. relative motion between coil and magnet produces change in magnetic flux
7. Only the magnet should be moved towards the coil
8. Only the coil should be moved towards the magnet

37-Paramagnetic materials have relative permeability

1)Slightly less than unity   2)Equal to unity

3)Slightly more than unity   4)Equal to that ferromagnetic materials

38-Which of the following type of materials are not very important for engineering applications?

1)Diamagnetic   2)Paramagnetic   3)Ferromagnetic   4) None of the above

39-What will be the current passing through the ring-shaped air-cored coil when the number of turns is 800 and ampere-turns are 3200?

1)2   2)4   3)6   4) 8

40- In the left-hand rule, the forefinger always represents

1)Magnetic field   2)Current

3)Voltage   4)The direction of the force on the conductor

41- Biot-Savart's law is a general modification of

   1)Kirchhoff's law   2)Lenz's law   3)Ampere's law   4) Faraday's laws

42-Materials subjected to rapid reversal of magnetism should have

   1)Large area of B-H loop   2) High permeability and low hysteresis loss

   3)High coercivity and high retentivity   4) High coercivity and low density

43- permeable substance is one which is:

   1) a good conductor   2) a bad conductor

   3) a strong magnet   4)Through which magnetic force lines can pass very easily

44- Hysteresis loop in the case of magnetically hard materials is more in shape as compared to magnetically soft materials

   1)Triangular   2)Rectangular   3) Circular   4) None of the above

45- The relative permeability of materials is not constant

   1)Diamagnetic   2) Paramagnetic   3) Ferromagnetic   4) Insulating

46- When a magnet is in motion relative to a coil the induced .m. f. does not depend upon?

   1) Number of turns of the coil   2) Motion of the magnet

   3) Pole strength of the magnet   4) Resistance of the coil

47- When two ends of a circular uniform wire are joined to the terminals of a battery, the field at the center of the circle:

1) Will depend on the radius of the circle   2) Will depend on the amount of e. m. f. applied

3) Will be infinite   4) Will be zero

48- Two long parallel conductors carry 100 A. If the conductors are separated by 20 mm, the force per meter of length of each conductor will be

1)100 N   2)0.1 N   3)1 N   4)10 N

49- The magnetic reluctance of a material

5. Decreases with an increasing cross-sectional area of material
6. Increases with an increasing cross-sectional area of material
7. Does not vary with an increasing cross-sectional area of material
8. Any of the above

50- Gilbert is a unit of

1)Magneto motive force   2)Conductance

3)Electromotive force   4) Permittivity

**** انتهت الأسئلة ** أطيب الأمنيات ** أ.د. جلال سعد حسن ****

Instead of oral exam

[1] Write what is meant by two of the following equations

$$\nabla \cdot E = \rho / \varepsilon_0,$$

$$\nabla^2 V = -\frac{\rho_v}{\varepsilon}$$

$$\nabla^2 V = 0$$

[2] Write what is meant by two of the following equations

$$\nabla \cdot B = 0,$$

$$\nabla \cdot \bar{j} = -\frac{\partial \rho_v}{\partial t}$$

$$\nabla \cdot \bar{j} = 0 \quad \text{(Steady current)}$$

[3] Write what is meant by two of the following equations

$$\nabla \times E = -\partial B / \partial t$$

$$\oint \bar{H} \cdot d\bar{L} = I$$

$$F = \frac{\mu I_1 I_2 l}{2\pi d}$$

[4] Write what is meant by two of the following equations

$$\bar{F} = m\bar{a} = m\frac{d\bar{v}}{dt} = Q(\bar{E} + \bar{v} \times \bar{B}) \ N$$

$$\bar{F}_1 = \frac{\mu_0 I_1 I_2}{4\pi} \oint_{L_1} \oint_{L_2} \frac{d\bar{L}_1 \times (d\bar{L}_2 \times \bar{a}_{R21})}{R_{21}^2}$$

$$\bar{F}_2 = \frac{\mu_0 I_2 I_1}{4\pi} \oint_{L_2} \oint_{L_1} \frac{d\bar{L}_2 \times (d\bar{L}_1 \times \bar{a}_{R12})}{R_{12}^2}$$

[5] Write what is meant by two of the following equations

$$\bar{B} = \nabla \times \bar{A} \quad \nabla \cdot \bar{B} = 0 \quad \nabla^2 \bar{A} = -\mu \bar{J}$$

كلية العلوم – قسم الفيزياء

جامعة أسيوط

Final Exam. "Diffraction rays & its applications" (352 P)

June. 2022

time: 3 hours

أولا: الامتحان التحريري: السؤال الأول (30 درجة)

I) Choose the right answer between brackets:

1- The value of the packing factor for simple cubic must be (lower- higher – equal) than that of the FCC- cubic system.

2- If d-spacing have the same order of magnitude of lattice parameter the crystalline plane is (*010, 011, 110, 101*).

3- The diameter of cubic face must includes two atoms in (S. cubic – FCC – BCC).

4- A monochromatic X-ray beam used to study the crystal structure of (single crystal–poly crystalline–crystalline) material.

5- The wavelength of the linear X-ray spectrum depends on the (accelerating voltage – type of the target – both of them).

6- Each face of the simple cube includes (two atoms – one atoms – more than atom).

7- Polycrystalline material includes grains with the (different- semi – same) atomic orientation.

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

1) Space lattice represents an infinite arrangement of array points in one dimension

2) One can not prepare the perfect crystal due to surface effects.

3) For the 2nd order reflections the wavelength of the incident X-ray beam must be equal the d- spacing.

4) XRD of the single crystal characterized by circular spots with other few scattered spots

5) A continuous X-ray beam used to study the crystal structure of poly crystalline material.

6) The linear X-ray spectrum is characterized by two different peaks with different intensities.

7) The direct and reciprocal lattice constant are parallel to each other.

8) The energy of the incident neutron beam must be equal the vibration energy at high temperature.

السؤال الثاني: (20 درجة)

2. a) Find the dependence of the lattice constant of the direct crystal on both the d-spacing and Miller indices. Express the resulting eqn. in terms of the reciprocal lattice axis and vector.

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

c) Explain by the eqns. the conditions required to study the XRD using the reciprocal crystal.

ثانيا: "الامتحان الشفوى وأعمال الفصل" (50 درجة)

السؤال الثالث: (15درجة)

3.a) Illustrate the eqns. the necessary conditions for studying the crystal structure by neutron diffraction.

b) Aluminum has FCC structure with the atomic radius 1.43 A^0, If energetic X-ray beam of 7.38 KeV incident on (100) plane, calculate the Bragg's angle considering the1$^{\underline{St}}$ order reflection (h = 6.62×10^{-34} J.sec).

c) Prove that the Bragg's low for n-order reflections is expressed as: $n\lambda = 2d \sin\theta$, show how the Bragg's low can be achieved in terms of Bragg's angle.

للأسئلة بقية فى الورقة التالية

a) Prove that the energy of X-ray beam incident on BCC crystals in terms of atomic radius, Bragg's angle and Miller

indices can expressed as: $E = hC /(8r \sin\theta)[3(h^2 + k^2 + l^2)]^{-1/2}$

b) Explain in details the conditions required for applying the Bragg's low for different reflections, Find the correlation

between the X-ray beam wavelength and d-spacing for the $2^{\underline{nd}}$, and $3^{\underline{d}}$ reflections.

c) Explain one of the standard experimental method used to study the crystal structure by applying the XRD data.

السؤال الخامس: (20 درجة)

5. a) Explain by the eqn. a theoretical method used for identification of the crystallographic planes. If the Miller indices

satisfy that: $h^2 + k^2 + \ell^2 = 13, 7,$ and 19 determine the different available crystalline planes.

b) Prove that the correction of Bragg's low for the higher order reflection depends on the refractive index (μ) of the

crystal material in the form: $C = [1 - \dfrac{2d^2(1-\mu^2)}{n^2\lambda^2}]$

c) Show that : (i) The packing fraction in the case of FCC crystal is 0.74

(ii) the 1^{St} order reflected Bragg's angle of the FCC crystal: $\theta = \sin^{-1}[\dfrac{\lambda^2(h^2+k^2+l^2)}{32r^2}]^{1/2}$

انتهت الأسئلة

تمنياتي بالتوفيق أ.د. عبد المنعم سلطان

Question № 1 (18 degrees)   Total (50 degrees)

Write in the attached table the symbol indicating the correct answer

1. Physics is a science that studies....
   (A) Material and energy   (B) Quantum mechanics   (C) All of the above

2. The human used the universe without suffering thanks to:....
   (A) His understanding of the universe   (B) Harness the Creator of the Universe   (C) All of the above

3. Heat transfer in the universe is done from......:
   (A) Hot to cold   (B) Cold to hot   (C) All of the above

4. The method of vision, hearing and smelling according to the latest theories.......
   (A) Vibrations & oscillations   (B) particles   (C) all of the above

5. Spectra emitted from some materials give us an idea about:
   (A) Light components   (B) Nature of light   (C) material structure

6. Different colors are:
   (A) Wave & vibrations   (B) particles   (C) Photons

7. light can be considered as.....and is treated in a physical way
   (A) energy   (B) waves   (C) particles

8. light can be considered as.....and is treated using quantum theory
   (A) energy   (B) waves   (C) particles

9. When we use the words " colors, refractive index " we are talking in ..... Language
   (A) quantum   (B) Wavelike   (C) particulate

10. When we use the words " spectra , wavelengths " we are talking in .... Language.
   (A) quantum   (B) Wavelike   (C) particulate

11. When we use the words " photons – frequencies – energies " we are talking in .... Language.
   (A) quantum   (B) Wavelike   (C) particulate

12. Radioactive energy per square meter per unit time- for a black body – is proportional to:
   $(A) T^4$ $(B)\ T^3$ $(C) T^2$

13. One of the hypotheses of classical physics is that any charged object emits ...radiation:
   (A) Electric   (B) Magnetic   (C) Electromagnetic

14. Raleigh used KT in the energy distribution formula in terms of λ , and that caused it to:
s   (A) Fail   (B) Succed

15. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are ...   (A) continuous   (B) separate

16. When Plank's hypothesis of a black body spectrum appeared, we began to understand ..
   (A) Absorption & emission   (B) orbits   (C) all of the above

17. The interaction between radiation and substance is confirmed
   (A) practically   (B) axiomatically   (C) all of the above

18. The interaction between radiation and matter confirms the principle of:
   (A) Equivalence   (B) quantitative energy   (C) all of the above

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

(1)

19. Radiation behaves as a: (A) Particle   (B) Wave   (C) Energy   (D) all of the above

20. Interaction between radiation and matter is done by: (A) particles   (B) waves   (C) photons

21. The type of Interaction depends on the...   (A) energy   (B) intensity

22. The interaction of low-energy photons causes:
    (A) Photoelectric effect   (B) Compton effect   (C) Pair production

23. Electrons emission in the Photoelectric effect depends on the ... of the incident light:
    (A) Frequency   (B) intensity   (C) density

24. Photons are fully absorbed and electrons are emitted:
    (A) Photoelectric effect   (B) Compton effect   (C) Pair production

25. .... is the ability of light to remove the electron, and its value depends on the light
    frequency only   (A) Energy   (B) Intensity   (C) Capacity

26. ... is the least energy required to remove the electron from the orbit:
    (A) Potential energy   (B) work function   (C) current intensity

27. If the frequency is less than this value, no electrons are release whatever the
    intensity of light: (A) Stress frequency   (B) Strain frequency   (C) Critical frequency

28. As the photon approaches the nucleus field it disappears, and elementary particles appear:
    (A) Photoelectric effect   (B) Compton effect   (C) Pair production

29. Energy is absorbed, electrons are emitted and resident photons are released:
    (A) Photoelectric effect   (B) Compton effect   (C) Pair production

30. Photonic and radiative energy are emitted as...:
    (A) Separate quantities (Photons)   (B) Continuous quantities

31. Photonic and radiative energy are absorbed as
    (A) Separate quantities (Photons)   (B) Continuous quantities

32. The rotation of the electron around the nucleus
    (A) lead to   (B) does not lead to   energy radiation

33. De Broglie was able to unite the energy with the...
    (A) Momentum   (B) Mass   (C) Frequency

34. The wave function refers to the... (A) probability   (B) Certainty   of a particle existing at a
    given time and place

35. The uncertainty principle applies to .....particles   (A) large   (B) small & fast

36. In case of high energy, when the exact position is determined, the .... behavior of
    radiation appears   (A) Particulate   (B) waveform   (C) Quantitative

19	20	21	22	23	24	25	26	27

28	29	30	31	32	33	34	35	36

Question № 2 (20 degrees)

Write in the attached table the symbol (T) *for true answer* or (F) *for false answer*

1. Matter annihilates, energy appears. Energy disappears, matter appears
2. Our mission - only - is to follow the behaviors and actions of the universe to produce what we need
3. The progress in using behaviors is enormous, while progress in understanding is small
4. With his knowledge, man was able to destroy matter into nothingness
5. Einstein's equation united matter and energy, so there is no substance without energy.
6. Any amount of mass, no matter how small, contains an enormous amount of energy
7. Energy has no priority over mass neither mass over energy
8. Vision requires the presence of: Light Source, vision instrument and medium
9. Thermal radiation is an electromagnetic radiation that its energy is dependent on temperature
10. End of the universe - may be – a thermal radiation
11. One of the hypotheses of classical physics is that any charged object emits an electric radiation
12. Raleigh used KT in the energy distribution formula in terms of λ, and that caused it to: *Succed*
13. Raleigh-Jeans relationship of energy distribution of black body represents the state of continuous energy distribution
14. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are *continuous*
15. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are separate
16. A black body absorbs all radiation and reflects nothing
17. Any absorbed energy can be released as an emission spectra
18. When Plank's hypothesis of a black body spectrum appeared, we began to understand: Absorption, emission and orbits
19. The interaction between radiation and substance is confirmed practically
20. The interaction between radiation and matter confirms the principle of equivalence and quantitative energy
21. The interaction between radiation and matter confirms the principle of: continuity
22. Interaction between radiation and matter is done by: particles
23. Interaction between radiation and matter is done by: photons
24. The type of Interaction depends on the energy of the light

1	2	3	4	5	6	7	8	9	10	11	12

13	14	15	16	17	18	19	20	21	22	23	24

(3)

25. The type of Interaction depends on the intensity of photons
26. The interaction of low-energy photons causes: photoelectric effect
27. The interaction of low-energy photons causes: A Pair production
28. Electrons emission in the Photoelectric effect depends on the frequency of the incident light
29. Electrons emission in the Photoelectric effect depends on the intensity of the incident light
30. work function is the least energy required to remove the electron from the orbit
31. If the frequency is less than this value, no electrons are released whatever the intensity of light: Critical frequency
32. Light intensity contributes to electron removal from its orbit
33. Photonic and radiative energy are emitted as: Separate quantities (Photons)
34. Photonic and radiative energy are absorbed as a Continuous quantity
35. The rotation of the electron around the nucleus lead to energy radiation
36. The rotation of the electron around the nucleus does not lead to energy radiation
37. De Broglie was able to unite the energy with the Momentum
38. De Broglie was able to unite the energy with the Frequency
39. The wave function refers to the probability of a particle existing at a given time and place
40. The wave function refers to the Certainty of a particle existing at a given time and place

25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40

Question № 3 (12 degrees)
Circle the wrong word or words and correct them in the specified place

1. Nature is a science that studies the created universe

2. A small amount of mass, contains a small amount of energy

3. Raleigh used KT in the energy distribution formula in terms of λ, and that caused it to: *Success*

4. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are *continuous*

5. Ψ is a fixed amount that expresses the De Broglie waves

6. We can measure both the place and the momentum simultaneously

1	2	3	4	5	6

Assiut University
faculty of Science
Physics Department

final semester examination
plasma physics (P332)

Allowable time:3 hours
3rd level (physics) 2021/2022
18/6/2022

Answer the flowing questions

I-a-i Prove (with a diagram), that the particle mean free path is equal to reciprocal of the effective collision cross section area

ii- Prove that the magnetic moment in the case of charged particles motion in a nonuniform magnetic field is an adiabatic invariant

b-i- Study the motion of charged particles in a constant and crossed electric filed and magnetic field

ii- Give a definition for the magnetic mirror and put an illustrated configuration for this mirror. What the following two equations means in the magnetic mirror

$$sin\ \theta(0) < \sqrt{\frac{B_{min.}}{B_{max.}}} \quad and \quad sin\ \theta(0) > \sqrt{\frac{B_{min.}}{B_{max.}}}$$

iii- Assume that the absolute value of the magnetic flux is (16×10^{-4}wb.) through area of 2×10^{-4}m^2 at each end of the magnetic mirror where the absolute value of the magnetic flux is (10×10^{-4}web.) through an area of 5×10^{-4} cm^2 in the middle region of this magnetic mirror. Calculate the angle θ (0) which the particle orbit makes with the z-axis of the central plane of this mirror

II-a-i- Deduce an expression for the plasma dielectric constant and the store energy in the plasma medium

ii – Discuss (with an illustrated figure) the self –constriction that occurs in a plasma for rising the temperature of fully ionized plasma. Deduce the relationship between the plasma temperature and the current in the formed narrow filament in this case.

b- For a plasma of density N=2×10^{15} cm^{-3} and container area 1000 cm^2. If the temperature required to reach 100 eV, calculate the required current (in Amp) for this case (where 1 eV=1.6×10^{-19} joule and kT in joule)

III-a-Prove that the plasma electric constant ε is related to the plasma angular frequency ωp and the angular frequency ω of an incident e. m. wave by the expression ε=[1-(ωP/ω)^2]. Show when:

 i- this wave can and cannot propagate through the plasma,
 ii- the cut-off condition occurs in this case

b- Derive the wave equation for a medium having dielectric constant $\left[\varepsilon = 1 + \frac{4\pi\rho c^2}{B_x^2}\right]$

IV-a- Deduce an expression for the speed of Alfven waves

b- Give the approximate phase velocity of Alfven wave in plasma of mass density 10^{-6}kg m^{-3} and magnetic flux density 10Tesla

========================Good Luck With my best wishes========================
Prof. Dr. Abdel-Haleem Turky

السؤال الاول: في ورقة البابل ظلل (T) للعبارة الصحيحة أو ظلل (F) للعبارة الخاطئة للعبارات التالية: (٣٠ درجة)

١ـ المعضلة الأخلاقية هي الاختيار بين تصرف يبدو أنه صحيح وتصرف أخر يبدو أنه صحيح ايضا. ( )

٢ـ من شروط السلامة في المنشآت الصناعية وضع العلامات الارشادية بالعربية والانجليزية ( )

٣ـ التخلص من مخلفات المعامل يكون بالحرق الآمن للمخلفات ودفن الرماد في مدافن آمنة ( )

٤ـالتقرير هو عرض كتابي او شفوي منهجي مركز لموضوع معين يقدمه فرد او مجموعه. ( )

٥ـيؤدي النهوض بالملكية الفكرية الي دفع عجلة التنمية الاقتصادية واتاحة فرص عمل وصناعات جديدة ( )

٦ـمن مواصفات التقرير المهني الجيد ان يكون له بعد زمني ودقيق وصحيح البيانات ( )

٧ـالشائعة هي خبر زائف ينتشر في المجتمع بشكل سريع و يتداول بين العامة ظنا منهم على صحته. ( )

٨ـ الالتزام بأخلاقيات المهنة أشمل من الالتزام بالقوانين الحاكمة للمهنة. ( )

٩ـالسلامة والامانة والصدق من أخلاقيات البحث العلمي. ( )

١٠ـمن مبررات إفشاء الأسرار المختبرية حماية النفس والدفاع عن شرف مهنته . ( )

١١ـCode of Ethics تعني اخلاقيات المهنة والسلامة المهنية ( )

١٢ـ تسهم السلامة المهنية في مواقع العمل في ابعاد السلامة عن العاملين. ( )

١٣ـالإسعافات الأولية هي مجموعه من الخطوات لتقديم العلاج إلى المصاب قبل نقله إلى المستشفى ( )

١٤ـ يجب عند أعداد وتجهيز مختبرات العلوم ان تكون ارضيات المختبرات والاحواض من انواع تتأثر بالمواد الكيماوية ( )

١٥ـعدم الالتزام بمعايير الجودة من الأخلاقيات الهامة لأي مهنة ( )

١٦ـ من إجراءات السلامة أنه عند حفظ المواد الكيميائية أن تحفظ المواد الكيميائية التي تتفاعل معاً بالقرب من بعضها. ( )

١٧ـ ضرورة استخدام معدات الوقاية والسلامة الشخصية بعد العمل وعدم الاستهانة بأهميتها ( )

١٨ـ الالتزام الأخلاقي لا يسهم في شيوع الرضا الاجتماعي. ( )

١٩ـ وجود ميثاق أخلاقي للمهنة هام لخلق خلافات او جدال في مجال المهنة ( )

٢٠ـ العمل يقتضي الاتقان بينما المهنة قد يتولاها غير المتقن. ( )

٣٠ـ يسمح بالتدخين	٢٩ـ ممنوع المشي	٢٨ـ مخاطر اشعاعية	٢٧ـمخاطر حريق	٢٦ـ سر في اتجاه السهم	٢٥ـ مخاطر بيولوجية	٢٤ـ شباك	٢٣ـ دش طوارئ	٢٢ـ مخاطر الة حادة	٢١ـ ممنوع التدخين

السؤال الثاني: في ورقة البابل ظلل حرف A او B او C او D للاجابة الصحيحة: (٢٠ درجات)

٢١ـ من انواع الشائعات (A ـالشائعة البطيئة – B ـ الشائعة السريعة C ـ الشائعة الاستطلاعية D ـ كل ما سبق)

٣٢ـ من مجالات الاخلاقيات البيولوجية (A ـالاستنساخ B ـالقرصنة البيولوجية – C ـسرقة الجينات – D ـكل ما سبق)

٣٣ـ من الاهداف العامة التي تسعى السلامة والصحة المهنية الى تحقيقها (A ـ حماية العنصر البشري – B ـالحفاظ على العنصر المادي ـ C ـثبيت الأمان والطمأنينة للعاملين – D ـكل ما سبق)

٣٤ـ من انواع البلاجياريزم (A ـالنسخ – B ـالترقيع – C ـ اعادة الصياغة – D ـكل ما سبق)

٣٥- من مبادئ وأخلاقيات مهنه التعليم (A ـالثقة والاحترام المتبادل ـ B ـاحترام التعددية والتنوع C ـالمواطنة والسلوك المنضبط – D ـكل ما سبق)

٣٦ـ من صفات الشخصية السوية (A.الثقة – B.الانسجام – C.الواقعية ـ D. كل ما سبق)

٣٧ـ من أخلاقيات البحث العلمي (A.الصدق في جمع البيانات ـ B. العمل الإيجابي ـ C.تجنب الضرر – D.كل ما سبق)

٣٨ـ يجب التبليغ الفوري في حالة اكتشاف تحاليل ايجابية لمرض (A.الجرب – B. شلل الأطفال ـ C. الكوليرا ـ D ـ كل ما سبق)

٣٩ـ وجود ميثاق أخلاقي للمهنة هام كـ (A.مرجع يسترشد به ـ B.حل للخلافات والجدل ـ C.كلاهما – D.غير ذلك)

٤٠ـ من يعد ميثاق اخلاقيات المهنة ؟ (A.رئيس المؤسسة B.فريق عمل المؤسسة – C. لجنة – D.كل ما سبق)

٤١ـ من الآداب العامة لمزاولة مهنه المختبرات الطبية (A.التواضع ـ B. الامل ـ C.حسن الخلق ـ D. كل ما سبق)

٤٢ـ صفات الشخصية السوية (A. الواقعية ـ B.الثقة ـ C.الاتزان الانفعالي ـ D. كل ما سبق)

٤٣ـ الحيوانات المستنسخة تعيش لفترات (A ـ نفس فترات الحيوانات الطبيعية ـ B. طويلة ـ C ـ قصيرة ـ D ـ غير ما سبق)

٤٤ـ من طرق علاج الشائعات (A ـ المنطقية في التعامل ـ B.نشر الحقائق ـ C.التوعية ـ D.كل ما سبق)

٤٥ـالرعاف هو (A.نزيف دموي من الانف – B.رعشة الجسم ـ C.صدمة عصبية – D ـ كل ما سبق)

٤٦ـ يجب ان تحتوى شنطة الاسعافات الأولية على (A.مطهرات ـ B.منبهات ـ C.مسكنات ـ D.كل ما سبق)

٤٧ـمن الاشتراطات عند تجهيز مختبرات العلوم (A. ملائمة المساحة مع عدد الطلاب ـ B. توافر بابين ـ C.لها إضاءة وتهوية جيدة ـ D ـ كل ما سبق)

٤٨ـ.......هي الجرعة القاتلة لنصف عدد حيوانات التجارب (A.MSDS ـ B. LC50 ـ C. LEL ـ D. LD50)

٤٩ـ من نفايات المعامل (A.اطباق مزارع بكتيرية ـ B.نفايات كيميائية ـ C. بقايا احياء بريه ـ D.كل ما سبق)

٥٠ـ...... هامة لمستخدمي الحاسوب لاتخاذ القرارات السليمة المتعلقة بالمهنة .(A.أخلاقيات العمل ـ B.التقارير المهنية ـ C. أخلاقيات الحاسوب ـ D.كل ما سبق)

انتهت الأسئلة   مع تمنياتي بالتفوق   أ.د. ناصر الشيمي

Answer All the Following Questions:

Question 1   10 Marks

Choose the correct answer to each of the following statements: (1 Mark for Each Point)
(Note: multiple choices are not allowed)

1. The main processing unit in Intel 8086 which contains the IP register is ....

    A BIU   B ALU   C EU   D non of the previous

2. The maximum size of any memory segment in the real mode is ....

    A 1 MB   B 64 KB   C 4 MB   D 256 KB

3. The computing machine which can be considered the first general-purpose computer is ....

    A Colossus   B Z3   C ENIAC   D Abacus

4. The .... bus selects the memory or I/O device and causes them to perform a read or write operation

    A data   B control   C address   D non of the previous

5. .... can be considered a suitable combination of segment:offset registers

    A CS:IP   B DS:SP   C SS:SI   D ES:BP

6. IF SP = 37CD H, the offset address of the first location in the stack to pop data from is ....

    A 37CC H   B 37CD H   C 37CE H   D 37CB H

7. The first microprocessor in Intel which has 32-bit address bus and 64-bit data bus is ....

    A Intel 80386 B Intel 80486 C Intel Pentium   D Intel Pentium Pro

8. Consider DS = 3000 H, the ending address of the data segment in DS:2000 H is ....

    A 2FFFF H   B 32FFF H   C 3FFFF H   D 32000 H

9. Consider CF = 1 and AL = 10100011 B. After the execution of `RCL AL,2` ....

    A CF = 1 and AL = 01000111 B   B CF = 0 and AL = 10001111 B
    C CF = 0 and AL = 10001110 B   D CF = 1 and AL = 11101000 B

10. The data addressing mode in `MOV AX,[SI+8]` is ....

    A register indirect   B base plus index
    C register relative   D base relative plus index

1

Question 2 | 16 Marks |

i) Suppose that AL = 00001100 B, write the assembly lines to preform the following operations without using the command MUL, and then show the contents of AL: (6 Marks)

   a) Multiply AL by 4
   b) Multiply AL by 10
   c) Multiply AL by 21

ii) Show the contents of BX and the flag bits (CF, ZF, SF, OF, PF and AF) after the execution of the following assembly lines: (6 Marks)

```
MOV BH,23H
ADD BH,89H
CMC
MOV BL,0C8H
SBB BL,43H
```

iii) Assume that AX = 2500 H and BX = 1200 H.

   a) Explain the main function of the following assembly lines and show the contents of AX and BX after the execution of them (3 Marks)

```
MOV CX,AX
MOV AX,BX
MOV BX,CX
```

   b) Write just a one assembly line that can replace the three lines given in (a). (1 Mark)

Question 3 | 10 Marks |

i) Check if the jump will occur or not in the following cases: (6 Marks)
   (Note: answer with occur or not occur, and also write the reason)

```
a) MOV AX,32B7H      b) MOV AL,0F5H      c) MOV AL,9AH      -d) MOV CX,5
   CMP AX,6A2DH         ADD AL,41H          CMP AL,76H          DEC CX
   JA NEXT             JC NEXT             JL NEXT            JCXZ NEXT
```

ii) Write the assembly lines that perform the following operations: (4 Marks)

   a) Set the bits No. 0, 3 and 5 in AL
   b) Clear the bits No. 1, 2, 4 and 6 in BL
   c) Toggle the bits No. 2, 3 and 7 in CL
   d) Clear the contents of DX without using the command MOV

Question 4 | 14 Marks |

Write the assembly code that: (12 Marks)

- adds and counts the even and odd numbers in a series of byte size data (37, 62, 28, 51, 46, 84 and 0)
- stores the sum and count of the even numbers in CL and CH, respectively
- stores the sum and count of the odd numbers in DL and DH, respectively
- stops when the number 0 is read

then show the contents of CX and DX after the execution of the assembly code. (2 Marks)

Best Wishes | *Dr. Abdelrahman Morsi*