



The final exam is in 4 pages (50 degree)

First question: Choose the correct answer (One degree for each point)

1) An electron is bound in one-dimensional infinite well of width $L = 6 \times 10^{-10}m$. Find the energy value in the second excited state.	A. 632 eV	B. 0.632 eV	C. 1422 eV	D. 1.422 eV
2) The equations of motion for a body in phase space (p, q) is called a	A. ellipse	B. phase space	C. biaxial plane	D. canonical equation
3) An electron is confined to a one-dimensional potential box. The distance between energy levels of the second excited state and third excited state is	A. $5 E_1$	B. $7 E_1$	C. $9 E_1$	D. $16 E_1$
4) What is the value of the entropy of the unit moles of the system state $(4,3,2,1,0)$?	A. $0.785/JK^{-1}mol^{-1}$	B. $78.5/JK^{-1}mol^{-1}$	C. $785/JK^{-1}mol^{-1}$	D. $7.85/JK^{-1}mol^{-1}$
5) The relationship between the partition function of the total indistinguishable particles Z_N and the partition function of the single particle of Z_{sp} is given by:	A. $Z_N = Z_{sp}/N!$	B. $Z_N = (Z_{sp})^N/N!$	C. $Z_N = (Z_{sp})^N$	D. $Z_N = Z_{sp}/N$
6) "Arrangement of distinguishable particles during a defined state of the system" is the definition of ...	A. microstate	B. macrostate	C. system state	D. probability
7) The number of total microstates at $T \rightarrow 0$ is ...	A. 0	B. 1	C. < 1	D. $\gg 1$
8) Which relation is true ?	A. $\Omega_{total} = \Omega_1 \times \Omega_2$	B. $S_{total} = S_1 \times S_2$	C. $\Omega_{total} = \Omega_1 + \Omega_2$	D. $S_{total} = S_1 - S_2$
9) The e^α coefficient in classic Maxwell-Boltzmann statistical distribution is a function of	A. volume	B. temperature	C. Both A & B	D. None of mentioned
10) The classical mechanics becomes appropriate at	A. low density gas	B. low temperature	C. light molecule mass	D. All of mentioned
11) The adiabatic relation between pressure and temperature of gas is.....	A. $P^{1-\gamma}T^\gamma = Const.$	B. $P^\gamma T^{-1} = Const.$	C. $P^{1+\gamma}T^\gamma = Const.$	D. $P^\gamma T^{+1} = Const.$

3. A physical pendulum in the form of a planar body moves in simple harmonic motion with a frequency of 0.450 Hz. If the pendulum has a mass of 2.20 kg and the pivot is located 0.350 m from the center of mass, determine the moment of inertia of the pendulum.

4. A string has a linear density of 8.5×10^{-3} kg/m and is under a tension of 280 N. The string is 1.8 m long, is fixed at both ends, and is vibrating in the standing wave pattern. Determine the (a) speed, (b) wavelength, if the frequency of the traveling waves is 150 Hz that make up the standing wave.

5. The audible frequency for a normal human being is 20 Hz to 20 kHz. Define the loudness of the sound and find it at the threshold of pain?

D. double the number of vibrations and decreasing periodic time to half

9. which of the following equations represents simple harmonic motion

A. $y=vt+l$

B. $A \cos (wt+\phi)$

C. e^{-2t}

D. $5t^2$

10. A taut string which its linear mass density is 0.05 kg/m; under a tension of 80 N. How much power must be supplied to the string to generate sinusoidal waves at a frequency of 60 Hz and amplitude 60 mm?

A. 320 W

B. 511.7 W

C. 115.2 W

Part II: Answer the following questions:

1. A 10 kg mass suspended on Earth by a spring oscillates with a period of 12 seconds. This mass-spring system is now moved to the moon where the gravity is one-sixth that of the Earth. What is the new period of motion?

2. In an electric shaver, the blade moves back and forth over a distance of 2.0mm in simple harmonic motion, with frequency 120Hz. Find (a) the amplitude, (b) the maximum blade speed, and (c) the magnitude of the maximum acceleration.

4. How much energy must the shock absorbers of a 1200-kg car dissipate in order to damp a bounce that initially has a velocity of 0.800 m/s at the equilibrium position? Assume the car returns to its original vertical position
- 330 J
 - 384 J
 - 348 J
 - 584 J
5. An ideal pendulum hangs stationary at its equilibrium position. Which of the following is true of the string supporting the mass?
- It is doing work.
 - It is exerting a torque on the mass.
 - The tension in the string is constant.
 - There is no tension in the string.
 - The force provided by the string is greater than the weight of the mass.
6. A block is attached to a vertical spring and undergoes simple harmonic motion with frequency f . If the block is removed and replaced by a block with 4 times the mass of the first block, what will the new frequency
- $f/4$
 - $f/2$
 - f
 - $2f$
 - $4f$
7. Transverse waves propagate at 43.2 m/s in a string that is subjected to a tension of 60.5 N. If the string is 19.0 m long, what is its mass?
- 0.616 kg
 - 0.259 kg
 - 0.437 kg
 - 0.715 kg
8. To quadruple the frequency of an oscillator, we have to.....
- double number of vibrations
 - decreasing periodic time to half
 - double both of number of vibrations and periodic time

Assiut University
Faculty of science – Physics department

Duration of test	3 hours	Course	Physics P212 - Vibrations and waves
Degree	50	Exam	Final summer course 2024-2025

Part I: Choose the correct answer:

1. An object moves up and down the y -axis with position s given as a function of time t by the expression $s = A \sin \omega t$. What is the period of this motion?
A. ω
B. $2\pi\omega$
C. $A\omega$
D. $2\pi/\omega$
E. ω
2. A pendulum and a mass-spring system each have a period T . If the mass in each system is halved, what is the new period of each system?
A. pendulum: $T/\sqrt{2}$, mass on spring: $\sqrt{2}T$
B. pendulum: T , mass on spring: $\sqrt{2}T$
C. pendulum: T , mass on spring: T
D. pendulum: T , mass on spring: $T/\sqrt{2}$
E. pendulum: $\sqrt{2}T$, mass on spring: $T/\sqrt{2}$
3. Consider a propagating wave $y(x,t)$ given by:
 $y(x,t) = (5.0 \times 10^{-6}) \cos[(2.0 \times 10^6 \text{ rad/m})x + (8.0 \times 10^{14} \text{ rad/s})t]$,
Which one of the following describes the velocity v of the wave?
A. $v = 2.0 \times 10^8 \text{ m/s}$ traveling in the $+x$ direction
B. $v = 2.0 \times 10^8 \text{ m/s}$ traveling in the $-x$ direction
C. $v = 4.0 \times 10^8 \text{ m/s}$ traveling in the $+x$ direction
D. $v = 4.0 \times 10^8 \text{ m/s}$ traveling in the $-x$ direction

Question (VI):

(8 Marks)

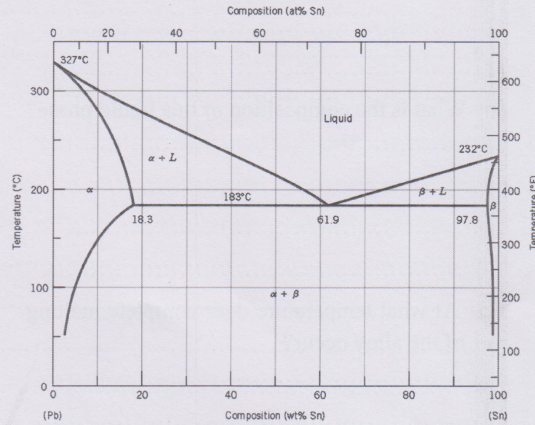
For a 10 at% Pb-90 at% Sn alloy at 200°C, in below phase diagram:

(a) What phase(s) is (are) present?

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(b) What is (are) the composition(s) of the phase(s)?

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(c) Calculate the relative amount of each phase present in terms of mass fraction.

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(d) State the eutectic reaction, temperature, and composition of this system, and what is the melting temperature for pure Sn and Pb?

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BEST WISHES,

Question (V):

(6 Marks)

A copper (Cu)-nickel (Ni) alloy of composition 70 wt% Ni-30 wt% Cu is slowly heated from a temperature of 1300°C (2370°F), using below phase diagram:

(a) At what temperature does the first liquid phase form?

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(b) What is the composition of this liquid phase?

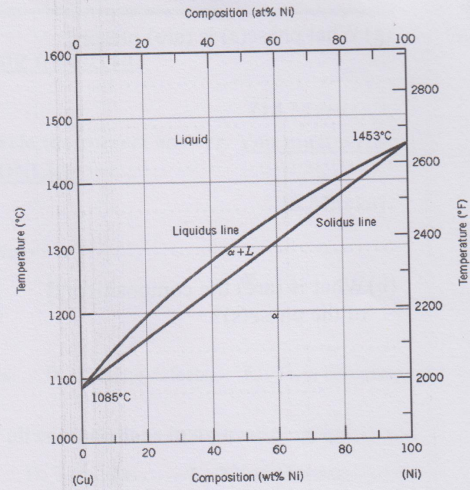
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(c) At what temperature does complete melting of the alloy occur?

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(a) What is the composition of the last solid remaining before complete melting? What is the name of this type of phase diagram?

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3. A 10 mm diameter Brinell hardness indenter produced an indentation 1.62 mm in diameter in a steel alloy when a load of 500 kg was used. Compute the Brinell hardness, HB, of this material.

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4. At 300 °C, the diffusion coefficient is $7.8 \times 10^{-11} \text{ m}^2/\text{s}$ and the activation energy for Cu in Si is 41.5 kJ/mol. What is the diffusion coefficient at 350 °C? ($R = 8.314 \text{ J/mol.K}$)

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Question (IV):

(10 Marks)

1. (a) What is the composition, in weight percent, of an alloy that consists of 6 at% Pb and 94 at% Sn? (Hint: $A_{\text{Pb}} = 207.2 \text{ g/mol}$; $A_{\text{Sn}} = 118.71 \text{ g/mol}$). (b) Calculate the amount of each element if the mass of a given Sn-Pb alloy is 50 g.

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2. (a) Derive linear density expressions for BCC [110] and [111] directions in terms of the atomic radius R. (b) Compute and compare linear density values for these same two directions for tungsten (Hint: atomic radius for tungsten is 0.137 nm).

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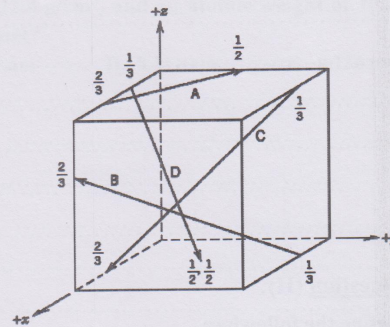
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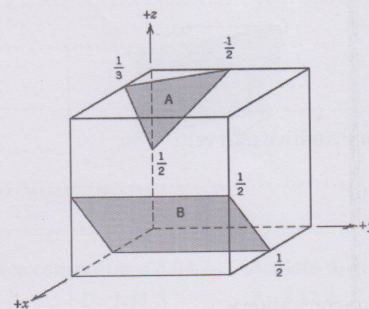
Question (III):

(6 Marks)

A. Determine the indices for two directions only of the shown directions in the following cubic unit cell:



B. Determine the Miller indices for the planes A and B shown in the following cubic unit cell:



10. A specimen of aluminum having a rectangular cross section $10 \text{ mm} \times 12.7 \text{ mm}$ is pulled in tension with a $3.55 \times 10^4 \text{ N}$ force, producing only elastic deformation. If the elastic modulus for Al is $69 \times 10^9 \text{ N/m}^2$, the resulting strain is:

- A. 6.2×10^{-4} B. 4.1×10^{-3} C. 7.5×10^{-2} D. 1.3×10^{-2} E. 0.154

Question (II):

(6 Marks)

Define the following:

1. Hardness:

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2. Schottky defect:

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3. Primitive unit cell:

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4. Segregation:

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I-Part 2: (8 Marks: each point 1 mark for correct choice and 1 mark for correct steps)

7. Ir has an FCC crystal structure, a density of 22.4 g/cm^3 , and an atomic weight of 192.2 g/mol , then the radius of an iridium atom is equal?
- A. 0.553 nm B. 0.439 nm C. 0.363 nm D. 0.211 nm E. 0.136 nm

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8. Miller indices for the indicated plane, below the figure, is:

A. (001) B. (110) C. (101) D. $(\bar{1}01)$ E. $(0\bar{1}1)$

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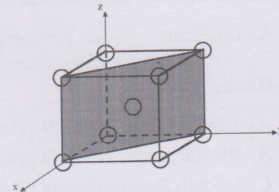
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9. Aluminum (Al) has an FCC cubic structure of lattice constant $a = 4.04 \text{ \AA}$, Calculate d_{111} :
- A. $4.04 \text{ \AA}$ B. $2.34 \text{ \AA}$ C. $2.02 \text{ \AA}$ D. $1.43 \text{ \AA}$ E. $1.12 \text{ \AA}$

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Answer all the following questions

Question (I):

(14 Marks)

In the following multiple-choice questions, please circle the correct answer. **You must write down the steps to get the correct answer (for part 2 ONLY).**

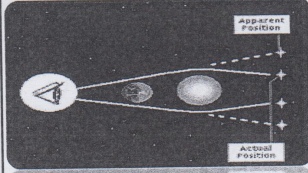
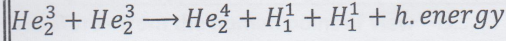
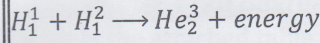
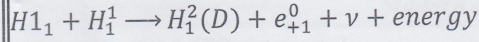
I-Part 1

(6 Marks)

1. Coordination number in hexagonal crystal structure:
A. 2. B. 4. C. 6. D. 8. E. 12.
2. Thermodynamically stable defects:
A. Point defects. B. Line defects. C. Surface defects. D. Volume defects. E. Twin boundary.
3. Above the following line, a liquid phase exists for all compositions in a phase diagram:
A. Tie-line. B. Solvus. C. Solidus. D. Liquidus. E. None of these.
4. An invariant reaction that produces a solid upon cooling two liquids:
A. Eutectic. B. Peritectic. C. Monotectic. D. Syntectic. E. Peritectoid.
5. Hooke's law:
A. Elastic range, strain is proportional to stress.
B. Plastic range, strain is proportional to stress.
C. In both the elastic and plastic range, strain is proportional to stress.
D. Elastic range, strain is independent of stress.
E. None of the above.
6. The following is wrong about a phase diagram:
A. It gives information on transformation rates.
B. The relative amount of different phases can be found under the given equilibrium conditions.
C. It indicates the temperature at which different phases start to melt.
D. Solid solubility limits are depicted by it.
E. None of the above.

Question No 3 (15 degrees)

1). Suggest a title for the following



2) Find & correct the mistake in the following sentences

1. Nature is a science that studies the created universe

2. Matter and energy interact to give natural phenomena

3. The human used his mind, so he was able to harness and adapt the universe

4. The progress in using behaviors & understanding is enormous

5. The absolute beginning of the universe is an energy

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

7. Heat transfer in the universe can occur from cold to hot

8. Physics can define time & space

9. Electron Volt unit is a unit of charge

10. The type of Interaction depends on the intensity of light

انتهت اسئلة الفيزياء الحديثة - مع تمنيات بالنجاح - Best wishes - اسر المنعرج : د/ حسام وحيه

16. A black body absorbs all radiation and reflects nothing
17. Any absorbed energy can be released as emission spectra
18. The interaction between radiation and matter confirms the principle of:
continuity
19. Interaction between radiation and matter is done by: photons
20. The type of interaction depends on the energy of the light
21. The type of interaction depends on the intensity of photons
22. Electrons emission in the Photoelectric effect depends on the frequency of the
incident light
23. Work function is the least energy required to remove the electron from the
orbit
24. Photonic and radiative energy are emitted as: Separate quantities (Photons)
25. Photonic and radiative energy are absorbed as continuous quantities
26. The rotation of the electron around the nucleus lead to energy radiation
27. De Broglie was able to unite the energy with the Frequency
28. The wave function refers to the probability of a particle existing at a given
time and place
29. The velocity of De Broglie wave is equal to the speed of light
30. Studying a particle considering its particulate properties
leads to the loss of its wave properties and vice versa

16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	

Question № 2 (15 degrees)

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

1. Nature is a science that studies the created universe
2. Matter and energy interact to give natural phenomena
3. Matter annihilates, energy appears. Energy disappears, matter appears
4. Einstein's equation united matter and energy, so there is no substance without energy.
5. Any amount of mass, no matter how small, contains an enormous amount of energy
6. Energy has no priority over mass or mass over energy
7. Classical physics encountered difficulties when trying to explain the photoelectric effect
8. Relativity used the principle of "invisible field" instead of the force (actual mass)
9. The laws of mechanics applied in our daily lives lose their validity when the speed approaches the speed of light
10. The curvature of space and time and the paths of light are some of the basics of general relativity
11. In Galileo Transformations, space is absolute and time is absolute
12. Because the speed of light is not equal to infinity, relativity is true
13. We do not have the ability to measure the decrease in length when increasing the speed
14. General relativity showed that Newton's equations are completely wrong
15. Everything bends, including time and space

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

(3)

21. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are ... (A) continuous (B) separate
22. When Planck's hypothesis of a black body spectrum appeared, we began to understand .. (A) Absorption & emission (B) orbits (C) all of the above
23. The interaction between radiation and substance is confirmed (A) practically (B) axiomatically (C) all of the above
24. The interaction between radiation and matter confirms the principle of: (A) Equivalence (B) quantitative energy (C) all of the above
25. Radiation behaves as a ... : (A) Particle (B) Wave (C) Energy (D) all of the above
26. Interaction between radiation and matter is done by: (A) particles (B) waves (C) photons
27. The type of Interaction depends on the... (A) energy (B) intensity
28. The interaction of high-energy photons causes: (A) Photoelectric effect (B) Compton effect
29. The interaction of low-energy photons causes (A) Photoelectric effect (B) Compton effect
30. Electrons emission in the Photoelectric effect depends on the ... of the incident light: (A) Frequency (B) intensity (C) density
31. Photons are fully absorbed and electrons are emitted: (A) Photoelectric effect (B) Compton effect (C) Pair production
32. is the ability of light to remove the electron, And its value depends on the light frequency only (A) Energy (B) Intensity (C) Capacity
33. ... is the least energy required to remove the electron from the orbit: (A) Potential energy (B) work function (C) current intensity
34. If the frequency is less than this value , no electrons are released whatever the intensity of light: (A) Stress frequency (B) Strain frequency (C) Critical frequency
35. As the photon approaches the nucleus field it disappears , and elementary particles appear : (A) Photoelectric effect (B) Compton effect (C) Pair production
36. Energy is absorbed, electrons are emitted and resident photons are released: (A) Photoelectric effect (B) Compton effect (C) Pair production
37. Photonic and radiative energy are emitted as...: (A) Separate quantities (Photons) (B) continuous quantities
38. Photonic and radiative energy are absorbed as (A) Separate quantities (Photons) (B) continuous quantities
39. The rotation of the electron around the nucleus (A) lead to (B) does not lead to energy radiation
40. De Broglie was able to unite the energy with the... (A) Momentum (B) Mass (C) Frequency

21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

Level: **II** المستوى: الثاني

Summer semester

Assiut University

25/8/ 2025

2024 - 2025

Faculty of Science

"3 hours " ثلاث ساعات

"Modern physics " P 215

Physics Dept.

Question № 1 (20 degrees)

Total (50 degrees)

Write in the attached table the symbol indicating the correct answer

1. Nature - from the human point of view – is.....:
(A) Material and Energy (B) heat & radiation (C) All of the above
2. Physics is a science that studies....
(A) Material and energy (B) Interaction of radiation & matter (C) All of the above
3. 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
4. The star is not eternal because its transformations from:
(A) Mass to energy (B) Energy to mass (C) All of the above
5. Atom is not eternal because of...
(A) its extreme smallness (B) its exchanged and transformation (C) All of the above
6. Heat transfer in the universe is done from...: (A) Hot to cold (B) Cold to hot (C) All the above
7. The absolute beginning of the universe was... (A) Material (B) energy (C) Noor
8. The method of vision, hearing and smell according to the latest theories.....
(A) Vibrations & oscillations (B) particles (C) all of the above
9. Different colors are: (A) waves & vibrations (B) particles (C) photons
10. Electrodynamics, thermodynamics & electromagnetism are: (A) Classical physics. (B) Modern phy.
11. Relativity deals with: (A) atoms & nucleus (B) stars & planets (C) all the above
12. Inertia is a property of matter that causes it tochanges. (A) resist (B) accept
13. The laws of mechanics that apply in our daily life are: (A) invalid (B) valid
14. Converting one observer's measurements to another - according to Galileo, considered as arelativity (A) modern (B) classical (C) general
15. Laws of adding and subtracting to sound waves
(A) does not apply (B) sometimes apply (C) Always apply
16. An aircraft is flying at a speed of 500 m/s facing winds of speed (50) m/s, monitors inside the aircraft will register a speed of.....: (A) 550 (B) 450
17. The final result of the Michelson-Morley experiment demonstrated that the speed of light in vacuum or air is.....: (A) constant (B) variable
18. In physics the length is absolute and does not depend on the movement of the observer (A) Traditional (B) Modern (C) General
19. Radioactive energy per square meter per unit time- for a black body – is proportional to:
(A) T^4 (B) T^3 (C) T^2
20. Raleigh used KT in the energy distribution formula in terms of λ , and that caused it to:
(A) Fail (B) Succeed

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

3-a) Apply the thermodynamic energy eqn. of state : $(\frac{dE}{dV})_T = [T(\frac{\partial P}{\partial T})_V - P]$, to prove that:

(i) The internal energy of ideal gas depends on temp. , (ii) The radiant energy is related to fourth power of temp.

3-b) Prove that: (i) $T(\partial H / \partial T)_P = (\partial S / \partial T)P$

3-c) Calculate the work done due to compressing (2 mole) of ideal gas at 300 K to (1.2 atm) if the initial pressure (0.4 atm) (given: $R = 8.31$ J/mole K).

4-a) According to the change of entropy: $TdS = C_p dT - T(\frac{\partial V}{\partial T})_P dP$,

(i) use the condition of constant enthalpy during the gas liquefaction to prove that: $\mu = \frac{T}{C_p} [(\frac{\partial V}{\partial T})_P - \frac{V}{T}]$,

explain the physical meaning of the presence of cooling and heating areas around the inflection curve.

4-b) Use the obtained eqn. to Prove that the absorbed heat during isothermal process through the pressure change:

$(\Delta Q)_T = TV\alpha_P \Delta P$, apply this eqn. for the abnormal state of water and describe its phase diagram.

4-c) If the volume of a gas, expands adiabatically, doubles while its absolute temperature decreases by 1.32 times, determine the no. of degree of freedom of the gas.

5-a) Find the work done adiabatically by a gas , describe by the eqns.(and drawing) the applied thermal procedures through the first half of the thermal Carnot's cycle.

5-b) Express the thermodynamic Maxwell's eqns., then prove that the difference: $C_p - C_v = R$ for ideal gas.

5-c) If the adiabatic volumetric elasticity factor of the gas: $\lambda_Q = \gamma P$, prove that: (i) The isothermal volumetric elasticity coefficient also depends on the pressure of the gas. (ii) $\lambda_Q / \lambda_T = (1 + 2/i)$, where γ , and i are the adiabatic change constant and no. of degrees of freedom, respectively.

انتهت الأسئلة

أ.د. عبد المنعم سلطان

Summer course in "thermodynamics (P 223)"

Sep. 2025

Time: 3 hours

Answer the following question: (14 درجة)

1- a) Choose the right answer between brackets:

- 1) At constant pressure the work done is related to the change in (temperature – volume- both of them).
- 2) During the Carnot's cycle the thermal procedures are performed by (expansion – compression -both of them)
- 3) The heat capacity at constant volume is related to the change of (entropy – enthalpy – Gibbs free energy).
- 4) The enthalpy curve represents the pressure vs. temp. dependence during (isothermal – isobaric – adiabatic) process.
- 5) Due to similarity of the photonic and ideal gases, the radiant energy density depends on (temp.-volume-pressure).
- 6) The electronic heat capacity contribution equal the (double – half- quarter) value that for atomic contribution.
- 7) Due to the const. (volume – pressure – mass) of the gas during liquefaction the change of its internal energy is constant.

1- b) Transfer the following sentences after putting a check mark right or wrong:

- 1) The work done isothermally by ideal gas is accompanied by the decrease in pressure.
- 2) Both the heat exchange between two bodies and homogenous mixture represents irreversible process
- 3) The internal energy of one mole of monatomic gas: $E = (5/2)RT$
- 4) The surface pressure will be taken into consideration for real gases due to an interaction between their molecules.
- 5) The critical point lies on the highest enthalpy curve through which the inflection curve passes.
- 6) During adiabatic process the radiant volume exponentially proportional with radiant temperature.
- 7) The pressure of ideal gas is related to momentum or kinetic energy of their molecules per unit volume.

Answer only three questions : (12 درجة لكل سؤال)

2-a) For ideal gas under isothermal process prove that: (i) the work done by the gas: $W_T = RT \ln(V_2/V_1)$

(ii) the change of entropy due to the change of its volume: $(\frac{\partial S}{\partial V})_T = R \ln(V_2/V_1)$

(iii) Explain the physical meaning related to the previous equations.

2-b) Consider the eqn. of entropy change: $TdS = C_v dT + T(\frac{\partial P}{\partial T})_V dV$, prove that: (i) the heat capacity C_v of ideal gas represents a constant value. (ii) The eqn. of entropy changes due to the change of radiation temp. and radiation volume: $\Delta S = \frac{8}{3}bVT^3 + C$ (Consider the radiant energy density: $\epsilon = bT^4 = 3P = E/V$).

2-c) Prove that during isothermal process the Helmholtz free energy represents heat loss through a system.

..... للأسئلة بقية في الورقة التالية ←

Question No 2 (25 degrees)

Mark - In the answer sheet - the symbol indicating the correct answer

26. Nature - from the human point of view - is.....:
(A) Material and Energy (B) heat & radiation (C) All of the above
27. Physics is a science that studies....
(A) Material and energy (B) Interaction of radiation & matter (C) All of the above
28. 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
29. The star is not eternal because its transformations from:
(A) Mass to energy (B) Energy to mass (C) All of the above
30. Heat transfer in the universe is done from....: (A) Hot to cold (B) Cold to hot (C) All the above
31. The absolute beginning of the universe was..... (A) Material (B) energy (C) Noor
32. The method of vision, hearing and smell according to the latest theories.....
(A) Vibrations & oscillations (B) particles (C) all of the above
33. Different colors are: (A) waves & vibrations (B) particles (C) photons
34. Electrodynamics, thermodynamics & electromagnetism are: (A) Classical physics. (B) Modern phy.
35. Relativity deals with: (A) atoms & nucleus (B) stars & planets (C) all the above
36. Inertia is a property of matter that causes it tochanges. (A) resist (B) accept
37. The laws of mechanics that apply in our daily life are: (A) invalid (B) valid
38. Converting one observer's measurements to another - according to Galileo, considered as arelativity. (A) modern (B) classical (C) general
39. Laws of adding and subtracting to sound waves
(A) does not apply (B) sometimes apply (C) Always apply
40. An aircraft is flying at a speed of 500 m/s facing winds of speed (50) m/s, monitors inside the aircraft will register a speed of...: (A) 550 (B) 450
41. The final result of the Michelson-Morley experiment demonstrated that the speed of light in vacuum or air is.....: (A) constant (B) variable
42. In physics the length is absolute and does not depend on the movement of the observer (A) Traditional (B) Modern (C) General
43. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are ... (A) continuous (B) separate
44. Interaction between radiation and matter is done by: (A) particles (B) waves (C) photons
45. The type of Interaction depends on the... (A) energy (B) intensity
46. Photons are fully absorbed and electrons are emitted:
(A) Photoelectric effect (B) Compton effect (C) Pair production
47. is the ability of light to remove the electron, And its value depends on the light frequency only (A) Energy (B) Intensity (C) Capacity
48. ... is the least energy required to remove the electron from the orbit:
(A) Potential energy (B) work function (C) current intensity
49. As the photon approaches the nucleus field it disappears, and elementary particles appear:
(A) Photoelectric effect (B) Compton effect (C) Pair production
50. De Broglie was able to unite the energy with the (A) Momentum (B) Mass (C) Frequency

___ انتهت أسئلة مبادئ الفيزياء الحديثة - مع التمنيات بالنجاح - اسرار المنع د / حسام وحيد

Level: **II** **المستوي: الثاني**
6/9/ 2025
" 2 hours "

summer semester
2024-2025
Principles of modern physics P225

Assiut University
Faculty of Science
Physics Dept.

Question № 1 (25 degrees)

Total (50 degrees)

Mark - In the answer sheet the symbol (T) for true answer or (F) for false answer

1. Physics is the created universe
2. Matter annihilates, energy appears. Energy disappears, matter appears
3. The human used his mind, so he was able to harness and adapt the universe to serve him.
4. Energy has an advantage over matter
5. Classical physics encountered difficulties when trying to explain the photoelectric effect
6. Relativity used the principle of "invisible field" instead of the force (actual mass)
7. The laws of mechanics applied in our daily lives lose their validity when the speed approaches the speed of light
8. The curvature of space and time and the paths of light are some of the basics of general relativity
9. In Galileo Transformations, space is absolute and time is absolute
10. Because the speed of light is not equal to infinity, relativity is true
11. We do not have the ability to measure the decrease in length when increasing the speed
12. General relativity showed that Newton's equations are completely wrong
13. Everything bends, including time and space
14. A black body absorbs all radiation and reflects nothing
15. Any absorbed energy can be get out as an emission spectrum
16. The interaction between radiation and matter confirms the principle of: continuity
17. Interaction between radiation and matter is done by: photons
18. The type of Interaction depends on the energy of the light
19. The type of Interaction depends on the intensity of photons
20. Work function is the least energy required to remove the electron from the orbit
21. Photonic and radiative energy are emitted as: Separate quantities (Photons)
22. Photonic and radiative energy are absorbed as a continuous quantity
23. De Broglie was able to unite the energy with the Frequency
24. The velocity of De Broglie wave is equal to the speed of light
25. Photonic and radiative energy are emitted as a continuous quantity and absorbed as a separate quantities (photons)

(1)



The final exam is in 4 pages (50 degree)

First question: Choose the correct answer (One degree for each point)

1) An electron is bound in one-dimensional infinite well of width $L = 6 \times 10^{-10}m$. Find the energy value in the second excited state.	A. 632 eV	B. 0.632 eV	C. 1422 eV	D. 1.422 eV
2) The equations of motion for a body in phase space (p, q) is called a	A. ellipse	B. phase space	C. biaxial plane	D. canonical equation
3) An electron is confined to a one-dimensional potential box. The distance between energy levels of the second excited state and third excited state is	A. $5 E_1$	B. $7 E_1$	C. $9 E_1$	D. $16 E_1$
4) What is the value of the entropy of the unit moles of the system state (4,3,2,1,0)?	A. $0.785/JK^{-1}mol^{-1}$	B. $78.5/JK^{-1}mol^{-1}$	C. $785/JK^{-1}mol^{-1}$	D. $7.85/JK^{-1}mol^{-1}$
5) The relationship between the partition function of the total indistinguishable particles Z_N and the partition function of the single particle of Z_{sp} is given by:	A. $Z_N = Z_{sp}/N!$	B. $Z_N = (Z_{sp})^N/N!$	C. $Z_N = (Z_{sp})^N$	D. $Z_N = Z_{sp}/N$
6) "Arrangement of distinguishable particles during a defined state of the system" is the definition of ...	A. microstate	B. macrostate	C. system state	D. probability
7) The number of total microstates at $T \rightarrow 0$ is ...	A. 0	B. 1	C. < 1	D. $\gg 1$
8) Which relation is true ?	A. $\Omega_{total} = \Omega_1 \times \Omega_2$	B. $S_{total} = S_1 \times S_2$	C. $\Omega_{total} = \Omega_1 + \Omega_2$	D. $S_{total} = S_1 - S_2$
9) The e^α coefficient in classic Maxwell-Boltzmann statistical distribution is a function of	A. volume	B. temperature	C. Both A & B	D. None of mentioned
10) The classical mechanics becomes appropriate at	A. low density gas	B. low temperature	C. light molecule mass	D. All of mentioned
11) The adiabatic relation between pressure and temperature of gas is.....	A. $P^{1-\gamma}T^\gamma = Const.$	B. $P^\gamma T^{-1} = Const.$	C. $P^{1+\gamma}T^\gamma = Const.$	D. $P^\gamma T^{+1} = Const.$

3. A physical pendulum in the form of a planar body moves in simple harmonic motion with a frequency of 0.450 Hz. If the pendulum has a mass of 2.20 kg and the pivot is located 0.350 m from the center of mass, determine the moment of inertia of the pendulum.

4. A string has a linear density of 8.5×10^{-3} kg/m and is under a tension of 280 N. The string is 1.8 m long, is fixed at both ends, and is vibrating in the standing wave pattern. Determine the (a) speed, (b) wavelength, if the frequency of the traveling waves is 150 Hz that make up the standing wave.

5. The audible frequency for a normal human being is 20 Hz to 20 kHz. Define the loudness of the sound and find it at the threshold of pain?

D. double the number of vibrations and decreasing periodic time to half

9. which of the following equations represents simple harmonic motion

A. $y=vt+l$

B. $A \cos (wt+\phi)$

C. e^{-2t}

D. $5t^2$

10. A taut string which its linear mass density is 0.05 kg/m; under a tension of 80 N. How much power must be supplied to the string to generate sinusoidal waves at a frequency of 60 Hz and amplitude 60 mm?

A. 320 W

B. 511.7 W

C. 115.2 W

Part II: Answer the following questions:

1. A 10 kg mass suspended on Earth by a spring oscillates with a period of 12 seconds. This mass-spring system is now moved to the moon where the gravity is one-sixth that of the Earth. What is the new period of motion?

2. In an electric shaver, the blade moves back and forth over a distance of 2.0mm in simple harmonic motion, with frequency 120Hz. Find (a) the amplitude, (b) the maximum blade speed, and (c) the magnitude of the maximum acceleration.

4. How much energy must the shock absorbers of a 1200-kg car dissipate in order to damp a bounce that initially has a velocity of 0.800 m/s at the equilibrium position? Assume the car returns to its original vertical position
- 330 J
 - 384 J
 - 348 J
 - 584 J
5. An ideal pendulum hangs stationary at its equilibrium position. Which of the following is true of the string supporting the mass?
- It is doing work.
 - It is exerting a torque on the mass.
 - The tension in the string is constant.
 - There is no tension in the string.
 - The force provided by the string is greater than the weight of the mass.
6. A block is attached to a vertical spring and undergoes simple harmonic motion with frequency f . If the block is removed and replaced by a block with 4 times the mass of the first block, what will the new frequency
- $f/4$
 - $f/2$
 - f
 - $2f$
 - $4f$
7. Transverse waves propagate at 43.2 m/s in a string that is subjected to a tension of 60.5 N. If the string is 19.0 m long, what is its mass?
- 0.616 kg
 - 0.259 kg
 - 0.437 kg
 - 0.715 kg
8. To quadruple the frequency of an oscillator, we have to.....
- double number of vibrations
 - decreasing periodic time to half
 - double both of number of vibrations and periodic time

Assiut University
Faculty of science – Physics department

Duration of test	3 hours	Course	Physics P212 - Vibrations and waves
Degree	50	Exam	Final summer course 2024-2025

Part I: Choose the correct answer:

1. An object moves up and down the y -axis with position s given as a function of time t by the expression $s = A \sin \omega t$. What is the period of this motion?
A. ω
B. $2\pi\omega$
C. $A\omega$
D. $2\pi/\omega$
E. ω
2. A pendulum and a mass-spring system each have a period T . If the mass in each system is halved, what is the new period of each system?
A. pendulum: $T/\sqrt{2}$, mass on spring: $\sqrt{2}T$
B. pendulum: T , mass on spring: $\sqrt{2}T$
C. pendulum: T , mass on spring: T
D. pendulum: T , mass on spring: $T/\sqrt{2}$
E. pendulum: $\sqrt{2}T$, mass on spring: $T/\sqrt{2}$
3. Consider a propagating wave $y(x,t)$ given by:
 $y(x,t) = (5.0 \times 10^{-6}) \cos[(2.0 \times 10^6 \text{ rad/m})x + (8.0 \times 10^{14} \text{ rad/s})t]$,
Which one of the following describes the velocity v of the wave?
A. $v = 2.0 \times 10^8 \text{ m/s}$ traveling in the $+x$ direction
B. $v = 2.0 \times 10^8 \text{ m/s}$ traveling in the $-x$ direction
C. $v = 4.0 \times 10^8 \text{ m/s}$ traveling in the $+x$ direction
D. $v = 4.0 \times 10^8 \text{ m/s}$ traveling in the $-x$ direction

Question (VI):

(8 Marks)

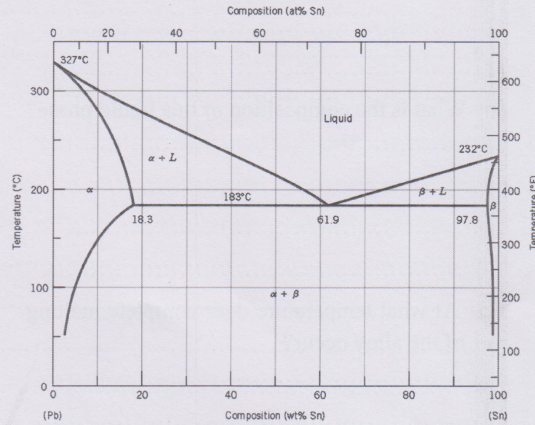
For a 10 at% Pb-90 at% Sn alloy at 200°C, in below phase diagram:

(a) What phase(s) is (are) present?

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(b) What is (are) the composition(s) of the phase(s)?

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(c) Calculate the relative amount of each phase present in terms of mass fraction.

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(d) State the eutectic reaction, temperature, and composition of this system, and what is the melting temperature for pure Sn and Pb?

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BEST WISHES,

Question (V):

(6 Marks)

A copper (Cu)-nickel (Ni) alloy of composition 70 wt% Ni-30 wt% Cu is slowly heated from a temperature of 1300°C (2370°F), using below phase diagram:

(a) At what temperature does the first liquid phase form?

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(b) What is the composition of this liquid phase?

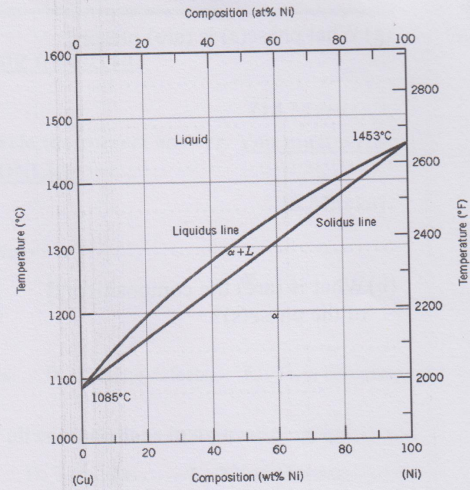
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(c) At what temperature does complete melting of the alloy occur?

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(a) What is the composition of the last solid remaining before complete melting? What is the name of this type of phase diagram?

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3. A 10 mm diameter Brinell hardness indenter produced an indentation 1.62 mm in diameter in a steel alloy when a load of 500 kg was used. Compute the Brinell hardness, HB, of this material.

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4. At 300 °C, the diffusion coefficient is $7.8 \times 10^{-11} \text{ m}^2/\text{s}$ and the activation energy for Cu in Si is 41.5 kJ/mol. What is the diffusion coefficient at 350 °C? ($R = 8.314 \text{ J/mol.K}$)

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Question (IV):

(10 Marks)

1. (a) What is the composition, in weight percent, of an alloy that consists of 6 at% Pb and 94 at% Sn? (Hint: $A_{\text{Pb}} = 207.2 \text{ g/mol}$; $A_{\text{Sn}} = 118.71 \text{ g/mol}$). (b) Calculate the amount of each element if the mass of a given Sn-Pb alloy is 50 g.

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2. (a) Derive linear density expressions for BCC [110] and [111] directions in terms of the atomic radius R. (b) Compute and compare linear density values for these same two directions for tungsten (Hint: atomic radius for tungsten is 0.137 nm).

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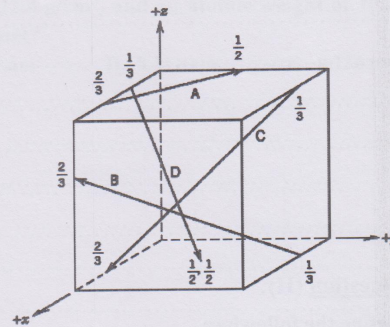
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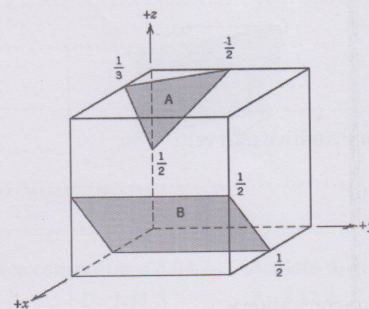
Question (III):

(6 Marks)

A. Determine the indices for two directions only of the shown directions in the following cubic unit cell:



B. Determine the Miller indices for the planes A and B shown in the following cubic unit cell:



10. A specimen of aluminum having a rectangular cross section $10 \text{ mm} \times 12.7 \text{ mm}$ is pulled in tension with a $3.55 \times 10^4 \text{ N}$ force, producing only elastic deformation. If the elastic modulus for Al is $69 \times 10^9 \text{ N/m}^2$, the resulting strain is:

- A. 6.2×10^{-4} B. 4.1×10^{-3} C. 7.5×10^{-2} D. 1.3×10^{-2} E. 0.154

Question (II):

(6 Marks)

Define the following:

1. Hardness:

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2. Schottky defect:

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3. Primitive unit cell:

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4. Segregation:

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I-Part 2: (8 Marks: each point 1 mark for correct choice and 1 mark for correct steps)

7. Ir has an FCC crystal structure, a density of 22.4 g/cm^3 , and an atomic weight of 192.2 g/mol , then the radius of an iridium atom is equal?
 A. 0.553 nm B. 0.439 nm C. 0.363 nm D. 0.211 nm E. 0.136 nm

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8. Miller indices for the indicated plane, below the figure, is:

A. (001) B. (110) C. (101) D. $(\bar{1}01)$ E. $(0\bar{1}1)$

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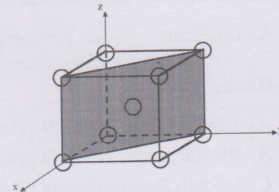
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9. Aluminum (Al) has an FCC cubic structure of lattice constant $a = 4.04 \text{ \AA}$, Calculate d_{111} :
 A. $4.04 \text{ \AA}$ B. $2.34 \text{ \AA}$ C. $2.02 \text{ \AA}$ D. $1.43 \text{ \AA}$ E. $1.12 \text{ \AA}$

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Answer all the following questions

Question (I):

(14 Marks)

In the following multiple-choice questions, please circle the correct answer. **You must write down the steps to get the correct answer (for part 2 ONLY).**

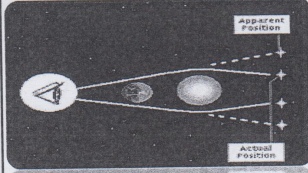
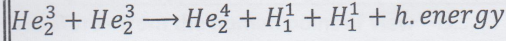
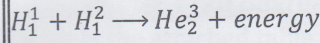
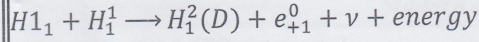
I-Part 1

(6 Marks)

1. Coordination number in hexagonal crystal structure:
A. 2. B. 4. C. 6. D. 8. E. 12.
2. Thermodynamically stable defects:
A. Point defects. B. Line defects. C. Surface defects. D. Volume defects. E. Twin boundary.
3. Above the following line, a liquid phase exists for all compositions in a phase diagram:
A. Tie-line. B. Solvus. C. Solidus. D. Liquidus. E. None of these.
4. An invariant reaction that produces a solid upon cooling two liquids:
A. Eutectic. B. Peritectic. C. Monotectic. D. Syntectic. E. Peritectoid.
5. Hooke's law:
A. Elastic range, strain is proportional to stress.
B. Plastic range, strain is proportional to stress.
C. In both the elastic and plastic range, strain is proportional to stress.
D. Elastic range, strain is independent of stress.
E. None of the above.
6. The following is wrong about a phase diagram:
A. It gives information on transformation rates.
B. The relative amount of different phases can be found under the given equilibrium conditions.
C. It indicates the temperature at which different phases start to melt.
D. Solid solubility limits are depicted by it.
E. None of the above.

Question No 3 (15 degrees)

1). Suggest a title for the following



2) Find & correct the mistake in the following sentences

1. Nature is a science that studies the created universe

2. Matter and energy interact to give natural phenomena

3. The human used his mind, so he was able to harness and adapt the universe

4. The progress in using behaviors & understanding is enormous

5. The absolute beginning of the universe is an energy

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

7. Heat transfer in the universe can occur from cold to hot

8. Physics can define time & space

9. Electron Volt unit is a unit of charge

10. The type of Interaction depends on the intensity of light

انتهت اسئلة الفيزياء الحديثة - مع تمنيات بالنجاح - Best wishes - اسر المنعرج : د/ حسام وحيه

16. A black body absorbs all radiation and reflects nothing
17. Any absorbed energy can be released as emission spectra
18. The interaction between radiation and matter confirms the principle of:
continuity
19. Interaction between radiation and matter is done by: photons
20. The type of interaction depends on the energy of the light
21. The type of interaction depends on the intensity of photons
22. Electrons emission in the Photoelectric effect depends on the frequency of the
incident light
23. Work function is the least energy required to remove the electron from the
orbit
24. Photonic and radiative energy are emitted as: Separate quantities (Photons)
25. Photonic and radiative energy are absorbed as continuous quantities
26. The rotation of the electron around the nucleus lead to energy radiation
27. De Broglie was able to unite the energy with the Frequency
28. The wave function refers to the probability of a particle existing at a given
time and place
29. The velocity of De Broglie wave is equal to the speed of light
30. Studying a particle considering its particulate properties
leads to the loss of its wave properties and vice versa

16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	

Question № 2 (15 degrees)

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

1. Nature is a science that studies the created universe
2. Matter and energy interact to give natural phenomena
3. Matter annihilates, energy appears. Energy disappears, matter appears
4. Einstein's equation united matter and energy, so there is no substance without energy.
5. Any amount of mass, no matter how small, contains an enormous amount of energy
6. Energy has no priority over mass or mass over energy
7. Classical physics encountered difficulties when trying to explain the photoelectric effect
8. Relativity used the principle of "invisible field" instead of the force (actual mass)
9. The laws of mechanics applied in our daily lives lose their validity when the speed approaches the speed of light
10. The curvature of space and time and the paths of light are some of the basics of general relativity
11. In Galileo Transformations, space is absolute and time is absolute
12. Because the speed of light is not equal to infinity, relativity is true
13. We do not have the ability to measure the decrease in length when increasing the speed
14. General relativity showed that Newton's equations are completely wrong
15. Everything bends, including time and space

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

(3)

21. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are ... (A) continuous (B) separate
22. When Planck's hypothesis of a black body spectrum appeared, we began to understand .. (A) Absorption & emission (B) orbits (C) all of the above
23. The interaction between radiation and substance is confirmed (A) practically (B) axiomatically (C) all of the above
24. The interaction between radiation and matter confirms the principle of: (A) Equivalence (B) quantitative energy (C) all of the above
25. Radiation behaves as a ... : (A) Particle (B) Wave (C) Energy (D) all of the above
26. Interaction between radiation and matter is done by: (A) particles (B) waves (C) photons
27. The type of Interaction depends on the... (A) energy (B) intensity
28. The interaction of high-energy photons causes: (A) Photoelectric effect (B) Compton effect
29. The interaction of low-energy photons causes (A) Photoelectric effect (B) Compton effect
30. Electrons emission in the Photoelectric effect depends on the ... of the incident light: (A) Frequency (B) intensity (C) density
31. Photons are fully absorbed and electrons are emitted: (A) Photoelectric effect (B) Compton effect (C) Pair production
32. is the ability of light to remove the electron, And its value depends on the light frequency only (A) Energy (B) Intensity (C) Capacity
33. ... is the least energy required to remove the electron from the orbit: (A) Potential energy (B) work function (C) current intensity
34. If the frequency is less than this value , no electrons are released whatever the intensity of light: (A) Stress frequency (B) Strain frequency (C) Critical frequency
35. As the photon approaches the nucleus field it disappears , and elementary particles appear : (A) Photoelectric effect (B) Compton effect (C) Pair production
36. Energy is absorbed, electrons are emitted and resident photons are released: (A) Photoelectric effect (B) Compton effect (C) Pair production
37. Photonic and radiative energy are emitted as...: (A) Separate quantities (Photons) (B) continuous quantities
38. Photonic and radiative energy are absorbed as (A) Separate quantities (Photons) (B) continuous quantities
39. The rotation of the electron around the nucleus (A) lead to (B) does not lead to energy radiation
40. De Broglie was able to unite the energy with the... (A) Momentum (B) Mass (C) Frequency

21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

Level: **II** المستوى: الثاني

Summer semester

Assiut University

25/8/ 2025

2024 - 2025

Faculty of Science

"3 hours " ثلاث ساعات

"Modern physics " P 215

Physics Dept.

Question № 1 (20 degrees)

Total (50 degrees)

Write in the attached table the symbol indicating the correct answer

1. Nature - from the human point of view – is.....:
(A) Material and Energy (B) heat & radiation (C) All of the above
2. Physics is a science that studies....
(A) Material and energy (B) Interaction of radiation & matter (C) All of the above
3. 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
4. The star is not eternal because its transformations from:
(A) Mass to energy (B) Energy to mass (C) All of the above
5. Atom is not eternal because of...
(A) its extreme smallness (B) its exchanged and transformation (C) All of the above
6. Heat transfer in the universe is done from...: (A) Hot to cold (B) Cold to hot (C) All the above
7. The absolute beginning of the universe was... (A) Material (B) energy (C) Noor
8. The method of vision, hearing and smell according to the latest theories.....
(A) Vibrations & oscillations (B) particles (C) all of the above
9. Different colors are: (A) waves & vibrations (B) particles (C) photons
10. Electrodynamics, thermodynamics & electromagnetism are: (A) Classical physics. (B) Modern phy.
11. Relativity deals with: (A) atoms & nucleus (B) stars & planets (C) all the above
12. Inertia is a property of matter that causes it tochanges. (A) resist (B) accept
13. The laws of mechanics that apply in our daily life are: (A) invalid (B) valid
14. Converting one observer's measurements to another - according to Galileo, considered as arelativity (A) modern (B) classical (C) general
15. Laws of adding and subtracting to sound waves
(A) does not apply (B) sometimes apply (C) Always apply
16. An aircraft is flying at a speed of 500 m/s facing winds of speed (50) m/s, monitors inside the aircraft will register a speed of.....: (A) 550 (B) 450
17. The final result of the Michelson-Morley experiment demonstrated that the speed of light in vacuum or air is.....: (A) constant (B) variable
18. In physics the length is absolute and does not depend on the movement of the observer (A) Traditional (B) Modern (C) General
19. Radioactive energy per square meter per unit time- for a black body – is proportional to:
(A) T^4 (B) T^3 (C) T^2
20. Raleigh used KT in the energy distribution formula in terms of λ , and that caused it to:
(A) Fail (B) Succeed

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

3-a) Apply the thermodynamic energy eqn. of state : $(\frac{dE}{dV})_T = [T(\frac{\partial P}{\partial T})_V - P]$, to prove that:

(i) The internal energy of ideal gas depends on temp. , (ii) The radiant energy is related to fourth power of temp.

3-b) Prove that: (i) $T(\partial H / \partial T)_P = (\partial S / \partial T)P$

3-c) Calculate the work done due to compressing (2 mole) of ideal gas at 300 K to (1.2 atm) if the initial pressure (0.4 atm) (given: R = 8.31 J/mole K).

4-a) According to the change of entropy: $TdS = C_p dT - T(\frac{\partial V}{\partial T})_P dP$,

(i) use the condition of constant enthalpy during the gas liquefaction to prove that: $\mu = \frac{T}{C_p} [(\frac{\partial V}{\partial T})_P - \frac{V}{T}]$,

explain the physical meaning of the presence of cooling and heating areas around the inflection curve.

4-b) Use the obtained eqn. to Prove that the absorbed heat during isothermal process through the pressure change:

$(\Delta Q)_T = TV\alpha_P \Delta P$, apply this eqn. for the abnormal state of water and describe its phase diagram.

4-c) If the volume of a gas, expands adiabatically, doubles while its absolute temperature decreases by 1.32 times, determine the no. of degree of freedom of the gas.

5-a) Find the work done adiabatically by a gas , describe by the eqns.(and drawing) the applied thermal procedures through the first half of the thermal Carnot's cycle.

5-b) Express the thermodynamic Maxwell's eqns., then prove that the difference: $C_p - C_v = R$ for ideal gas.

5-c) If the adiabatic volumetric elasticity factor of the gas: $\lambda_Q = \gamma P$, prove that: (i) The isothermal volumetric elasticity coefficient also depends on the pressure of the gas. (ii) $\lambda_Q / \lambda_T = (1 + 2/i)$, where γ , and i are the adiabatic change constant and no. of degrees of freedom, respectively.

انتهت الأسئلة

أ.د. عبد المنعم سلطان

Summer course in "thermodynamics (P 223)"

Sep. 2025

Time: 3 hours

Answer the following question: (14 درجة)

1- a) Choose the right answer between brackets:

- 1) At constant pressure the work done is related to the change in (temperature – volume- both of them).
- 2) During the Carnot's cycle the thermal procedures are performed by (expansion – compression -both of them)
- 3) The heat capacity at constant volume is related to the change of (entropy – enthalpy – Gibbs free energy).
- 4) The enthalpy curve represents the pressure vs. temp. dependence during (isothermal – isobaric – adiabatic) process.
- 5) Due to similarity of the photonic and ideal gases, the radiant energy density depends on (temp.-volume-pressure).
- 6) The electronic heat capacity contribution equal the (double – half- quarter) value that for atomic contribution.
- 7) Due to the const. (volume – pressure – mass) of the gas during liquefaction the change of its internal energy is constant.

1- b) Transfer the following sentences after putting a check mark right or wrong:

- 1) The work done isothermally by ideal gas is accompanied by the decrease in pressure.
- 2) Both the heat exchange between two bodies and homogenous mixture represents irreversible process
- 3) The internal energy of one mole of monatomic gas: $E = (5/2)RT$
- 4) The surface pressure will be taken into consideration for real gases due to an interaction between their molecules.
- 5) The critical point lies on the highest enthalpy curve through which the inflection curve passes.
- 6) During adiabatic process the radiant volume exponentially proportional with radiant temperature.
- 7) The pressure of ideal gas is related to momentum or kinetic energy of their molecules per unit volume.

Answer only three questions : (12 درجة لكل سؤال)

2-a) For ideal gas under isothermal process prove that: (i) the work done by the gas: $W_T = RT \ln(V_2/V_1)$

(ii) the change of entropy due to the change of its volume: $(\frac{\partial S}{\partial V})_T = R \ln(V_2/V_1)$

(iii) Explain the physical meaning related to the previous equations.

2-b) Consider the eqn. of entropy change: $TdS = C_V dT + T(\frac{\partial P}{\partial T})_V dV$, prove that: (i) the heat capacity C_V of ideal gas represents a constant value. (ii) The eqn. of entropy changes due to the change of radiation temp. and radiation volume: $\Delta S = \frac{8}{3}bVT^3 + C$ (Consider the radiant energy density: $\epsilon = bT^4 = 3P = E/V$).

2-c) Prove that during isothermal process the Helmholtz free energy represents heat loss through a system.

..... للأسئلة بقية في الورقة التالية ←

Question No 2 (25 degrees)

Mark - In the answer sheet - the symbol indicating the correct answer

26. Nature - from the human point of view - is.....:
(A) Material and Energy (B) heat & radiation (C) All of the above
27. Physics is a science that studies....
(A) Material and energy (B) Interaction of radiation & matter (C) All of the above
28. 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
29. The star is not eternal because its transformations from:
(A) Mass to energy (B) Energy to mass (C) All of the above
30. Heat transfer in the universe is done from....: (A) Hot to cold (B) Cold to hot (C) All the above
31. The absolute beginning of the universe was..... (A) Material (B) energy (C) Noor
32. The method of vision, hearing and smell according to the latest theories.....
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41. The final result of the Michelson-Morley experiment demonstrated that the speed of light in vacuum or air is.....: (A) constant (B) variable
42. In physics the length is absolute and does not depend on the movement of the observer (A) Traditional (B) Modern (C) General
43. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are ... (A) continuous (B) separate
44. Interaction between radiation and matter is done by: (A) particles (B) waves (C) photons
45. The type of Interaction depends on the... (A) energy (B) intensity
46. Photons are fully absorbed and electrons are emitted:
(A) Photoelectric effect (B) Compton effect (C) Pair production
47. is the ability of light to remove the electron, And its value depends on the light frequency only (A) Energy (B) Intensity (C) Capacity
48. ... is the least energy required to remove the electron from the orbit:
(A) Potential energy (B) work function (C) current intensity
49. As the photon approaches the nucleus field it disappears, and elementary particles appear:
(A) Photoelectric effect (B) Compton effect (C) Pair production
50. De Broglie was able to unite the energy with the (A) Momentum (B) Mass (C) Frequency

___ انتهت أسئلة مبادئ الفيزياء الحديثة - مع التمنيات بالنجاح - اسرار المنع د / حسام وحيد

Level: **II** **المستوي: الثاني**
6/9/ 2025
" 2 hours "

summer semester
2024-2025
Principles of modern physics P225

Assiut University
Faculty of Science
Physics Dept.

Question № 1 (25 degrees)

Total (50 degrees)

Mark - In the answer sheet the symbol (T) for true answer or (F) for false answer

1. Physics is the created universe
2. Matter annihilates, energy appears. Energy disappears, matter appears
3. The human used his mind, so he was able to harness and adapt the universe to serve him.
4. Energy has an advantage over matter
5. Classical physics encountered difficulties when trying to explain the photoelectric effect
6. Relativity used the principle of "invisible field" instead of the force (actual mass)
7. The laws of mechanics applied in our daily lives lose their validity when the speed approaches the speed of light
8. The curvature of space and time and the paths of light are some of the basics of general relativity
9. In Galileo Transformations, space is absolute and time is absolute
10. Because the speed of light is not equal to infinity, relativity is true
11. We do not have the ability to measure the decrease in length when increasing the speed
12. General relativity showed that Newton's equations are completely wrong
13. Everything bends, including time and space
14. A black body absorbs all radiation and reflects nothing
15. Any absorbed energy can be get out as an emission spectrum
16. The interaction between radiation and matter confirms the principle of: continuity
17. Interaction between radiation and matter is done by: photons
18. The type of Interaction depends on the energy of the light
19. The type of Interaction depends on the intensity of photons
20. Work function is the least energy required to remove the electron from the orbit
21. Photonic and radiative energy are emitted as: Separate quantities (Photons)
22. Photonic and radiative energy are absorbed as a continuous quantity
23. De Broglie was able to unite the energy with the Frequency
24. The velocity of De Broglie wave is equal to the speed of light
25. Photonic and radiative energy are emitted as a continuous quantity and absorbed as a separate quantities (photons)

(1)