



24. Plasma jets can operate using different working gases, altering their biological effects. (T/F)
25. Thermal plasmas are safe for direct application on living tissue at all power levels. (T/F)
26. Reactive species generated by CAP play roles similar to those in normal physiological signaling. (T/F)
27. Plasma medicine currently lacks standardized dosing parameters. (T/F)
28. All CAP devices use the same electrical configuration. (T/F)
29. Plasma dose is independent of treatment distance. (T/F)
30. ROS/RNS measurement is essential for plasma certification. (T/F)
31. Temperature rise must be monitored during medical plasma use. (T/F)
32. All plasma devices emit the same levels of UV radiation. (T/F)
33. Certification ensures the device meets biological safety requirements. (T/F)
34. Plasma medicine uses physical plasma, not blood plasma. (T/F)
35. Thermal plasmas are safe for direct application on living tissue. (T/F)

	Assiut University- Faculty of Science Frist Semester- Final Exam 2025-2026 Physics Department	Program: Physics and Electronics Level: (4) Date: 17/1/2026 Time: 3 h	
Course Title: Selected Topics in Physics (1)		Code: 491 Fhy.	
Instructors: Prof. Dr. Abdelaziz Abulfadi Abdelaziz			
Important:	No. of pages 4	No. Of questions parts 3	Total Mark: 50 degree

Part I: Answer 2 (two) questions from the following: (18 Marks)

- 1- (a)- Explain the method of the operation of: i-Scanning Tunneling Microscope (TEM) ii-Atomic Force Microscope (AFM).
(b)-How the properties of different thicknesses of gold change at the nanoscale?
(c)- Explain the Bridgman and Stockbarger technique for crystal growth from melt?
- 2- (a)- Write short notes on: i- perfect crystal, ii- liquid encapsulation technique iii- crystal twins and iv- crystal habit.
(b) The pulling techniques are typified by the Kyropoulos and Czochralski methods for crystal growth from melt. What is the difference between the operation of the two methods?
(c)- What are the top-down and bottom-up techniques of the synthesis of nanomaterials?
- 3- (a)- Explain each of the following: i-Why do different crystals have different shapes and sizes? and ii- Why crystals grow at different rates in different directions?
(b)- Write short notes on: i- Crystallization by solute diffusion, ii- Crystallization by vapor diffusion and iii-The basic requirements for the growth of crystals from solutions?
(c) Mention the four important ways in which nanoscale materials may differ from macroscale materials?

Part II: Choose the correct answer from a, b, c or d :(18 Marks)

- 1- **Nanoscience is the study of:**
 - a) Phenomena on the scale of 1-100 nm
 - b) Phenomena on the scale of single atom
 - c) Phenomena on the scale of electron
 - d) None of the above
- 2- **A scanning electron microscope uses to produce an image.**
 - a) Negatively charged particles
 - b) Positive charged particles
 - c) Neutral particles
 - d) Atoms
- 3- **What is the primary function of an electron microscope?**
 - a) To analyze sound waves
 - b) To observe live specimens
 - c) To magnify objects using visible light
 - d) To create images using a beam of electrons
- 4- **Which type of electron microscope is best suited for studying the surface topology of samples?**
 - a) Reflection Electron Microscope (REM)
 - b) Scanning Transmission Electron Microscope (STEM)
 - c) Scanning Electron Microscope (SEM)
 - d) Transmission Electron Microscope (TEM)

△ Remember ■ Understand ● Apply ◊ Analysis *Evaluate ○ Create

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5- What does TEM stand for in microscopy?

- a) Scanning Electron Microscopy
- b) Scanning Tunneling Microscopy
- c) Specimen Electron Microscopy
- d) Stereoscopic Electron Microscopy

6- Nucleation Can Either Start with the Molecules Themselves We Call This:

- a) Assisted nucleation
- b) Unassisted nucleation
- c) Crystallization
- d) None of the above

7- Different Crystals Have Different Shapes and Sizes for:

- a) The internal symmetry of the crystal,
- b) The relative growth rates along the various directions
- c) The choice of seed crystal
- d) All of the above

8- What Do We Consider a Perfect Crystal?

- a) Not a twinned crystal
- b) Completely regular
- c) Free of defects and dislocations.
- d) All of the above

9- How Does Light Affect the Color of a Crystal?

- a) If the crystal absorbs red light, it will appear green.
- b) If the crystal absorbs red light, it will appear yellow.
- c) If the crystal absorbs green light, it will appear pink.
- d) If the crystal absorbs green light, it will appear white.

10- Define Crystal Twins:

- a) The existence of one orientation of a lattice
- b) The existence of two different orientations of a lattice
- c) Often apparently one crystal.
- d) None of the above

11- Define Crystal Habit:

- a) Crystals may have one form
- b) Crystals may have different forms
- c) Crystals grow in a dendritic form
- d) All of the above

12-What is the Reactant Diffusion Method of Crystallization?

- a) Two reactants may be allowed to diffuse together and form the crystal
- b) Two reactants may be allowed to diffuse away and form the crystal
- c) The reactants will crystallize away from the zone where they mix.
- d) None of the above

Which one of the following principle has been used in the zone melting method?

- Impurities concentrate in the liquid phase than in the solid phase
- Impurities concentrate in the solid phase than in liquid phase
- Impurities concentrate in the liquid phase than in gaseous phase
- Impurities concentrate in the gaseous phase than in the solid phase

Which one of the following statements describes best the Bridgman method?

- Melt is inside the temperature furnace; solidification occurs at the cooler end
- Melt is outside the temperature furnace, solidification begins at the hotter end
- Melt is inside the temperature furnace, solidification occurs at the hotter end
- Solidification is achieved by passing the melt through a temperature gradient

What is the advantage of using Czochralski, Bridgman-Stockbarger and Verneuil methods for the growth of crystals?

- High tech apparatus
- Gives large crystals
- Low growth rates
- Uses plasma torch

Czochralski (CZ) and Bridgman methods both fall under which category of crystal growth?

- Solution growth methods.
- Vapor phase growth methods.
- Melt growth methods.
- Hydrothermal methods.

7- What is the purpose of seed crystal in crystal growth?

- Catalyst center
- Solvent center
- Solution center
- Nucleation center

8- What happens when a crystal grows in size?

- It becomes softer
- It becomes smoother
- It becomes rough
- It becomes coarsely

Part III- Write True (T) or False (F) for each of the following statements: (14 Marks)

- 1- Nanoscale materials often exhibit different optical, thermal, and mechanical properties compared to their bulk counterparts. ()
- 2- Nanomaterials are defined as structures with at least one dimension larger than 1 micrometer's. ()
- 3- Carbon nanotubes (CNTs) are one-dimensional (1D) nanomaterials known for high tensile strength and electrical conductivity. ()
- 4- Nanometer-scale materials can be stronger, more durable, and more conductive than their larger-scale (called bulk) counterparts. ()
- 5- Nanomaterials are classified into three types based on their size dimensions: 0D, 2D and 3D. ()

△ Remember ■ Understand ● Apply ◊ Analysis *Evaluate ○ Create

- 6- Newtonian (classical) mechanics can fully describe nanoparticles. ()
- 7- Impurities concentrate in the liquid phase than in the solid phase has been used in the zone melting method ()
- 8- The solution which is obtained after filtration is a clear solution. The solution is filtered to remove insoluble impurities. ()
- 9- Rapid growth rate is the advantage of using Czochralski, Bridgman- Stockbarger and Verneuil methods ()
- 10- Czochralski and Bridgman methods both fall under the category of solution growth methods. ()
- 11- Crystals don't grow in cold temperature? ()
- 12- Melt is inside the temperature furnace; solidification occurs at the cooler end describes best the Bridgman-Stockbarger method ()
- 13- Gold nanoparticles have the same yellow color as bulk gold. ()
- 14- Self-assembly fabrication for creating nanostructures is a common example of a bottom-up approach. ()

End of Exam

Best Wishes Prof. Dr. Abdelaziz Abulfadl Abdelaziz
Prof. Dr.
Prof. Dr.

Date : 5 / 1 / 2026 Max. degree (50)	First Semester Exam 2025-2026 Semiconductor Physics and Thin Film Applications (451 Phys.)	Assiut university Faculty of Science Physics Department
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Answer the following questions:

Q. (1): Choose the correct answer from the following (13 degree)

1- Incorporation of impurities into the crystal lattice sites of semiconductor at constant temperature results in: (a) A decrease in electrical conductivity due to the decrease in the concentration of free charge carrier. (b) An increase in electrical conductivity due to the increase in the concentration of free charge carrier. (c) No change in electrical conductivity.	
2- The optical band gap of direct band gap semiconductors such as CdS, ZnO and GaAs can be determined from the extrapolation of straight line portion of: (a) Tauc's plot $[(ah\nu)^2 vs h\nu]$ to $(ah\nu)^2 = 0$, and the intercept with $h\nu$ -axis gives $h\nu = E_g$. (b) The plot of $(ah\nu)^{1/2} vs h\nu$, and the intercept with $h\nu$ -axis gives $h\nu = E_g$ (c) The plot of $(ah\nu)^{3/2} vs h\nu$, and the intercept with $h\nu$ -axis gives $h\nu = E_g$	
3- The general expression for Fermi energy level in an intrinsic semiconductor is (a) $E_f = \frac{E_c+E_v}{2} + \frac{4}{3K_B T} \ln\left[\frac{m_p^*}{m_e^*}\right]$ (b) $E_f = \frac{E_c+E_v}{2} + \frac{3K_B T}{4} \ln\left[\frac{m_p^*}{m_e^*}\right]$ (c) $E_f = \frac{E_c+E_v}{2} + \frac{K_B T}{2} \ln\left[\frac{m_e^*}{m_p^*}\right]$	
4- When the complex refractive index of a semiconductor is given by a relation $n^* = n + ik$ at a certain wavelength λ , hence the absorption coefficient α is: (a) $\alpha = \frac{2\pi k}{\lambda}$ (b) $\alpha = \frac{4\pi k}{\lambda}$ (c) $\alpha = \frac{4\pi}{\lambda k}$	
5- The general expression for the density electrons in an intrinsic semiconductor with an energy gap E_g and $C = 4.83 \times 10^{21}$ is: (a) $n_i = CT^{2/3} \exp\left[-\frac{E_g}{2K_B T}\right]$ (b) $n_i = CT^{2/3} \exp\left[+\frac{2E_g}{K_B T}\right]$ (c) $n_i = CT^{2/3} \exp\left[+\frac{E_g}{K_B T}\right]$	
6- When intrinsic charge carrier concentration (n_i) is $2.5 \times 10^{19}/m^3$, at room temperature 300oC, where $K_B T = 0.026$ eV and $C = 4.83 \times 10^{21}$, hence the estimated forbidden energy gap is: (a) $E_g = 1.44$ eV (b) $E_g = 0.72$ eV (c) $E_g = 1.22$ eV	
7- If the complex dielectric constant of nano-semiconductor compound of particle size 3 nm is given by $\epsilon^* = \epsilon_1 + i\epsilon_2$, then real refractive index n is: (a) $n = \frac{1}{\sqrt{2}} [\{\epsilon_1 + (\epsilon_1^2 + \epsilon_2^2)^{1/2}\}]^{1/2}$ (b) $n = \frac{1}{\sqrt{2}} [\{\epsilon_1 + (\epsilon_1^2 - \epsilon_2^2)^{1/2}\}]^{1/2}$	

8- 3- When the complex refractive index of a semiconductor is given by the relation $n^* = n + ik$ at a certain wavelength λ , hence the reflectivity (R) is given by:

(a) $R = \frac{(n-1)^2+(k+1)^2}{(n+1)^2+(k+1)^2}$ (b) $R = \frac{(n-1)^2+(k)^2}{(n+1)^2+(k)^2}$ (c) $\frac{(n+1)^2+(k+1)^2}{(n-1)^2+(k+1)^2}$

9- The injected excess carriers into a semiconductor, diffuse away from the metal-semiconductor point contact at $x = 0$ and their density decreases exponentially with a distance x by the equation:

(a) $(\Delta n)_x = (\Delta n)_{x0} \exp\left[-\frac{x}{\sqrt{D_n \tau_n}}\right]$ (b) $(\Delta n)_x = (\Delta n)_{x0} \exp\left[-\frac{\sqrt{D_n \tau_n}}{x}\right]$
 (c) $(\Delta n)_x = (\Delta n)_{x0} \exp\left[-\frac{\sqrt{D_n \tau_n}}{x^2}\right]$ Where, $L_n = \sqrt{D_n \tau_n}$ is the electron diffusion length. τ_n the lifetime and D_n is the electron diffusion coefficient

10- If the band gap of CdS photoconductor is 2.4eV, hence wavelength (λ) of the emitted photons due to a direct recombination process of electrons from the conduction band with holes in the valence is:

(a) $\lambda = 526 \text{ nm}$ (b) $\lambda = 625 \text{ nm}$ (c) $\lambda = 517 \text{ nm}$

11- Enhancement of the optical and optoelectronic properties in nanosemiconductor materials can be attributed to:

- (a) Decrease in the nanoparticle size (i.e., quantum size effect) and increase in surface area (i.e., Surface to volume ratio (S/V) of atoms at the nanoparticle surface.
- (b) Increase in the nanoparticle size and a decrease in the surface area of atoms at the nanoparticle surface.

12- Donor impurities in n-type semiconductor introduce localized defect states within the energy band gap:

- (a) Near the conduction band edge.
- (b) At the midpoint of the band gap
- (c) Near the valence band edge

13- In **n-type** semiconductor the optical absorption process at photon energy $h\nu < E_g$ is ascribed to:

- (a) Optical excitation of electron from a donor level to the conduction band.
- (b) Optical excitation of electron from the valence band to a donor levels.
- (c) Optical excitation of electron from the valence band to the conduction band.

Q. 2: Put a sing (✓) in the front of the right sentence and a sign (✗) for the wrong sentence (12 degree)

1- When an electron is captured by an excited center in the band gap containing a hole, or a hole being captured by an excited center containing electron. Then PL emission can be assigned as defect related- PL emission process.

2- To have high efficient photovoltaic cells and photodiodes, it is preferable to use indirect band gap semiconductor materials.

3- The defect states which localized at energy level at the middle of the band gap will be more likely to act as a trapping center than as a recombination center.	
4- Photovoltaic energy conversion depends on the number of photons striking earth surface with energy larger than the band gap of the semiconductor, these photons promote an electron from the valence band to the conduction band.	
5- n-type semiconductor reveals extrinsic photoconductivity due to optical absorption by localized donor atom, accompanied by the creation of excess free holes in the valence band and positive ion bounded to the donor atom.	
6- Under the influence of applied electric field, the intrinsic photoconduction in CdS is ascribed to the optical absorption by host atoms, accompanied by photo generation of a free electrons and holes in conduction and valence band respectively.	
7-The optical band gap of pure semiconductor increases with increasing temperature due to electron-electron and electron -phonon interaction (i.e., scattering process).	
8- The efficiency of amorphous silicon solar cell is higher than that of defect free (pure) single crystalline silicon cell.	
9- According to Franck-Condon principle, PL emission spectrum is usually red-shifted with respect to the optical absorption spectrum, i.e. it lies at long wavelength side.	
10- In Group II-IV nanosemiconductor material such as $Zn_xCd_{1-x}S$ the optical absorption edge blue shifted toward the short wavelength region, with increasing zinc content (molar ratio x), because the optical energy gap of ZnS is larger than that of CdS.	
11- In Group II-IV nanosemiconductor such as $Zn_xCd_{1-x}S$ the optical absorption edge blue shifted toward the short wavelength region, with increasing zinc content (molar ratio x), since the optical gap of ZnS is larger than that of CdS.	
12- UV irradiation of CdS nanostructure (quantum dots) results in increasing in the optical band gap and enhancement in PL intensity ascribed to reduction in a particle size via photo-corrosion process..	

Q.3:

(9 degrees)

(a) Explain the following:

- (1) Trapping and recombination processes of free charge carriers in semiconductors.
- (2) Different types of exciton absorption process in semiconductors.

(b) The complex dielectric constant (ϵ^*) of GaAs semiconductor compound of particle size 4 nm is given by the relation:

$$\epsilon^* = 12 + i6$$

at wavelength $\lambda = 540$ nm. Deduce the real part of refractive index (n), the phase velocity (v), the absorption coefficient (α), and the reflectivity (R).

Q. 4: write accounts only on two of the following (8 degrees)

- (a) Light emitting diode.
- (b) Photodiode and photoconductor.
- (c) Photo-voltaic cells.

Q. 5: (8 degrees)

- (a) Write short accounts on different types of experimental techniques for thin films preparation.
- (b) Deduce an expression for electron concentration in an intrinsic semiconductor.

With my best wishes

Prof. Dr. Mohamed Abd -Elhamed Osman



FIRST TERM FINAL EXAM 2025-2026



SPECIAL TOPICS IN PHYSICS (2) P492

Time. 3h

Date. 22/01/2026

No of Pages. 14

Marks. 50

Section 1: Multiple-Choice Questions

(Marks: 10)

Select the best answer

1. Plasma effects on mammalian cells depend primarily on:
 - a) The color of emitted plasma light
 - b) Exposure time and plasma source
 - c) The type of nutrient medium only
 - d) Body mass index
2. Plasma-induced apoptosis in cells is primarily caused by:
 - a) Low oxygen levels
 - b) Excessive redox stress
 - c) Decreased ATP production
 - d) Protein overexpression
3. The key challenge in plasma medicine dosing is:
 - a) Measuring electrical resistance
 - b) Lack of plasma device comparability
 - c) Lack of medical demand
 - d) Cost of gases
4. Which parameter is most critical in defining plasma safety for medical certification?
 - a) Gas color
 - b) Plasma power and dose
 - c) Device shape
 - d) Operator's experience
5. Electromagnetic emissions from plasma devices must be evaluated to:
 - a) Improve color of plasma
 - b) Ensure safety and avoid interference
 - c) Increase noise
 - d) Reduce gas flow
6. Certification requires characterization of plasma at:
 - a) Source only
 - b) Point of application
 - c) Gas cylinder
 - d) Wall outlet

7. Plasma medicine is mainly an interface between:

- a) Chemistry and biology
- b) Plasma physics and life sciences
- c)) Medicine and pharmacology
- d) Biology and engineering

8. Physical plasma is often called the fourth state of matter because:

- a) It exists only in space
- b) It is electrically neutral
- c) It consists of ionized gas
- d) It is a type of liquid

9. Physical plasma used in medicine is best described as

- a) Liquid portion of blood
- b) Ionized gas with reactive species
- c) Solid-state ion conductor
- d) Dense molecular fluid

10. Cold Atmospheric Plasma (CAP) is characterized by:

- a) High temperature and low pressure
- b) Low T and P
- c) No reactive species
- d) Exclusive UV radiation

11. One major advantage of CAP in wound healing is:

- a) Increased tissue necrosis
- b) Reduction of immune response
- c) Modulation of redox signaling & stimulation of regeneration
- d) None of the above

12. Plasma sources for biomedical applications include:

- a) DBD and plasma jets
- b) Only thermal plasma devices
- c) Blood analyzers
- d) None of the above

13. The main biologically active components in CAP are:

- a) Heavy metals
- b) Reactive O and N species
- c) Nutrients
- d) Carbohydrates

14. Which of the following is 'not' a component typically produced by cold atmospheric plasma?

- a) UV radiation
- b) Reactive oxygen species
- c) Reactive nitrogen species
- d) Carbohydrates

15. The main gas commonly used in plasma generation for medical use is:
 a) Argon b) Chlorine c) Methane d) Hydrogen
16. The first evidence of non-lethal plasma effects on cells was demonstrated by:
 a) Newton b) Eva Stoffels' group
 c) Einstein d) Faraday
17. One main difference between thermal and non-thermal plasma is:
 a) Temperature b) Gas composition only
 c) Only used in vacuum d) No reactive species in non-thermal plasma
18. The effectiveness of plasma in wound healing is due to:
 a) Increased inflammation b) Modulation of redox balance
 c) Tissue dehydration d) Ion suppression
19. Plasma jets operate by:
 a) Heating metal electrodes b) Applying electrical energy to flowing gas
 c) Chemical combustion d) Laser-induced gas excitation
20. The primary factor determining biological response to CAP is:
 a) Gas color b) Treatment duration
 c) Electrode shape only d) Environmental humidity
21. Plasma-induced apoptosis in cancer cells is mainly due to:
 a) Increased nutrient uptake b) Excessive ROS/RNS generation
 c) DNA repair stimulation d) Reduction in membrane permeability
22. DBD plasma devices operate by:
 a) Continuous DC current between two metal rods
 b) AC voltage causing micro-discharges across a dielectric barrier
 c) Magnetizing air molecules
 d) High-temperature arc formation
23. Which reactive species are most monitored for certification?
 a) CO_2 and H_2 b) N_2 only c) O_3 only d) ROS and RNS

24. In indirect plasma applications, plasma is used to:
- a) Directly treat human tissue
 - b) Ionize blood plasma
 - c) Modify surfaces or liquids before medical use
 - d) Replace antibiotics systemically
25. Plasma-treated liquids retain biological activity due to:
- a) Long-lived reactive species
 - b) Suspended bacteria
 - c) Residual heat
 - d) Increased viscosity
26. Which of the following best defines physical plasma?
- a) Liquid component of blood
 - b) Ionized gas containing charged particles
 - c) Fully ionized solid
 - d) High-temperature metal vapor
27. Which species play a key role in plasma-cell interactions?
- a) Carbohydrates
 - b) Reactive oxygen and nitrogen species
 - c) Lipids
 - d) Proteins only
28. Plasma dose mainly depends on:
- a) Room temperature
 - b) Treatment time and distance
 - c) Skin moisture
 - d) Gas tank size
29. Cold atmospheric plasma (CAP) is primarily used because it operates at:
- a) High pressure and high temperature
 - b) Low pressure and high temperature
 - c) Atmospheric pressure and low temperature
 - d) Vacuum pressure only
30. Plasma-based sterilization is advantageous because:
- a) It leaves no toxic residues
 - b) It is only effective on metals
 - c) It requires high heat
 - d) Microorganisms quickly develop resistance
31. A major clinical application of CAP is:
- a) Orthopedic surgery replacement
 - b) Enhancing wound healing
 - c) Increasing blood pressure
 - d) Muscle stimulation

- 32.** Which of the following plasmas is suitable for direct medical application?
- a) Thermal plasma
 - b) High-pressure plasma
 - c) Cold atmospheric plasma
 - d) Nuclear plasma
- 33.** Cold atmospheric plasma is preferred in medicine because it:
- a) Produces high heat
 - b) Is non-reactive
 - c) Is tissue compatible
 - d) Is radioactive
- 34.** Which species play a dominant role in biological plasma effects?
- a) Electrons only
 - b) UV photons
 - c) Ions only
 - d) Reactive oxygen and nitrogen species
- 35.** Which application is considered an indirect plasma application?
- a) Wound healing
 - b) Cancer therapy
 - c) Surface modification of implants
 - d) Blood coagulation
- 36.** Plasma medicine research requires cooperation between:
- a) Physics only
 - b) Medicine only
 - c) Physics, life sciences, and medicine
 - d) Chemistry and engineering
- 37.** Which effect is considered lethal for cells?
- a) Cell migration
 - b) Angiogenesis
 - c) Apoptosis
 - d) Cell differentiation
- 38.** Plasma poration refers to:
- a) Permanent membrane damage
 - b) Reversible membrane permeabilization
 - c) DNA mutation
 - d) Protein denaturation
- 39.** The transcription factor Nrf2 is mainly involved in:
- a) DNA replication
 - b) Antioxidant defense
 - c) Cell division
 - d) Protein synthesis
- 40.** Which plasma application is already a clinical reality?
- a) Cancer therapy
 - b) Plasma pharmacy
 - c) Wound healing
 - d) Ophthalmic surgery

Section 2: True or False:

(Marks: 5)

Classify the following statements as true (T) or false (F).

1. Cold atmospheric plasma can be generated at atmospheric pressure. (T/F)
2. Plasma-generated ROS are similar to those in normal cell metabolism. (T/F)
3. Plasma medicine is a purely medical discipline. (T/F)
4. Plasma can inactivate antibiotic-resistant microorganisms. (T/F)
5. Resistance of microorganisms to plasma has been observed. (T/F)
6. Low plasma doses can stimulate cell proliferation. (T/F)
7. High plasma doses always improve wound healing. (T/F)
8. Nrf2 activation helps protect cells from oxidative stress. (T/F)
9. Plasma treatment always causes DNA mutations. (T/F)
10. Plasma-supported wound healing includes antimicrobial effects. (T/F)
11. Plasma therapy relies mainly on thermal effects. (T/F)
12. Treatment time is currently the main control parameter in plasma medicine. (T/F)
13. Plasma medicine has no future applications beyond wound healing. (T/F)
14. CAP can stimulate cell proliferation at low treatment doses. (T/F)
15. All plasma sources generate identical biological effects. (T/F)
16. Plasma medicine combines physics, life sciences, and clinical medicine. (T/F)
17. Reactive species produced by CAP also exist in normal cell physiology. (T/F)
18. CAP always causes irreversible DNA damage. (T/F)
19. Plasma-generated ROS can be neutralized by normal cellular antioxidant systems.
(T/F)
20. CAP devices all produce identical dosages regardless of configuration. (T/F)
21. The biological effects of CAP depend strongly on treatment time. (T/F)
22. Plasma-treated liquids can retain temporary biological activity. (T/F)
23. All cell types respond identically to plasma exposure. (T/F)