# اختر الإجابة الصحيحة ( لكل جملة درجة واحدة)

1) The strongest force in the nature is

(A) Magnetic force       (B) Nuclear force

(C) Electric force       (D) Gravitational force

2) Neutron was discovered by

(A) Rutherford       (B) James Chadwick

(C) J.J. Thomson       (D) Henry Becquerrel

3) Hydrogen bomb is based upon the principle of

(A) Controlled nuclear fission       (B) Nuclear fission

(C) Nuclear fusion       (D) None of the above

4) A good moderator should

(A) Not be a gas only       (B) Not have appetite for neutrons only

(C) Be light in mass number only       (D) Be all above three

5) The main source of solar energy is

(A) Combustion    (B) Nuclear fission   (C) Nuclear fusion   (D) None of these

6) Nuclear forces are

(A) Long range       (B) Spin dependent

(C) Charge dependent       (D) None of these

7) In nuclear fission, the percentage of mass converted into energy is about

(A) 10%    (B) 0.01%    (C) 0.1%    (D) 1%

8) When the speed of electrons increases, then the value of the specific charge on an electron

(A) Increases    (B) Decreases    (C) Remains unchanged    (D) None of these

9) The size of atom is of the order of

A. $10^{-14}$ m    B. $10^{-12}$ m    C. $10^{-10}$ m    D. $10^{10}$ m

10) $X^{210}$ has half life of 5 days. The time taken for seven-eights of sample of $X^{210}$ to decay is

A. 15 days    B. 20 days    C. 10 days    D. none

11) Electrons emitted in the photoelectric effect from a metal surface.

A. if incident radiation frequency is above a certain threshold value

B. if the temperature of the surface is high

C. at a rate independent of the nature of the metal

D. None of the above

12) Cathode rays are made up of electrons. Anode rays are made up of

A. Protons only    B. Protons and positrons only

C. Positive residence of atom    D. All positive particles of atom

13) A strong argument for the particle nature of cathode rays is that they

A. Travel through vacuum .    B. Produce fhorescence

C. Cast shadow    D. Get deflected in magnetic field

14) The number of electrons in an atom of Z and A is

A. A    B. Z    C. A-Z    D. none

15)The half - life of a radioactive element which has only 1 / 32 of its original mass left after lapse of 60 days us

   A.12 days    B.32 days    C.60 days    D.64 days

16)The fuel used in nuclear power plants is

   A.U – 235   B.U – 238    C.U – 236    D. U - 239

17)Fusion reaction occures at high temperature because

   A.Atoms are Ionized at high temperature

   B.Molecules break up at high temperature

   C.Nuclei break up at high temperature

   D.Kinetic energy overcomes repulsion at high temperature

18)One-sixteenth of a radioactive substance remains undecayed after two hours. The half-life of the substance is

   A.15 min     B.45 min     C.30 min     D.60 min

19)A proton of mass m is moving with the velocity C, its mass will be

   A.Unchanged    B.Large but finite    C.Infinite    D.Zero

20)One atomic mass unit is equal to

   A.Mass of one hydrogen atom        B.Mass of one atom of $_6C^{12}$

   C .1 / 12 th of the mass of one atom of $_6C^{12}$   D.None of the above

21)What was the fissionable material used in the bomb dropped at Nagasaki (Japan) in the year 1945 ?

   A.Uranium   B.Plutonium    C.Neptunium    D.None of these

22)Energy transferred to a person by gamma is measured in units of

   A.Cuaries    B.B. Rutherfords    C. Roentgens    D. None of these

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    (A) 10%    (B) 0.01%    (C) 0.1%    (D) 1%

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23)In the photoelectric effect, electrons are emitted

   A.At a rate that is independent of the emitter

   B.At a rate proportional to the square amplitude of  incident radiation

   C.With a velocity proportional to the frequency of incident radiation

   D.Only if the frequency of the radiation is above a threshold value

24)A photo sensitive material would emit electrons, if excited by photons beyond a threshold. To overcome the threshold, we increase

   A.The voltage applied to the light source   B.Intensity of light

   C.The wavelength of light          D.The frequency of light

25)Compton effect is associated with

   A.Positive rays   B.$\beta$ – rays   C.$\gamma$ – rays   D.X - rays

26)Photoelectric effect can be explained by assuming that light

   A. Is a form of transverse wave
   B. Is a form of longitudinal wave
   C. Can be polarised
   D. Consists of quanta

27)Einstein's mass energy relation is given by the expression

   A. $E = 1 / 2\ mv^2$
   B. $E = mc^2$
   C. $E = mgh$
   D. none of these

28)The dual nature of light is exhibited by

   A. Diffraction and photoelectric effect
   B. Diffraction and reflection
   C. Refraction and interference
   D. Photoelectric effect

29) Which of the following will deflect in electric field

   A.Y – rays   B.X – rays   C.Cathode rays   D.Ultraviolet rays

30)The mass defect per nucleon is equivelant to

a. Binding energy          B.Packing fraction

C.Ionization energy          D.Excitation energy

31)The important conclusion given by Millikan's experiment about the charge is

A.Charge is never quantized     B.Charges has no definite value

C.Charge is quantized     D.Charge on oil drop always increases

32)Atomic power plant works on the principle of

. A.Fission    B.Fusion    C.Thermal combustion    D.Combined effect of all

.33)The mass energy relation is the out come of

A.Quantum theory     B.General theory of relativity

C.Field theory of relativity     D.Special theory of relativity

34)Curie is a unit of

A.Energy of gamma rays     B.Half-life

C.Intensity of gamma rays     D.Radioactivity

35)Which of the particles has similar mass to that of the electron ?

A.Proton    B.Neutron    C.Positron    D.Neutrino

36)The cause of fractional atomic weights of elements is the presence of

A.Isobars    B.Isotopes    C.isotones    D.None of these

37)The maximum number of photo electrons released in photocell is independent of

A.Nature of the cathode surface    B.Frequency of incident ray

C.Intensity of radiations incident on cathode surface

D.None of the above

38)Gamma rays are

A.Single ionized gas atom        B.Helium nucleus

C.Fast moving electron        D.Electromagnetic waves

39)Nuclear forces are mediated by

A.Proton        B.Neutron        C.Meson        D.Electron

40)In which of the following decays, the atomic number decreases

A.$\beta^-$ - decay        B. $\beta^+$ - decay        C.$\alpha$ – decay        D.b and c both

41)Energy is generated in the sun due TO

a. fusion        b. fission        c.Radioactivity        d.Artificial radioactivity

42)In a discharge tube, ionization of enclosed gas is produced due to collisions between

A. Neutral gas atoms / molecules
B. Positive ions and neutral atoms / molecules
C. Negative electrons and neutral atoms / molecules
D Photons and neutral atoms / molecules

43)Which of the following is wrongly matched ?

A.Barometer – pressure        B.Lactometer - milk

C.Coulomb's law – charges        D.Nuclear reactor - electron

44)Heavy water is used as a moderator in a nuclear reactor. The function of the moderator is

A. To control the energy released in the reactor
B To absorb neutrons and stop the chain reaction
C. To cool the reactor
D. To slow down the neutrons to thermal energy

45)Which of the following has the longest de Broglie wavelength if they are moving with same velocity ?

A.Neutron        B.Proton        C.$\alpha$ – particle        D.$\beta$ - particle

46)In a nuclear reactor, cadmium rods are used to

A.Speed up neutrons

B.Slow down neutrons

C.Absorb neutrons

D.Produce neutrons

47)Quantum effects are important only when observing

A. small objects

B. very large objects

C. atomic spectra

D. atomic size objects

48)According to the special theory of relativity which one is not an absolute quantity?

A. Time and mass   B. mass   C. height   D. none of above

49) An inertial frame of reference is frame

A. in which first law of motion and inertia is valid

B. inertia is valid

C. which is not moving with uniform velocity

D. both a and b

50) A device based on photoelectric effect is called

A. Photosensitive detection      B. Photo diode

C. Photosynthesis            D. Photocell

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

# Question № 1 (15 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) light & 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 stars are not eternal because its transformations from:
    (A) Mass to energy      (B) Energy to mass      (C) All of the above

5. Atoms are not eternal because of…
    (A) its death      (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 of 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-When light is reflected or scattered by bodies, we see : (A) light   (B)  bodies   (C) Spectrum

10. light can be considered as….so it is treated in geometrical way (A) particles   (B) waves   (C) energy

11. light Reflects when falling on a smooth glossy surface, which forces us to deal with it as
    (A) particles      (B) waves      (C) energy

12. Light diffracts when it passes through very narrow slit which forces us to treat it as :
    (A) particles      (B) waves      (C) energy

13-The interaction of light with a sensitive material can only explained by considering
    the light as:      (A) particles      (B) waves      (C) energy

14-when we use the words "colors, refractive index",  we are talking in ….. Language
    (A) particulate      (B) Wavelike      (C) quantum

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

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

17. The greater the refractive index of the heavy medium, the …… the refractive angle.
    (A)Greater      (B)Smaller

18. The greater the refractive index of the heavy medium, the …. the refracted beam from the vertical:
    (A)Closer      (B) Further

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

(1)

19. Both reflection and refraction of light –together- can't be treated unless considering light as...
(A) Particles          (B)Waves          (C)Photons

20-When shadows appear, this means that the light may be: (A) Particles      (B)Waves      (C)Photons

21. Superposition of two waves have the same amplitude, frequency,......
(A) Interference          (B)Diffraction          (C)Polarization

22. .interference occurs when the maxima of two waves add together (A) Constructive    (B)Destructive

23. Brightness or darkness depend on: (A)Path difference    (B)Phase difference    (C)all the above

24. when natural light falls on thin film separating two different media, we get:
(A)Polarization          (B)Refraction and reflection    (C) all the above

25. Double refraction through a calcite crystal indicates the occurrence of :
(A)Polarization          (B)Interference    (C)Refraction and reflection

26.Spontaneous emission is characterized in:(A) Phase difference  (B)Destructive Interference  (C)all the above

27. Stimulated emission is characterized in: (A)Constructive Interference  (B)Coherence  (C) all the above

28.Light amplification by stimulated emission of radiation is: (A)Laser  (B)Maser    (C)leather

29. Laser is ultra-pure because it is:  (A)Mono Wavelength    (B)Monochromatic    (C)all the above

30. The best light to be used with the Mono-mode fiber is: (A) ordinary light   (B) LASER  (C) X-ray

| 19 | 20 | 21 | 22 | 23 | 24 |
|----|----|----|----|----|----|
|    |    |    |    |    |    |
| 25 | 26 | 27 | 28 | 29 | 30 |
|    |    |    |    |    |    |

# Question № 2 (20 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. Our mission - only - is to follow the behaviors and actions of the universe to produce what we need
5. The progress in using behaviors is enormous, while progress in understanding is small
6. With his knowledge, man was able to destroy matter into nothingness
7. One of the meanings of the law of the conservation is that: What God creates, man cannot destroy into nothingness
8. Einstein's equation united matter and energy, so there is no substance without energy.
9. Any amount of mass, no matter how small, contains an enormous amount of energy
10. Energy has no priority over mass or mass over energy

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
|   |   |   |   |   |   |   |   |   |    |

(2)

11. The origins of the universe, in order, are: Noor –light - radiation - energy – matter

12. Vision requires- only -  the presence of: *light Source, vision instrument*

13. When light is reflected or scattered by bodies, we see the bodies

14. Light *can be considered as* a particle, *so it is treated in geometrical way*

15. We can use the light in life applications as a result of our knowledge of its behaviors

16. Light Reflects when falling on a smooth glossy surface, which forces us to deal  with it as a wave.

17. The greater the refractive index of the heavy medium, the smaller the refractive angle.

18. Both reflection and refraction of light –together- can't be treated unless considering light as a photon

19. Glass has a single index of refraction
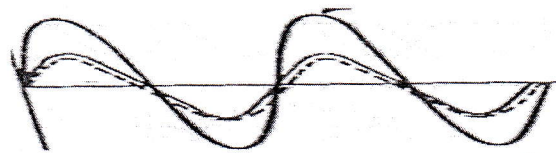
20. Calcite has two indices of refraction

| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----|----|----|----|----|----|----|----|----|----|
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# Question № 3 (9 degrees)
## Mark  the right choice:
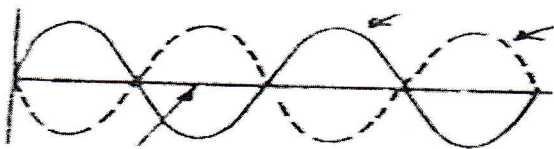


- ◯ destructive interference
- ◯ Constructive interference
- ◯ Path difference= $(n + 1/2)\lambda$
- ◯ Path difference  $=n\lambda$
- ◯ Angular difference= $2n\pi$
- ◯ Angular difference= $(2n + 1)\pi$

- ◯ Constructive interference
- ◯ destructive interference
- ◯ Path difference $=n\lambda$
- ◯ Path difference= $(n + 1/2)\lambda$
- ◯ Angular difference= $2n\pi$
- ◯ Angular difference= $(2n + 1)\pi$

. (3)

# Question № 4 (6 degrees)

**Circle the wrong word or words and correct them in the specified place**

1. Nature is a science that studies the created universe
2. A small amount of mass, contains a small amount of energy
3. Heat transfer in the universe can happen from cold to hot
4. When light is reflected or scattered by bodies, we see the light.
5. Spectra emitted from some materials help us learn something about light
6. Glass has two indices of refraction

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
|   |   |   |   |   |   |

انتهت الأسئلة مع التمنيات بالتوفيق _____ Best Wishes _____ حسام وحيد

| | | |
|---|---|---|
| **Assiut University** | **General Physics 2** | **Final term exam** |
| **Faculty of Science** | | **4/9/2022** |
| **Department of Physics** | | **Time Allow: 2 hours** |

**I- (1.5) mark for each question**

1- The symbol $k=1/4\pi\varepsilon_0$ appears in Coulomb's law because we use independently defined units for

a. force and distance.  b. charge.

c. charge and distance.  d. force, distance and electric charge.

2- The electric field resulting from electric force acting on an electron placed in the field is given by

(a) mge  (b) mg/e  (c) e/mg  (d) $e^2g/m^2$

3- Equipotentials are lines along which

a. the electric field is constant in magnitude and direction.

b. the electric charge is constant in magnitude and direction.

c. maximum work against electrical forces is required to move a charge at constant speed.

d. a charge may be moved at constant speed without work against electrical forces.

4- The figure here shows electric field lines. The electric field strength at $P_1$ is $E_1$ and that at $P_2$ is $E_2$. If distance between $P_1$, $P_2$ is r, then which of the following statement is true?



(a) $E_1 > E_2$  (b) $E_1 < E_2$  (c) $E_2 = rE_1$  (d) $E_2 = E_1/r^2$

5- When introduced into a region where an electric field is present, an proton with initial velocity v will always move

a. along an electric field line, in the positive direction of the line.

b. along an electric field line, in the negative direction of the line.

c. from a point at a positive potential to a point at a negative potential.

d. from a point at a negative potential to a point at a positive potential.

6. A hollow metal sphere of radius 5 cm is charged so that the potential on its surface is 10 V. The potential at the center of the sphere is

(a) 0 V          (b) Same as at point 5 cm away from the surface          (c) Same as on its surface

(d) Same as at point 10 cm away from the surface

7. If 5 J of work is needed to shift 10C of charge from one place to another. The potential difference between the places should be
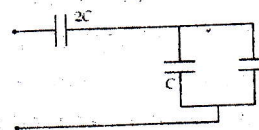
a.  10 V                    b.  2 V                    c.  5 V              d.  0.5 V

8- A parallel plate capacitor with separation d, voltage $V_0$ and charge of $Q_0$. The plates are pulled apart to a separation 2d without discharging them. The charge on the plates and the potential difference between them are

a. 1/2 $Q_0$, 1/2 $V_0$        b. $Q_0$, 1/2 $V_0$   c. $Q_0$ , 2$V_0$       d. 2$Q_0$ , 2$V_0$

9- The equivalent capacitance of the circuit shown below is
a. 0.5 C.          b. 1 C.          c. 1.5 C.          d. 2 C.

10- Light bulb A is rated at 60 W and light bulb B is rated at 100 W. Both are connected in parallel to 110 V. Which statement is correct?
a. The 60 W bulb has a greater resistance and greater current than the 100 W bulb.
b. The 60 W bulb has a greater resistance and smaller current than the 100 W bulb.
c. The 60 W bulb has a smaller resistance and smaller current than the 100 W bulb.
d. The 60 W bulb has a smaller resistance and greater current than the 100 W bulb

11- The circuit below contains three 100W light bulbs. Which current in bulb(s) is (are) greatest?
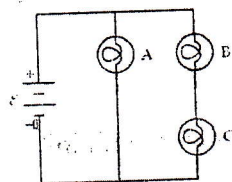
a. A     b. B    c. A, B and C          d. B and C

12. Which, among the following qualities, is not affected by the magnetic field?
a) Moving charge                              b) Change in velocity charge
c) Current flowing in a conductor        d) Stationary charge

II- (2.5) marks for each question

13-Two capacitors of 25 µF and 5 µF, are connected in parallel and charged by a battery of 100 V. What is total stored in the two capacitors.
a.  1.50 J          b.  0.75 J          c.  0.15 J          d.  0.30 J

14- What is the capacitance of a parallel plate capacitor having plates of area $1.5 \text{ m}^2$ that are separated by 0.02 mm of rubber with dielectric constant 6.7 ($\epsilon_0 = 8.85 \times 10^{-12}$ F/m).

a. 4.4 μ F     b. 3.4 μ F     c. 2.4 μ F     d. 1.4 μ F

15- A lightbulb has a tungsten filament with a resistance of 19Ω at 20°C. The resistance becomes 140Ω when the filament is hot. Find the temperature of the hot filament ($\alpha = 4.5 \times 10^{-3}$ °C$^{-1}$).

a. $1.44 \times 10^2$ °C     b. $1.44 \times 10^3$ °C     c. $1.44 \times 10^4$ °C     d. $1.44 \times 10^5$ °C

16- A spherical conductor has a radius of 14 cm and charge of 26 C. Calculate the electric field and the electric potential at a point of 10 cm from the center.

a. 1 N/C and $3.64 \times 10^6$ V     b. -1 N/C and $1.17 \times 10^6$ V

c. 0 N/C and $1.67 \times 10^6$ V     d. 1.4 N/C and $1.78 \times 10^6$ V

17. The emf of a battery is 6v, current of 0.5A and internal resistance is 1 ohm. If the cell is connected to a resistor, find the resistance.

a. 10 ohm     b. 11 ohm     c. 12 ohm     d. 13 ohm

18- A charged particle of mass m and charge q moves with a constant velocity along the positive x direction v=3 i. It enters a region of magnetic field **B** = 5 k. Find the force vector.

(a) (-15qm) **j**     (b) (15qm) **j**     (c) (-3q/5m) **j**     (d) (-5q/3m) **j**

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

21) Three charges as shown in the figure.

What is the electric force $F_B$ affects the charge B.

What is the axis direction of $F_B$?

. $(k = 9 \times 10^9 \, Nm^2C^{-2})$          (5 Marks)
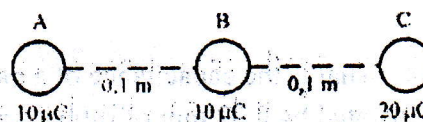


22) Deduce Ohm law in terms of $\Delta V$, I, R from the relation between the current density and the electric field.          (3 Marks)

23) Using Kirchhoff's rules to find the current in each resistor in the Figure.

**Hint**: let the point c is a branch point.     **(6 Marks)**
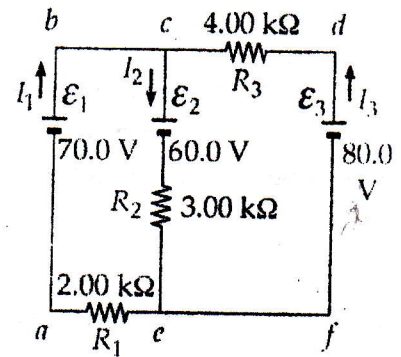
22) Deduce with drawing the magnetic force acting on a straight segment located in the magnetic field.                    **(3Marks)**

**Course: Electricity and Magnetism &AC**          Exam date: Monday, 05/9/2022

**Code: P261**                                     Exam Time: 3 hours

**Final Exam (50 Marks)**                          Summer semester 2021-2022

| | |
|---|---|
| Permeability of the free space ($\mu_0$) | $4\pi \times 10^{-7}$ H/m |
| Permittivity of the free space ($\varepsilon_0$) | $8.85 \times 10^{-12}$ F/m |
| Charge of electron or proton (e) | $1.6 \times 10^{-19}$ C |

## The exam is written in (5) sheets

**1st Question: Choose the correct answer**          ( 25 Marks, every question 1.0 Mark)

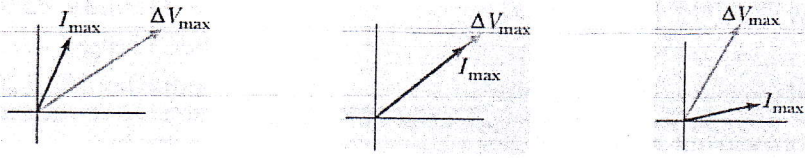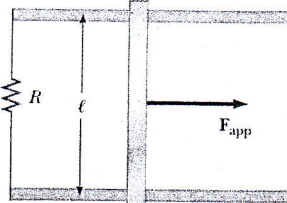| 1 | An ac source of variable frequency f is connected to an RLC series circuit. Which one of the graphs in figure represents the variation of current I in the circuit with frequency f ? |
|---|---|
| |  |
| 2 | A charge q is moving in a magnetic field, then the magnetic force does not depend upon ………. |
| | a) Charge <br> b) Mass <br> c) Magnetic field <br> d) Velocity |
| 3 | A charge of 1 C is moving in a magnetic field of 0.5 Tesla with a velocity of 10 m/sec perpendicular to the field. The force experienced is ………. |
| | a) 0.5 N <br> b) 5 N <br> c) zero <br> d) 10 N |
| 4 | A proton moves through a uniform electric field given by E=50.0 $\hat{j}$ V/m and a uniform magnetic field B=(0.20 $\hat{i}$ + 0.30 $\hat{j}$ + 0.40 $\hat{k}$) T. Determine the acceleration of the proton when it has a velocity v =200 $\hat{i}$ m/s. |
| | a) $(-2.87\times10^9\ j+5.75\times10^9 k)m/s^2$ <br> b) $(-2.87\times10^7\ j+5.75\times10^7 k)m/s^2$ <br> c) $(-30.0\ j+60.0k)m/s^2$ <br> d) $(2.87\ j+5.75\ k)m/s^2$ |
| 5 | For two long straight parallel wires separated by a distance $a$ and carrying currents $I_1$=2A and $I_2$ =6A in the same direction, where the magnetic force on each wire is $F_1$ and $F_2$. Which is true? |
| | a) $F_1 =F_2/3$ <br> b) $F_1 =3F_2$ <br> c) $F_1 = F_2$ <br> d) $F_1 =2F_2$ |
| 6 | Which phasor diagram represents capacitive reactance ($X_C$) = inductive reactance ($X_L$)? |

| | (a) | (b) | (c) | (d) none of these |

| 7 | Consider the arrangement shown in the Figure. Assume that $R=6.0\ \Omega$, $l=1.20$ m, and a uniform 2.50-T magnetic field is directed into the page. At what speed the bar should be moved to produce a current of 0.50 A in the resistor?  |
|---|---|
| | a) 1.0 m/s <br> b) 100 m/s <br> c) 10 m/s <br> d) 0.1 m/s |
| 8 | A toroid wound with 60.0 turns/m of wire carries a current of 5.0 A. The core is iron, which has a magnetic permeability of 5000 $\mu_0$ under the given conditions. Find the magnetic field strength ($H$). |
| | a) 300 A. turns/m <br> b) 12.0 A/sec <br> c) 1.88 Tesla <br> d) zero |
| 9 | From the previous question (8). Find the magnetic field (B) inside the iron core? |
| | a) 300 A. turns/m <br> b) 12.0 A/sec <br> c) 1.88 Tesla <br> d) zero |
| 10 | What is the time constant of RC circuit? If A capacitor in the circuit is charged to 60.0% of its maximum value in 0.90 s. |
| | a) 0.1 sec <br> b) 1 sec <br> c) 2 sec <br> d) 3 sec |
| 11 | The rms output voltage of an AC source is 200 V and the operating frequency is 100 Hz. Find the output voltage as a function of time? |
| | a) $\Delta V(t) = (283\ V)\sin(628t)$ <br> b) $\Delta V(t) = (50\ V)\sin(628t)$ <br> c) $\Delta V(t) = (200\ V)\sin(100t)$ <br> d) $\Delta V(t) = (200\ V)\sin(200t)$ |
| 12 | Which of the following is wrong statement ………? |
| | a) An emf can be induced between the ends of a straight conductor by moving it through a uniform magnetic field. <br> b) The self-induced emf produced by changing current in a coil always tends to decrease the current. <br> c) Inserting an iron core in a coil increases its coefficient of self-induction. <br> d) According to Lenz's law, the direction of the induced current is such that it opposes the flux change that causes it. |
| 13 | The direction of induced e.m.f. during electromagnetic induction is given by ………. |

| | |
|---|---|
| | a) Faraday's law <br> b) Lenz's law <br> c) Maxwell's law <br> d) Ampere's law |
| 14 | At what frequency does the inductive reactance of a 57 μH inductor equal the capacitive reactance of a 57 μF capacitor? |
| | a) 2.8 kHz <br> b) Zero Hz <br> c) 1 Hz <br> d) 100 Hz |
| 15 | ......... substances contain permanent atomic magnetic moments that tend to align parallel to each other even in a weak external magnetic field. |
| | a) Ferromagnetic <br> b) Paramagnetic <br> c) Diamagnetic <br> d) Ferrimagnetic |
| 16 | The magnetic field due to an infinitely long straight wire carrying a current I at a distance r from wire is given by |
| | a) $B = (\frac{\mu_0}{4\pi}) \frac{2I}{r}$ <br> b) $B = (\frac{\mu_0}{4\pi}) \frac{r}{2I}$ <br> c) $B = (\frac{4\pi}{\mu_0}) \frac{2i}{r}$ <br> d) $B = (\frac{4\pi}{\mu_0}) \frac{r}{2I}$ |
| 17 | A solenoid of 1.5 meter length and 4.0 cm diameter possess 10 turn per cm. A current of 5 amperes is flowing through it. Find the magnetic field inside the solenoid? |
| | a) $2\pi \times 10^{-3}$ Tesla <br> b) $2\pi \times 10^{-5}$ Tesla <br> c) $4\pi \times 10^{-2}$ Gauss <br> d) $2\pi \times 10^{-2}$ Gauss |
| 18 | A proton moving with a velocity, $2.5 \times 10^7$ m/s, enters a magnetic field of intensity 2.5 T making an angle 30° with the magnetic field. The force on the proton is .......... |
| | a) $3 \times 10^{-12}$ N <br> b) $5 \times 10^{-12}$ N <br> c) $6 \times 10^{-12}$ N <br> d) $1 \times 10^{-12}$ N |
| 19 | An 8.0 μF capacitor is connected to the terminals of a 60.0-Hz AC source whose rms voltage is 150 V. Find the rms current in the circuit? |
| | a) 0.45 A <br> b) 0.2 A <br> c) 1.0 A <br> d) 1.2 A |
| 20 | A sinusoidal voltage $\Delta V(t)=(40 \text{ V}) \sin(100 t)$ is applied to a series RLC circuit with L=160 mH, C=99 μF, and R=68 Ω. Determine the phase angle? |
| | a) -51.3° <br> b) -513° <br> c) -50° <br> d) 60° |
| 21 | A solenoid has 120 turns uniformly wrapped around a wooden core, which has a diameter of 10.0 |

| | | mm and a length of 9.0 cm. Calculate the inductance of the solenoid |
|---|---|---|
| | | a) 16 µH |
| | | b) 20 mH |
| | | c) Zero |
| | | d) 100 mH |
| 22 | | The voltage output of an AC source is given by the expression $\Delta V = (200\ V)\sin wt$. Find the rms current in the circuit when this source is connected to a 100 Ω resistor. |
| | | a) 1.41 A |
| | | b) 141 A |
| | | c) 14 A |
| | | d) 0.141 A |
| 23 | | A coil has an inductance of 2.5 H and a resistance of 0.5 Ω. If the coil is suddenly connected across a 6.0 volt battery, then the time required for the current to rise 0.63 of its final value is ………. |
| | | a) 3.5 sec |
| | | b) 5.0 sec |
| | | c) 4.0 sec |
| | | d) 4.5 sec |
| 24 | | A 1 µF capacitor is charged by a 40 V power supply. The fully charged capacitor is then discharged through a 10 mH inductor. Find the maximum current in the resulting oscillations? |
| | | a) 0.04 A |
| | | b) 0.4 A |
| | | c) 4A |
| | | d) None of the above |
| 25 | | The mutual inductance of an induction coil is 5 H. In the primary coil, the current reduces from 5 A to zero in $10^{-3}$ sec. What is the induced emf in the secondary coil? |
| | | a) 2500 V |
| | | b) 25000 V |
| | | c) 2510 V |
| | | d) Zero |

## 2ʳᵈ Question: State True or False on the following ( 25 Marks, every question 1.0 Mark)

| 26 | The phase difference between the current and voltage of RLC circuit in series combination at resonance equal $\pi$. | |
|---|---|---|
| | a) True | b) False |
| 27 | Resonance is a condition in a series RLC circuit in which the capacitive reactance and inductive reactance are equal in magnitude. | |
| | a) True | b) False |
| 28 | The inductance of an air cored coil will increase than an iron cored coil. | |
| | a) True | b) False |
| 29 | Gauss's law of magnetism states that the net magnetic flux through any closed surface equal zero. | |
| | a) True | b) False |
| 30 | Capacitors are charge and discharge in exponential manner. | |
| | a) True | b) False |
| 31 | The magnetic force between two parallel straight wires separated by a distance $a$ and carrying currents $I_1$ and $I_2$ in opposite directions is attractive force. | |
| | a) True | b) False |
| 32 | The time constant is the time taken for response to rise 0.63 of its maximum value. | |
| | a) True | b) False |

| 33 | The formula used to calculate the time constant in inductive circuit is $\tau = LR$. |
|---|---|
| | a) True                                        b) False |
| 34 | A self-induced emf is always proportional to the time rate of change of the current. |
| | a) True                                        b) False |
| 35 | The potential energy $\frac{1}{2}kx^2$ stored in a stretched spring is analogous to the electric potential energy $\frac{1}{2}CV^2$ stored in the capacitor. |
| | a) True                                        b) False |
| 36 | The inductance of a device depends on its geometry |
| | a) True                                        b) False |
| 37 | The resonant frequency of a circuit is $f$. If the capacitance is made 4 times the initial values, then the resonant frequency will become $2f$. |
| | a) True                                        b) False |
| 38 | In an LC circuit, the charge Q and Current I are $90°$ out of phase with each other. |
| | a) True                                        b) False |
| 39 | In an RLC circuit when R is very large, no oscillations occur in the circuit. |
| | a) True                                        b) False |
| 40 | The magnetic flux $\phi_B$ through a surface area A is defined by the surface integral $\int B \times dA$ |
| | a) True                                        b) False |
| 41 | Gauss's law in electricity, states that the total electric flux through any closed surface equals the net charge inside that surface divided by $\varepsilon_0$ |
| | a) True                                        b) False |
| 42 | The magnetic susceptibility ($\chi$) is a dimensionless factor. |
| | a) True                                        b) False |
| 43 | The Lorentz force law is calculated as $\vec{F} = q\vec{E} + q(\vec{v}.\vec{B})$ |
| | a) True                                        b) False |
| 44 | Resistors behave essentially the same way in both DC and AC circuits. |
| | a) True                                        b) False |
| 45 | The phase angle is negative, when the circuit is more inductive. |
| | a) True                                        b) False |
| 46 | Maxwell's equations describe the fundamental laws of electricity only. |
| | a) True                                        b) False |
| 47 | The impedance of a series $RLC$ circuit at resonance is larger than $R$. |
| | a) True                                        b) False |
| 48 | The unit of the magnetic flux is Tesla. meter$^2$, which is corresponding to weber. |
| | a) True                                        b) False |
| 49 | Diamagnetic materials are those made of atoms that do not have permanent magnetic moments. |
| | a) True                                        b) False |
| 50 | Magnitude of the force per unit length between two long parallel wires that carry identical currents and are separated by 1 m is $2\times10^{-7}$ N/m. The current in each wire is defined to be 1 A. |
| | a) True                                        b) False |

*With my best regards*
*Prof. Dr. Ahmed A. Ebrahim*

Level: **II**   المستوي :الثاني   summer semester   **Assiut University**
التاريخ: 4/9/ 2022   2021-2022 العام   **Faculty of Science**
الزمن: ساعتان " 2 hours "   *Principles of modern physics* **P 225**   **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) light & 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 stars are not eternal because its transformations from:**
   *(A) Mass to energy*   *(B) Energy to mass*   *(C)All of the above*

**5. Atoms are not eternal because of...**
   *(A) its death*   *(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 to .....changes.** *(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 a ........relativity** *(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 |
|    |    |    |    |    |    |    |    |    |    |

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

22. When Plank'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 th e 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 inten*sity

34. If the frequency is less than this value , no electrons are releases 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 quantités (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 |
|    |    |    |    |    |    |    |    |    |    |

# 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

16. A black body absorbs all radiation and reflects nothing

17. Any absorbed energy can be get out as an 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

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |

| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |

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 a 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

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|----|----|----|----|----|----|----|----|----|----|
|    |    |    |    |    |    |    |    |    |    |

# Question № 3 (15 degrees)

## Circle the wrong word or words and correct them in the specified place

1. Nature is a science that studies the created universe
2. A small amount of mass, contains a small amount of energy
3. The progress in understanding the universe is enormous
4. Heat transfer in the universe can happen from cold to hot
5. Physics can define time & space
6. Galileo's transformations are invalid for low velocities
7. The Michaelson-Morley experiment showed that the law of adding velocities was correct
8. Electron Volt unit is a unit of charge
9. Planck succeeded at finding a relationship to interpret the black body spectrum assuming that energy values are continuous
10. The type of Interaction depends on the intensity of light

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
|   |   |   |   |   |

| 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|----|
|   |   |   |   |    |

كلية العلوم- قسم الفيزياء

جامعة أسيوط

Sep, 2022

**Summer Course. In "Physics of Vibrations & Waves" (212 P)**

Time: 3 hours

السؤال الأول (إجبارى): (20 درجة)

### (I) <u>Choose the right answer between brackets</u>:

1) The periodic time of the liquid vibration inside U- tube depends on the (height – density – displacement) of the liquid.

2) The natural frequency of the free oscillator must be (higher – lower- equal) to that of the driving force at resonance state.

3) Damping oscillation in LRC- circuit is attributed to the stored (electrical – magnetic – thermal) energy in the resistance.

4) The heavy damping oscillation can be characterized by (exponential – linear – nonlinear) decreasing of amplitude.

5) The distortion factor of the LRC-circuit depends on the (capacitance –induction coil - total impedance) of the circuit.

6) The max. value of be velocity and acceleration of the free oscillation depend on (amplitude – frequency – both of them)

7) The change of gained potential energy by an element of a tense string depends on(wavelength–tensile strength-frequency)

8) The amplitude of an absorbed medium decreases (linearly – nonlinear- exponentially) through the medium width.

9) The total wave transmittance required the (impedance – velocity – tensile strength) equal values of the string's parts.

10) The distinctive impedance of a tense string depends on (wave velocity - tensile strength- both of them)

### (II) <u>Transfer the following sentences after putting a check mark right or wrong</u>:

1) The max. value of the potential energy of the free oscillator is given at equilibrium position.

2) The amplitude of the wave has the same behavior through an absorbed or damped medium.

3) The capacitance of the $LC$-circuit is related to the frequency of the free oscillation as: $C = L\omega_0^2$

4) The light damping oscillation can be characterized by linear decreasing of the amplitude.

5) The damping factor of the mechanical damped oscillation is represented by the friction factor.

6) The max. value of the driving force of the electrical forced damped oscillation is related to capacitance of the circuit.

7) The phase constant is inversely proportional with the wavelength of the propagated wave.

8) Both the reflected and transmitted factor depends on the amplitude of the incident wave.

9) The vibrating force acting on a certain position of a tense string divides it into two parts with different tensile strength.

10) The oscillation amplitude of the LRC-circuit at resonance state must be a maximum value.

أجب عن سؤالين فقط :

السؤال الثاني (اختيارى): (15 درجة)

2. a) Find the parameters on which the restoring force depends on for the following oscillations:

(i) Vibration of a liquid inside U- tube,   (ii) vibration of a mass tied at the middle of string fixed at their ends.

b) A simple pendulum vibrates by (2 sec) when its side displacement is (2 Cm), then the mass of the pendulum was left to vibrate. Calculate the time corresponding to a displacement of (1 Cm) from its equilibrium position.

c) Apply the eqns. of the mechanical and electrical forced damping oscillator to: (i) compare between the driving forces

(ii) Find the friction factor $D = f(m,k)$ for the critical mechanical oscillation and the capacitance $C = f(L,R)$ for the light electrical oscillation.

3. a) Consider the wave displacement: $y = A\cos(\omega t - kx)$, rewrite this eqn. in terms of the refractive index. If the wave propagates through an absorbed medium find the corresponding refractive index, explain the physical significance.

b) If the potential energy of the free oscillation: $P.E = 1/2kx^2$, find the total energy of the free oscillator, and the velocity at a certain position ( x) and at an equilibrium position.

Let the frequency of a mass suspended in spring is 4 oscillations per sec. with the max. amplitude of (6 cm).

(i) Determine the periodic time, and maximum velocity of the mass, (ii) Calculate the velocity and acceleration corresponding to a displacement of (2 cm) from the center of motion.

c) Prove that the density of the wave energy of an element of a tense string: $D(x,t) = 1/2[T(\frac{dy}{dx})^2 + \rho(\frac{dy}{dt})^2]$, where $T$, and $\rho$ are the tensile strength and mass per unit length of the string.

---

4. a) IF the amplitude of the electric forced damping oscillator: $A = E_0/Z$, where $E_0$ and Z are the maximum value of *emf*, and total impedance of the *LRC*- circuit, respectively, Prove that the current eqn. is expressed as: $i = A'\sin(\omega t - \theta)$, find the parameters on which current amplitude ($A'$) depends.

b) Consider a vertical periodic force acts at a certain position (x = 0) of a tense string, (i) write the displacement of the incident, reflected, and transmitted waves. (ii) Express the conditions required to determine the reflected ($n_1$) and transmitted ($n_2$) factors. (iii) if $n_1 = \frac{(Z_1 - Z_2)}{(Z_1 + Z_2)}$, and $n_2 = \frac{(2Z_1)}{(Z_1 + Z_2)}$, find the condition of a total reflection.

c) (i) Use the mechanical undamped oscillator to satisfy the validity of conservation low. (ii) Explain the condition of equilibrium state of the mechanical forced damped oscillator.

انتهت الأسئلة

تمنياتي بالتوفيق ...................أ.د. عبد المنعم سلطان