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Republic of Iraq
Ministry of Higher Education and
Scientific Research
University of Baghdad
College of Science
Astronomy & Space Department



Scientific Competitive Exam
for M.Sc. Program Applicants
(2018-2019)

Examination Time : 3 Hours

Examination Date : 24th June 2018

Name :

Signature:

Question No.	Mark (Number)	Mark (Written)	Signature
Q.1			
Q.2			
Total Mark			
Out of	100	Hundred	

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Name :

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Q1: Select the correct answer for the following - Multi-Choice Questions (MCQs):

- How did Rutherford revise ideas about the distribution of positive charge in an atom?
 - Compared with the 'plum pudding' model.
 - Rutherford suggested that the charge was evenly spread throughout the atom.
 - Rutherford suggested there was no positive charge in the atom.
 - Rutherford suggested that the positive charge was concentrated in the center of the atom.
- Which of the following statements does not form part of Bohr's model of the hydrogen atom.
 - Energy of the electrons in the orbit is quantized
 - The electron in the orbit nearest the nucleus has the lowest energy
 - Electrons revolve in different orbits around the nucleus
 - The position and velocity of the electrons in the orbit cannot be determined simultaneously
- A basic postulate of Einstein's theory of relativity is:
 - Moving clocks run more slowly than when they are at rest
 - Moving rods are shorter than when they are at rest
 - Light has both wave and particle properties
 - The laws of physics must be the same for observers moving with uniform velocity relative to each other
 - Everything is relative
- No two electrons in the same atom can have identical set of four quantum numbers. This statement is known as?
 - Hund's rule
 - Pauli's Exclusion principle
 - Selection rule
 - Binding Energy

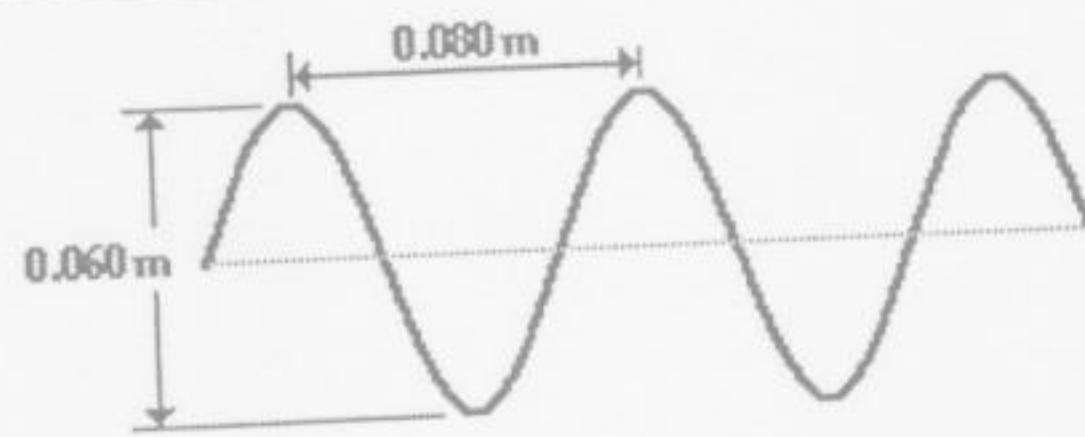
True	False

5. In Hydrogen spectrum, which one of the following series lies in the ultraviolet region?
 a. Ballmer series b. Pfund series c. Lyman series d. Bracket series

6. Atomic mass of an element is equal to the sum of?
 a. Electron and proton b. Proton and neutron
 c. None of the above d. Electron and neutron

7. As a wave passes across a boundary into a new medium, which characteristic of the wave would NOT change?
 a. speed b. frequency c. wavelength

8. What is the amplitude of the wave in the diagram below?



a. 0.03 m b. 0.04 m c. 0.05 m d. 0.06 m

9. How many complete waves are shown in the diagram?



a. 1 b. 2 c. 3 d. 1.5

10. Which phenomenon is produced when two or more waves passing simultaneously through the same medium meet up with one another?

a. refraction b. diffraction c. interference d. reflection

11. The Doppler effect produces apparent changes in

a. loudness b. frequency c. amplitude d. velocity

12. Which of the following is propagated by waves:

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

13. Whole world can be covered with

a. 2 geo-stationary satellites b. 3 geo-stationary satellites
 c. 4 geo-stationary satellites d. 0 geo-stationary satellites

14. The perturbation not effect on the HEO of satellite is

a. 12 b. other body attraction c. SRP d. Atmospheric drag

15. A/m for low Earth satellite is it's velocity .

a. increase b. decreas c. not effect

True	False

16. One satellite covers longitude of earth up to

- a. 90° b. 120° c. 150° d. 180°

17. GPS consists of

- a. 25 earth satellites b. 24 earth satellites
c. 12 earth satellites d. 36 earth satellites

18. Velocity of geostationary satellite with respect to earth is

- a. 15 m.s⁻¹ b. 10 m.s⁻¹ c. 5 m.s⁻¹ d. 0 m.s⁻¹

19. The kernel of Walsh transformation g(4,2) for 8 points function is:

- a. (8) b. (-8) c. ($\frac{1}{8}$) d. ($-\frac{1}{8}$)

20. Suppose that an image of size 64x64 with 96 gray levels has to be transmitted from place to another. The number of bytes will be required

- a. 3485 b. 3845 c. 3584

21. The third coordinate Z-axis, depth in the real world can be computed by stereoscopic imaging technique which is given by:

- a. $Z = \lambda - \frac{\lambda B}{x_2 - x_1}$ b. $Z = \lambda + \frac{\lambda B}{x_2 - x_1}$ c. $Z = \lambda - \frac{\lambda B}{x_2 + x_1}$

22. The half function of the Fast Fourier transform algorithm is given by:

- a. $F(u) = \frac{1}{2} [F_{even}(u) - F_{odd}(u)]$ b. $F(u) = \frac{1}{2} [F_{even}(u) + F_{odd}(u)]$
c. $F(u) = \frac{1}{2} [F_{even}(u) + F_{odd}(u)W_{2M}^u]$

23. The forward equation of KL- transform is

- a. $y=A(x-m_x)$ b. $y=A(x+m_x)$ c. $y=x(A-m_x)$

24. If the following matrix represents the inverse perspective transformation of an image system:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0.2 & 1 \end{bmatrix}$$

How long is the focal length of lens?

- a. 2 b. 5 c. 10

25. The planets viruses in position and brightness with time and have a phases as

- a. Venous b. Mars c. Jupiter d. Neptune.

True	False

26. The orbital elements which represent the orbital size are
 a. semi major axis (a) and eccentricity (e). b. Ω and ω c. inclination(i) and period(T).
27. The space observation is best of the Earth observation because
 a. the sky is near. b. the star not set. c. all the electromagnetic field resaved.
28. Sidereal time = .997(.....) + To.
 a. GMT b. LT c. LST.
29. The Moon declination change as
 a. ± 5 deg. b. ± 23.5 deg. c. ± 28 deg
30. To transfer the ecliptic coordinates to equatorial coordinates we need
 a. the observer latitude b- the inclined angle of the ecliptic plain c- The sidereal time.
31. The observer with latitude 30° S see the sky and the stars in the sky.
 a. all sky b. south sky c. some of north and all south sky
32. The Moon declination change between
 a. ± 5 deg. b. ± 23.5 deg. c. ± 28 deg
33. The collar of star depend on
 a. star luminosity b. star temperature. c. star distance.
34. The sidereal month equal day.
 a. 27.3 b-29.54 c-27.56 d- 30 or 29
35. The observer with latitude 90° N see the sky and the stars in the sky.
 a. all sky b. south sky c- some of north and all south sky d. all north sky
36. The planet may be show as crescent is
 a. Mars b. Saturn. c. Venous.
37. A large galaxy contains mostly old (Pop II) stars spread smoothly throughout its volume, but it has little dust or gas. What type galaxy is it most likely to be?
 a. Irr b. S c. E d. All of the above are possible
38. The Milky Way belongs to a cluster with about 40 members. Does the Milky Way belong to a rich or poor cluster?
 a. Rich b. Poor

True	False

39. What is the name of the galaxy cluster to which the Milky Way belongs?
 a. The Local Group b. M31 c. The Sagittarius Cloud d. The Scorpius Group
40. About 1% of all galaxies show signs of activity in their cores. What are some signs of an active galaxy?
 a. the core is very bright b. the core is very small
 c. spectra of the core show it contains lots of uranium d. All of the above except C
41. What theory do astronomers think explains the activity in galaxies ?
 a. The explosion of a supermassive star
 b. A chain reaction of supernovas
 c. A supermassive black hole
 d. Astronomers have no ideas at all to explain active galaxies
42. QSO's are among the most distant objects we know. How do we know they are so far away?
 a. Their spectrum shows a very high blueshift.
 b. Their spectrum shows a very high redshift.
 c. Their parallax is extremely small.
 d. None of the above are relevant.
43. If the time difference between the thunder and the lightning is 0.2sec. So, the distance between the observer and a cloud is:
 a. 63m b. 64m c. 65m d. 66m
44. The optical path of light passing through 10cm of oil ($n_{oil}=1.47$) is:
 a. 14.9cm b. 14.8cm c. 14.7cm d. 14.6cm
45. If an apex angle of prism is 45° and the index of refraction is 1.6. So, the minimum deviation angle of prism (δ_m) is:
 a. 27° b. 28° c. 29° d. 30°
46. The critical angle (θ_c) for a glass ($n_{glass}=1.5$) and air ($n_{air}=1$) surface is:
 a. 44° b. 43° c. 42° d. 41°
47. The formula of bright fringe of Fresnel's bi prism experiment is:
 a. $X_n = n\lambda D/d$ b. $X_n = n\lambda d/D$ c. $X_n = d/n\lambda D$ d. $X_n = nD/\lambda d$
48. The refractive index of the water is:
 a. 2.13 b. 1.23 c. 1.33 d. 2.33

True	False

49. If k is constant and r is the distance, then the simple Harmonic Oscillator (SHO) potential V_{SHO} is given by:

- a. $V_{SHO} = k/r$ b. $V_{SHO} = k/r^2$ c. $V_{SHO} = k r$ d. $V_{SHO} = k r^{1/2}$

50. If h is Planck's constant and p is the momentum, then De Broglie wavelength λ_d is given by:

- a. $\lambda_d = h/p$ b. $\lambda_d = p/h$ c. $\lambda_d = h p$ d. $\lambda_d = h p^2$

51. Ionization potential of Hydrogen atom on the ground state is:

- a. 12.5 eV b. 15.1 eV c. 13.6 eV d. 16.3 eV

52. If \hat{T} is the kinetic energy operator and \hat{V} is the potential operator, then the Hamiltonian operator \hat{H} is given by:

- a. $\hat{H} = \hat{T} - \hat{V}$ b. $\hat{H} = \hat{T} + \hat{V}$ c. $\hat{H} = \hat{T} + 2\hat{V}$ d. $\hat{H} = \hat{T} - \hat{V}$

53. If $\psi = 1/r^2$ then $\nabla\psi$ is given by:

- a. $\frac{-2}{r}$ b. $\frac{2\pi(r-1)}{r^2}$ c. $\frac{-2}{r^3}$ d. $2\pi r$

54. The canonical commutation relation $[\hat{x}, \hat{p}_x]$ results:

- a. $-i\hbar$ b. $i\hbar$ c. $2i\hbar$ d. $\frac{\hbar}{2}$

55. Radio astronomical Flux density unit is called -----

- a. watt b. gauss c. jansky .

56. The atmosphere radio window lower frequency limit of -----

- a. 15 KHz b. 15 MHz c. 15 Hz

57. The first amplifier in cascading must be -----

- a. Lowest noise temperature
b. highest noise temperature
c. middle noise temperature

58. Range of radio L band in wavelengths (cm) is -----

- a. 30-15 b. 3.75-2.4 c. 15-7.5

59. A best bolometer for radio astronomy having ----- thermal time constant.

- a. Long b. very long c. short

60. The time rotation of Jupiter is -----

- a. 3.325 hours b. 6.625 hours c. 9.925 hours

True	False

21. The lunar eclipse happen when the Moon
22. The Sun electromagnetic wave received on the Earth surface is
23. The Sun position in Milky way Galaxy is from the Galaxy center.
24. The P-P chain is
25. Spiral galaxies are divided into two sequences
26. Elliptical galaxies refer toin Hubble classification.
27. The star formation rate in the elliptical galaxies isthat in the Irregular galaxies.
28. Galaxies are often found in groups called
29. The departures of the actual image from the predictions of first order theory are called
30. Diffraction divided into two types is and diffraction.
31. A telescope whose primary element is a mirror is called
32. The type of the two coherent sources of Young's experiment is
33. Write down Time Independent Schrödinger Equation in Cartesian Coordinates for One Dimension.
34. If the principal quantum number for Hydrogen atom is $n = 3$, then what are the values of the orbital angular momentum quantum number l ?
35. A photon with wavelength $\lambda = 500 \text{ nm}$. Find its energy in electron volts (eV).
36. A particle in a box has the energy value $E_n = \frac{n^2 h^2}{8 m L^2}$ where n is the principal quantum number, h is Planck's constant, m is the particle's mass, and L is the box length. Find the variation of the energy with L .
37. The purpose of a phase lock loop (PPL) -----
38. The solution of differential equation of transfer is -----
39. The time revolution of Jupiter Io moon is -----
40. A radio telescope with 3 meter dish is small telescope. (Yes or No). -----

Wishing You All the Best

True	False

Q2: Answer the following (Short Answer)

1. The electrons were discovered by.....
2. The maximum number of electrons that can be accommodated by p - orbital is
3. The energy required to remove electron from an atom is called.....
4. Reverse process of photo electric effect is
5. The period of a pendulum depends on its.....
6. In transverse waves, the motion of the particles is, to the direction of propagation of the wave.
7. The main factor which effects the speed of a sound wave is the
8. A period of 0.005 seconds would be equivalent to a frequency of Hz.
9. A satellite with semi major axis = 1500 km, and eccentricity = 0.1, the distance at apogee is
10. Navigational satellites are used in
11. The delay time for satellite transmissions from earth transmitter to earth receiver is
12. The satellite orbit types depend on high are.....
13. The convolution of two functions is defined by
14. Sobal operator is used for
15. The auto correlation function is given by
16. If the following represent the homogeneous world coordinate vector:
$$W_h = [400 \quad 300 \quad 0 \quad 100]$$
then, the coordinates of image point (x,y) is
17. Equation of time is
18. Kepler third law is $T^2 =$
19. The sun declination variation through the year is between
20. Julian day is

<u>True</u>	<u>False</u>