# حل اختبار القبول لطلاب الدراسات العليا- ماجستير

## إهداء من : رشوان محمود إلى أعضاء المنتدى التعليمي للفيزياء

**1.** Which of the following quantities has the same dimensions as kinetic energy, $\frac{1}{2}mv^2$?

Note: $[a]=[g]=\mathrm{LT}^{-2}$; $[h]=\mathrm{L}$ and $[v]=\mathrm{LT}^{-1}$.

**a.** $ma$ **b.** $mvx$ **c.** $mvt$ **d.** $mgh$ **e.** $mgt$

$$\textbf{Energy = [ mgh ]} = M\,\frac{L}{T^2}L = ML^2T^{-2}$$

**2.** The position of a particle moving along the $x$ axis is given by $x=\left(21+22t-6.0t^2\right)\mathrm{m}$, where $t$ is in s. What is the average velocity during the time interval $t$ = 1.0 s to $t=3.0$ s?

**a.** $-6.0\ \mathrm{m/s}$ **b.** $-4.0\ \mathrm{m/s}$ **c.** $-2.0\ \mathrm{m/s}$ **d.** $-8.0\ \mathrm{m/s}$ **e.** $8.0\ \mathrm{m/s}$

$$X(t)=21+22t-6t^2$$
$$\overline{V}=\frac{\Delta x}{\Delta t}=\frac{X(3)-X(1)}{3-1}=-2m/s$$

**3.** The position of a particle moving along the $x$ axis is given by $x=6.0t^2-1.0t^3$, where $x$ is in meters and $t$ in seconds. What is the position of the particle when it achieves its maximum speed in the positive $x$ direction?

**a.** 24 m **b.** 12 m **c.** 32 m **d.** 16 m **e.** 2.0 m

$$X(t)=6t^2-t^3$$
$$V(t)=12t-3t^2$$
$$a(t)=12-6t$$
$$a(t)=0\Rightarrow t=2$$
$$X(2)=16m$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**4.** If **A** = 12**i** – 16**j** and **B** = -24**i** + 10**j**, what is the magnitude of the vector $\mathbf{C} = 2\mathbf{A} - \mathbf{B}$ ?

**a.** 42 **b.** 22 **c.** 64 **d.** 90 **e.** 13

$$A = 12i - 16j, B = -24i + 10j$$
$$C = 2A - b$$
$$= 24i - 32j + 24i - 10j$$
$$= 48i - 24j$$
$$\|C\| = \sqrt{28^2 + 24^2} = 63.7 \simeq 64$$

**5.** A particle starts from the origin at $t = 0$ with a velocity of 6.0**i** m/s and moves in the *xy* plane with a constant acceleration of (–2.0**i** + 4.0**j**) m/s$^2$. At the instant the particle achieves its maximum positive *x* coordinate, how far is it from the origin?

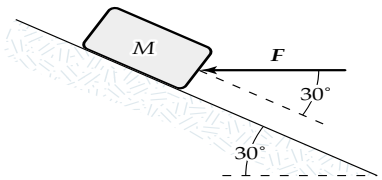
**a.** 36 m **b.** 20 m **c.** 45 m **d.** 27 m **e.** 37 m

$$a = -2i + 4j$$
$$V = \int a\,dt = -2ti + 4tj + c$$
$$V(0) = c = 6i + oj$$
$$\therefore V = -2ti + 4tj + 6i$$
$$= (-2t + 6)i + 4j$$
$$X(t) = \int V\,dt = (-t^2 + 6t)i + 4tj + c'$$
$$X(0) = 0i + 0j = c'$$
$$\therefore X = (-t^2 + 6t)i + 4tj$$
$$at\ V = 0 \Rightarrow -2t + 6 = 0 \Rightarrow t = 3$$
$$X(3) = (-9 + 18)i + 4 \times 3j$$
$$\|X\| = \sqrt{9^2 + 12^2} = 15m$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

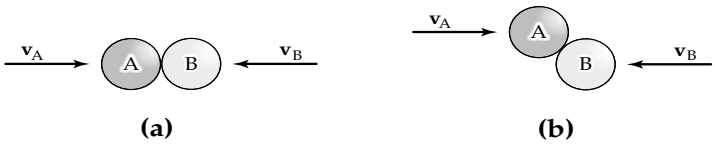
**6.** A block is pushed up a frictionless 30° incline by an applied force as shown. If $F$ = 25 N and $M$ = 3.0 kg, what is the magnitude of the resulting acceleration of the block?




**a.** 2.3 m/s$^2$ **b.** 4.6 m/s$^2$ **c.** 3.5 m/s$^2$ **d.** 2.9 m/s$^2$ **e.** 5.1 m/s$^2$

$$F = m\,a$$
$$= 25\cos 30 - 3\times 9.8\cos 60$$
$$= 3a$$
$$\therefore a = 2.3\ \text{m/s}^2$$

**7.** Two bodies, A and B, collide as shown in Figures a and b below.




Which statement is true?

**a.** They exert equal and opposite forces on each other in (a) but not in (b).
**a.** They exert equal and opposite force on each other in (b) but not in (a).
**c.** They exert equal and opposite force on each other in both (a) and (b).
**d.** The forces are equal and opposite to each other in (a), but only the components of the forces parallel to the velocities are equal in (b).
**e.** The forces are equal and opposite in (a), but only the components of the forces perpendicular to the velocities are equal in (b).

**8.** A race car travels 40 m/s around a banked (45° with the horizontal) circular (radius = 0.20 km) track. What is the magnitude of the resultant force on the 80-kg driver of this car?

**a.** 0.68 kN **b.** 0.64 kN **c.** 0.72 kN **d.** 0.76 kN **e.** 0.52 kN

$$F = \frac{mV^2}{r} = \frac{80\times 40^2}{0.2\times 100} = 640N = 0.64\ KN$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**9.** A constant force of 12 N in the positive $x$ direction acts on a 4.0-kg object as it moves from the origin to the point (6**i** – 8**j**) m. How much work is done by the given force during this displacement?

**a.** +60 J **b.** +84 J **c.** +72 J **d.** +48 J **e.** +57 J

$$\vec{F} = 12i + oj$$
$$\vec{X} = 6i - 8j$$
$$W = \vec{F}.\vec{X} = 6 \times 12 - 0 = 72\ J$$

**10.** As a particle moves along the $x$ axis it is acted upon by a single conservative force given by $F_x = (20 - 4.0x)$ N where $x$ is in m. The potential energy associated with this force has the value +30 J at the origin ($x = 0$). What is the value of the potential energy at $x = 4.0$ m?

**a.** –48 J **b.** +78 J **c.** –18 J **d.** +48 J **e.** +80 J

$$F = 40 - 4X$$
$$V = -\int F\,dX$$
$$= -20X + 2X^2 + c$$
$$V(0) = 30J \Rightarrow c = 30$$
$$\therefore V(X) = -20X + 2X^2 + 30$$
$$V(4) = -18\ J$$

**11.** A 2000-kg truck traveling at a speed of 6.0 m/s makes a 90° turn in a time of 4.0 s and emerges from this turn with a speed of 4.0 m/s. What is the magnitude of the average resultant force on the truck during this turn?

**a.** 4.0 kN **b.** 5.0 kN **c.** 3.6 kN **d.** 6.4 kN **e.** 0.67 kN

$$\vec{V} = \sqrt{36 + 64} = 10m/s$$
$$\vec{a} = \frac{\vec{V}}{t} = \frac{10}{4} = 2.5m/s^2$$
$$F = ma = 5000N = 5KN$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**12.** A 2.4-kg ball falling vertically hits the floor with a speed of 2.5 m/s and rebounds with a speed of 1.5 m/s. What is the magnitude of the impulse exerted on the ball by the floor?

**a.** 9.6 N s **b.** 2.4 N s **c.** 6.4 N s **d.** 1.6 N s **e.** 1.0 N s

$$impluse = m\Delta V$$
$$= 2.4(2.5-1.5) = 2.4N.s$$

**13.** At $t$ = 0, a wheel rotating about a fixed axis at a constant angular acceleration has an angular velocity of 2.0 rad/s. Two seconds later it has turned through 5.0 complete revolutions. What is the angular acceleration of this wheel?

**a.** 17 rad/s$^2$ **b.** 14 rad/s$^2$ **c.** 20 rad/s$^2$ **d.** 23 rad/s$^2$ **e.** 13 rad/s$^2$

**14.** A particle located at the position vector **r** = (**i** + **j**) m has a force **F** = (2**i** + 3**j**) N acting on it. The torque about the origin is:

**a.** (1**k**)N · m **b.** (5**k**)N · m **c.** (–1**k**)N · m **d.** (–5**k**)N · m **e.** (2**i** + 3**j**)N · m

$$\vec{F} = 2i + 3j$$
$$\vec{r} = i + j$$
$$\vec{I} = \vec{F} \times \vec{r} = 2\times 1 - 3\times 1 = (-1k)Nm$$

**15.** A satellite is in a circular orbit about the Earth at an altitude at which air resistance is negligible. Which of the following statements is true?

**a.** There is only one force acting on the satellite.
**b.** There are two forces acting on the satellite, and their resultant is zero.
**c.** There are two forces acting on the satellite, and their resultant is not zero.
**d.** There are three forces acting on the satellite.
**e.** None of the preceding statements are correct.



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**16.** When water freezes, it expands about 9 percent. What would be the pressure increase inside your automobile engine block if the water in there froze? The bulk modulus of ice is $2.0 \times 10^9$ N/m$^2$, and 1 atm = $10^5$ N/m$^2$.

**a.** 18 atm **b.** 360 atm **c.** 1080 atm **d.** 1800 atm **e.** 600 atm

Bulk modulus ; is the ratio of change in pressure acting in a volume to fractional changein a volume

$$B = \frac{\Delta P}{\Delta V \ /V}$$

$$P = 1800 atm$$

**17.** The motion of a particle connected to a spring is described by $x = 10 \sin(\pi t)$. At what time (in s) is the potential energy equal to the kinetic energy?

**a.** 0 **b.** 0.25 **c.** 0.50 **d.** 0.79 **e.** 1.0

$$x = 10 \sin(\pi t)$$

$$t = 1 \rightarrow x = 10$$

$$\therefore t = \frac{1}{2} \rightarrow E_k = E_p$$

**18.** The wavelength of light visible to the human eye is on the order of $5 \times 10^{-7}$ m. If the speed of light in air is $3 \times 10^8$ m/s, find the frequency of the light-wave.

**a.** $3 \times 10^7$ Hz **b.** $4 \times 10^9$ Hz **c.** $5 \times 10^{11}$ Hz **d.** $6 \times 10^{14}$ Hz **e.** $4 \times 10^{15}$ Hz

$$v = \frac{c}{\lambda} = \frac{3 \times 10^8}{5 \times 10^{-7}} = 6 \times 10^{14} Hz$$

**19.** A temperature difference of 5 K is equal to

**a.** A difference of 9 on the Celsius scale.
**b.** A difference of 9 on the Fahrenheit scale.
**c.** A difference of 2.8 on the Rankine scale.
**d.** A difference of 0.5 on the Fahrenheit scale.
**e.** A difference of 2.8 on the Celsius scale.



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**20.** The velocity of sound in sea water is 1533 m/s. Find the bulk modulus (in $N/m^2$) of sea water if its density is $1.025 \times 10^3$ kg/m$^3$.

**a.** $2.6 \times 10^9$ **b.** $2.2 \times 10^9$ **c.** $2.0 \times 10^9$ **d.** $2.4 \times 10^9$ **e.** $2.8 \times 10^9$

**21.** In order to understand the concept of temperature it is necessary to understand

**a.** The Zeroth law of thermodynamics.
**b.** The first law of thermodynamics.
**c.** The second law of thermodynamics.
**d.** All of the above.
**e.** Only (b) and (c) above.



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**22.** Two thermometers are calibrated, one in degrees Celsius and the other in degrees Fahrenheit. At what temperature (in Kelvins) do their readings measure the same temperature?

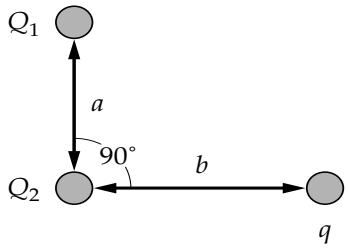
**a.** 218.15 **b.** 233.15 **c.** 273.15 **d.** 40.15 **e.** 0

$$f = \frac{9}{5}(c+32) \Rightarrow c = \frac{9}{5}(c+32)$$
$$c = 40$$
$$k = 233$$

**23.** Determine the heat capacity (in calories/°C) of a lake containing one million gallons (approximately 4 million kilograms) of water at 15°C.

**a.** $4\times10^{6}$ **b.** $4\times10^{9}$ **c.** $4\times10^{3}$ **d.** $1\times10^{3}$ **e.** $4\times10^{2}$

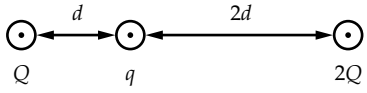
**24.** If $a$ = 3.0 mm, $b$ = 4.0 mm, $Q_1$ = 60 nC, $Q_2$ = 80 nC, and $q$ = 24 nC in the figure, what is the magnitude of the total electric force on $q$?




**a.** 2.7 N **b.** 1.9 N **c.** 2.3 N **d.** 1.5 N **e.** 0.52 N

$$F_1 = 9\times10^{9}\frac{80\times24\times10^{-18}}{\left(4\times10^{-3}\right)} = 1.08N$$
$$F_2 = 9\times10^{9}\frac{60\times24\times10^{-18}}{\left(5\times10^{-3}\right)} = 0.5148N$$
$$F^2 = F_1^2 + F_2^2 + 2F_1F_2\cos\theta \quad , \quad \cos\theta = \frac{4}{5}$$
$$\therefore\ F = 2.3N$$

**25.** In the figure, if $Q$ = 30 $\mu$C, $q$ = 5.0 $\mu$C, and $d$ = 30 cm, what is the magnitude of the electrostatic force on $q$?






Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**a.** 15 N **b.** 23 N **c.** zero **d.** 7.5 N **e.** 38 N

$$F = 9\times10^9 \frac{5\times30\times10^{12}}{0.3^2} - 9\times10^9 \frac{5\times60\times10^{12}}{0.6^2}$$
$$= 7.5N$$

**26.** Two charges of 15 pC and –40 pC are inside a cube with sides that are of 0.40 m length. Determine the net electric flux through the surface of the cube.

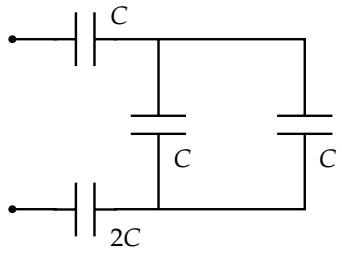
**a.** $+2.8\ \text{N}\cdot\text{m}^2/\text{C}$ **b.** $-1.1\ \text{N}\cdot\text{m}^2/\text{C}$ **c.** $+1.1\ \text{N}\cdot\text{m}^2/\text{C}$
**d.** $-2.8\ \text{N}\cdot\text{m}^2/\text{C}$ **e.** $-0.47\ \text{N}\cdot\text{m}^2/\text{C}$

**27.** A charged particle ($q$ = –8.0 mC), which moves in a region where the only force acting on the particle is an electric force, is released from rest at point A. At point B the kinetic energy of the particle is equal to 4.8 J. What is the electric potential difference $V_B - V_A$ ?

**a.** –0.60 kV **b.** +0.60 kV **c.** +0.80 kV **d.** –0.80 kV **e.** +0.48 kV

$$V_B - V_A = \frac{W}{q} = \frac{4.8}{-8} = -0.6$$

**28.** Determine the equivalent capacitance of the combination shown when $C$ = 12 pF.




**a.** 48 pF **b.** 12 pF **c.** 24 pF **d.** 6.0 pF **e.** 59 pF

$$C_1 = 12+12 = 24pF$$
$$\frac{1}{C_{total}} = \frac{1}{12}+\frac{1}{24}+\frac{1}{C_1} = \frac{1}{12}+\frac{1}{24}+\frac{1}{12}$$
$$C_{total} = 6\,pF$$



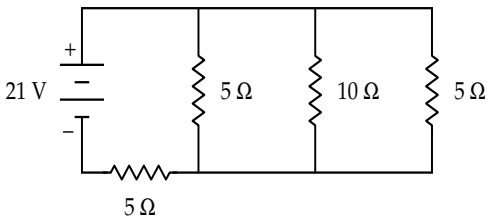
Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**29.** Light bulb A is rated at 60 W and light bulb B is rated at 100 W. Both are designed to operate at 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.
**e.** We need to know the resistivities of the filaments to answer this

$$w = IV = I^2R$$
$$I_A \times 110 = 60 \Rightarrow I_A = 0.545A$$
$$I_B \times 110 = 100 \Rightarrow I_B = 0.909A$$
$$I^2R_A = 60 \Rightarrow R_A = 202\Omega$$
$$I^2R_B = 100 \Rightarrow R_B = 121\Omega$$

**30.** What is the current in the 10-Ω resistor ?




**a.** 0.60 A **b.** 3.0 A **c.** 1.2 A **d.** 2.4 A **e.** 0.30 A

$$\frac{1}{R_1} = \frac{1}{5} + \frac{1}{10} + \frac{1}{5} \therefore R_1 = 2\Omega$$
$$R_{total} = R_1 + 5 = 2 + 5 = 7\Omega$$
$$I_{total} = \frac{V}{R_{total}} = \frac{21}{7} = 3A$$
$$V_{10} = I \times R_1 = 3 \times 2 = 6V$$
$$I_{10} = \frac{V_{10}}{10} = 0.6A$$

**31.** An electron has a velocity of $6.0 \times 10^6$ m/s in the positive $x$ direction at a point where the magnetic field has the components $B_x$ = 3.0 T, $B_y$ = 1.5 T and $B_z$ = 2.0 T. What is the magnitude of the acceleration of the electron at this point?

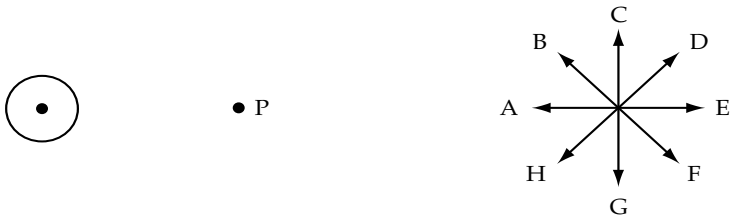


Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**a.** $2.1\times10^{18}\ \text{m/s}^2$ **b.** $1.6\times10^{18}\ \text{m/s}^2$ **c.** $2.6\times10^{18}\ \text{m/s}^2$
**d.** $3.2\times10^{18}\ \text{m/s}^2$ **e.** $3.7\times10^{18}\ \text{m/s}^2$

$$B=\sqrt{B_x^2+B_y^2+B_z^2}=3.905T$$
$$\cos\theta=\frac{3}{3.905}$$
$$F=Bqv.\cos\theta=m_e a \quad , \quad m_e=9.1\times10^{-31}Kg$$
$$a=F/9.1\times10^{-31}=3.2\times10^{18}m/s^2$$

**32.** The diagram below shows the position of a long straight wire perpendicular to the page and a set of directions labeled A through H.




When the current in the wire is directed up out of the page, the direction of the magnetic field at point P is

**a.** A. **b.** B. **c.** C. **d.** E. **e.** G.

**33.** One long wire carries a current of 30 A along the entire *x* axis. A second long wire carries a current of 40 A perpendicular to the *xy* plane and passes through the point (0, 4, 0) m. What is the magnitude of the resulting magnetic field at the point *y* = 2.0 m on the *y* axis?

**a.** 4.0 $\mu$T **b.** 5.0 $\mu$T **c.** 3.0 $\mu$T **d.** 7.0 $\mu$T **e.** 1.0 $\mu$T

$$B=\sqrt{B_x^2+B_z^2}$$
$$B_x=\frac{\mu}{2\pi}\frac{I_1}{d}=\frac{4\pi\times10^{-7}}{2\pi}\frac{30}{2}=3\times10^{-6}T$$
$$B_x=\frac{\mu}{2\pi}\frac{I_2}{d}=\frac{4\pi\times10^{-7}}{2\pi}\frac{40}{2}=4\times10^{-6}T$$
$$B=\sqrt{9\times10^{-12}+16\times10^{-12}}=5\mu T$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**34.** A coil is wrapped with 300 turns of wire on the perimeter of a circular frame (radius = 8.0 cm). Each turn has the same area, equal to that of the frame. A uniform magnetic field is turned on perpendicular to the plane of the coil. This field changes at a constant rate from 20 to 80 mT in a time of 20 ms. What is the magnitude of the induced emf in the coil at the instant the magnetic field has a magnitude of 50 mT?

**a.** 24 V **b.** 18 V **c.** 15 V **d.** 10 V **e.** 30 V

$$e.m.f = -N\frac{\Delta\phi}{\Delta t} = -N\frac{\Delta(BA)}{\Delta t}$$

$$60mt \longrightarrow 20ms$$

$$30mt \longrightarrow ?ms$$

$$e.m.f = 300\frac{30}{10}\pi 0.08^2 = 18.1V$$

**35.** A current may be induced in a coil by

**a.** Moving one end of a bar magnet through the coil.
**b.** Moving the coil toward one end of the bar magnet.
**c.** Holding the coil near a second coil while the electric current in the second coil is increasing.
**d.** All of the above.
**e.** None of the above.



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**36.** What is the inductance of a series *RL* circuit in which $R$ = 1.0 KΩ if the current increases to one-third of its final value in 30 $\mu$s?

**a.** 74 mH **b.** 99 mH **c.** 49 mH **d.** 62 mH **e.** None of the above

$$e.m.f = L\frac{\Delta I}{\Delta t} = L\frac{(1.3I - I)}{30\times10^{-6}} = \frac{0.3I}{30\times10^{-6}}$$
$$\frac{e.m.f}{I} = R = \frac{0.3}{30\times10^{-6}}L = 1000$$
$$\therefore\ L = 9\times10^{-6}H = 9mH$$

**37.** Inductive reactance $X_L$ is given by

**a.** $L\omega$ **b.** $L/\omega$ **c.** $1/L\omega$ **d.** $\omega/L$ **e.** $\omega^2 L$

$$X_L = Lw$$
$$X_C = \frac{1}{wC}$$

**38.** At what frequency will a 12-$\mu$F capacitor have a reactance $X_C$ = 300Ω?

**a.** 44 Hz **b.** 88 Hz **c.** 176 Hz **d.** 352 Hz **e.** 278 Hz

$$X_C = \frac{1}{wC} = \frac{1}{2\pi vC} = \frac{1}{2\pi v\,12\times10^{-6}} = 300$$
$$v = 88.3 \simeq 88Hz$$

**39.** Since $\varepsilon_0 = 8.85\times10^{-12}\ \mathrm{C^2/N\cdot m^2}$, the units of $\varepsilon_0 E^2$ are

**a.** $\frac{\mathrm{J}}{\mathrm{s\cdot m^3}}$. **b.** $\frac{\mathrm{N}}{\mathrm{s\cdot m^3}}$. **c.** $\frac{\mathrm{J}}{\mathrm{m^3}}$. **d.** $\frac{\mathrm{N}}{\mathrm{m^3}}$. **e.** $\frac{\mathrm{W}}{\mathrm{m^3}}$.

**40.** According to Planck 's theory, the energy of a photon is

**a.** Proportional to its wavelength.
**b.** Proportional to its frequency.
**c.** Constant, since the speed of light is a constant.
**d.** Quantized, since it always appears in bundles of size, $1.6\times10^{-19}$ C.
**e.** Proportional to the square of the frequency.



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**41.** Light behaves like

**a.** A wave at times, and a particle at other times.
**b.** A wave.
**c.** A particle.
**d.** Both a wave and a particle, because of its dual nature.

**42.** A light ray is incident on the surface of water ($n$ = 1.33) at an angle of 60° relative to the normal to the surface. The angle of the reflected wave is

**a.** 80° **b.** 40° **c.** 20° **d.** 60° **e.** 30°

$$\theta_1 = \theta_2 = 60^0$$

**43.** A concave mirror has a focal length of 20 cm. What is the position (in cm) of the resulting image if the image is inverted and four times smaller than the object?

**a.** 15 **b.** 25 **c.** 50 **d.** 100 **e.** –15

**44.** Two slits separated by 0.050 mm are illuminated with green light ($\lambda$ = 540 nm). How many bands of bright lines are there between the central maximum and the 12-cm position? (The distance between the double slits and the screen is 1.0 m).

**a.** 1111 **b.** 111 **c.** 11 **d.** 1 **e.** 11111

$$\lambda = 540\times10^{-9}m$$
$$R = 1m$$
$$d = 0.05\times10^{-3}m$$
$$\Delta y = \frac{\lambda R}{d} = \frac{540\times10^{-9}\times1}{0.05\times10^{-3}} = 0.0108m$$
$$n = \frac{12}{\Delta y} = \frac{12}{0.0108} = 11$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**45.** The binding energy of the ${}^{12}_{6}C$ nuclei is:

**a.** 12 MeV **b.** 937 MeV **c.** 92 MeV **d.** 241 MeV **e.** 81.5 MeV

$$E_B = [mass\ of\ \ nucleus - mass\ number] \times 931$$
$$= [1.oo73 \times 6 + 1.0087 \times 6 - 12] \times 931 = 89.3MeV$$

**46.** A proton's rest mass is $1.67 \times 10^{-27}$ kg. Calculate its kinetic energy when it is accelerated to a speed of 0.80 *c*.

**a.** $1.0 \times 10^{-10}$ J **b.** $1.5 \times 10^{-10}$ J **c.** $-2.0 \times 10^{-10}$ J **d.** $2.5 \times 10^{-10}$ J **e.** $7.5 \times 10^{-10}$ J

$$E_k = (\gamma - 1)mC^2$$
$$= \left(\frac{1}{\sqrt{1-0.64}} - 1\right) 1.67 \times 10^{-27} \times 9 \times 10^{16} = 1.00210^{-27} \times 10^{-10} J$$

**47.** The quantity which does not change in magnitude from that observed in system S when observed in system S′ moving away from system S at speed $v$ is

**a.** $m\mathbf{a}$. **b.** $m\mathbf{v}$. **c.** $(\gamma - 1)mc^2$. **d.** $E^2 - p^2c^2$. **e.** $x^2 + y^2 + z^2$.

**48.** A stopping potential of 3.2 V is needed for radiation whose wavelength is 200 nm. What is the work function (in eV) of the material?

**a.** 4.0 **b.** 3.0 **c.** 5.0 **d.** 6.0 **e.** 2.0

$$E_w = h\vartheta_c$$
$$= 6.626 \times 10^{-34} \times \frac{3 \times 10^8}{200 \times 10^{-9}} = 9.999 \times 10^{-19} J$$
$$= \frac{9.999 \times 10^{-19}}{1.6 \times 10^{-19}} = 6.2eV$$



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287

**49.** What is the quantum number $n$ of a particle of mass $m$ confined to a one-dimensional box of length $L$ when its momentum is $4h/L$?

**a.** 1 **b.** 4 **c.** 2 **d.** 8 **e.** 16

**50.** What value of wavelength is associated with the Lyman series for $n = 2$?
($R_H = 1.097 \times 10^7\ m^{-1}$)

**a.** $8.2 \times 10^6$ m **b.** $1.2 \times 10^{-7}$ m **c.** $2.7 \times 10^6$ m **d.** $3.6 \times 10^{-7}$ m **e.** $8.8 \times 10^{-7}$ m

$$E_n = \frac{13.6}{n^2}$$

$$\Delta E = 13.6\left(\frac{1}{1} - \frac{1}{2^2}\right) = h\nu$$

$$\lambda = \frac{c}{\nu} = 1.2 \times 10^{-7} m$$

**Physical constants:**

$g = 9.8 m/s^2, c = 3x10^8 m/s, h = 6.626x10^{-34} J.s, \mu_o = 4\pi x10^{-7} T.m/A, \varepsilon_o = 8.85x10^{-12} C^2/N.m^2,$
$e = 1.6x10^{-19} C, m_e = 9.1x10^{-31} kg, k = 9x10^9\ N.m^2/C^2.$

**مع التمنيات بالتوفيق والنجاح**



Rashwan Mahmoud
E-mail: Esam_s1s2@yahoo.com
Saudi Arabia: 0540923287