

charge, Electricity

Q unit, Coulomb [C]

+ Positive charge, - negative charge

* Like charge → Repulsion

* Unlike charge → Attraction

charge: is Quantized, conserved
integer, nq

m.c. → $\times 10^{-3}$

n.c. → $\times 10^{-9}$

$e^- = p^+ \rightarrow 1.6 \times 10^{-19}$

atom → neutral

neutron → no charge

me! كتلة الإلكترون قليلة

Coulomb Law

$$F = k_e \frac{Q_1 Q_2}{r^2}$$

$$= 9 \times 10^9$$

$$N = \frac{C^2}{m^2}$$

$$\frac{1}{4\pi \epsilon_0}$$

$$\epsilon_0 = 8.85 \times 10^{-12}$$

$\vec{F}$ → Vector quantity → Magnitude & direction

q_1 → q_2

$$\vec{F}_{(1,2)} = -\vec{F}_{(2,1)}$$

$$F_{(1,2)} = F_{(2,1)}$$

* calculate the Electrostatic Force between two charges $q_1 = 4 \text{ C}$, $q_2 = -8 \text{ C}$, $r = 7 \text{ mm}$

$$F = k_e \frac{Q_1 Q_2}{r^2} = 9 \times 10^9 \frac{4 \times (-8)}{(7 \times 10^{-3})^2} = -4.4 \times 10^{15} \text{ N}$$

* احسب القوة المتبادلة بين إلكترون وبروتون على مسافة $r = 8 \text{ cm}$

$$F = k_e \frac{Q_1 Q_2}{r^2} = 9 \times 10^9 \times \frac{(1.6 \times 10^{-19})^2}{(8 \times 10^{-2})^2} = 3.6 \times 10^{-26} \text{ N}$$

اسئلة الدكتور

* جسمين مشحونين المسافة قلت للنصف ، احسب كم ستكون القوة بالنسبة للأصلية ؟

$$F = K_e \frac{Q_1 Q_2}{r^2} = K_e \frac{Q_1 Q_2}{(\frac{1}{2})^2}$$

القوة تصبح 4F

لو قال احسب التغيير في القوة

$$4F - F = 3F$$

* جسمين مشحونين لو تضاعفت قيمة كل شحنة ماذا يحدث للقوة ؟

$$F = K_e \frac{Q_1 Q_2}{r^2} = K_e \frac{2 \cdot 2}{r^2}$$

القوة تصبح 4F

* إذا تضاعفت الشحنة Q_1 وقلت المسافة للنصف كم تصبح القوة ؟

$$F = K_e \frac{Q_1 Q_2}{r^2} = K_e \frac{2 \cdot 2}{(\frac{1}{2})^2}$$

القوة تصبح 16F

* أمامك إلكترونين e_1 و e_2 وبروتون p و p يساراً
أوجد ١- اتجاه الحصلة عند ما تؤثر e_1 على p يساراً
٢- اتجاه قوة التجاذب

٢- اتجاه المحصلة عند ما تؤثر e_2 على P يمين

٣- المحصلة الكلية المؤثرة على P يساراً
 (بمسبب المسافة r المسافة بين e_1, P f قلة من المسافة بين e_2, P)

$$q_0 = 1C$$

الجال الكهربائي Electric Field
 the region surrounding the charge
 كمية متجهة

$$E = \frac{F}{q} = \frac{K e Q}{r^2}$$

$$N/C$$

$$a = \frac{F}{m} = \frac{q E}{m}$$

Acceleration

$$E \propto F$$

* F المؤثرة على الشحنة

$$F = G \frac{m_1 m_2}{r^2}$$

الجذب العام

$$F = K m \frac{m_1 m_2}{r^2}$$

للأقطاب المغناطيسية

توزيع الشحنات على أساس :
 [المساحة - الحجم - الطول]

$$C/m$$

$$\lambda = \frac{Q}{l} = \text{كثافة الشحنة الطولية}$$

Linear

$$C/m^3$$

$$\rho = \frac{Q}{\text{الحجم}} = \text{كثافة الشحنة الحجمية}$$

Volume

$$C/m^2$$

$$\sigma = \frac{Q}{\text{المساحة}} = \text{كثافة الشحنة السطحية}$$

Surface

9.00

* بعض قوانين المساحة والحجم :-

10.00

حجم المستطيل = مألوش حجم لثنه شاشى زى المربع

مساحة المستطيل = الطول $\times$ العرض

11.00

حجم الكعب = L^3

مساحة الكعب = $6a^2$

12.00

حجم الكرة = $\frac{4}{3} \pi r^3$

مساحة الكرة = $4\pi r^2$

0

حجم الاسطوانة = $\pi r^2 h$

مساحة الاسطوانة = $2\pi r^2 h + 2\pi r^2 h$

1.00

خطوط المجال أو القوى الناتجة مع سطح ما : $\text{Unit: } N \cdot m^2 / C$
بين خطوط المجال الكهربى ومساحة المقطع

3.00

$$E = \frac{\phi}{A}$$

$$\phi = E \cdot A$$

لعمودى

$$\phi = E \cdot A \cdot \cos \theta$$

لومائل بزاوية θ

4.00

القوانين بتتبقى على الأجسام المشحونة (قانون جاوس) لكنت الأجسام الكبيرة مثل الكرة

5.00

$$\phi = \frac{\sum Q_{\text{شحنة السطح}}}{\epsilon_0}$$

$\epsilon_0 \rightarrow 8.85 \times 10^{-12}$

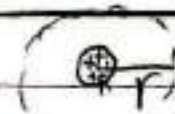
Gauss Law

* بيخلى الإشارة السالبة للشحنة زى ما هى (الفيض الكلى داخل سطح مغلق) كرة مشحونة

6.00

* Conducting still

$$E = \frac{1}{4\pi} \frac{Q}{r^2}$$



* in conducting still

$$E = \text{صفر}$$

حيث $r > R$



* احسب المجال الكهربائي إذا علمت أن $q = 4\text{C}$ و $r = 2\text{m}$

$$E = k_e \frac{Q}{r^2} = 9 \times 10^9 \times \frac{4}{2^2} = 9 \times 10^9 \text{ N/C}$$

* احسب المجال الكهربائي إذا علمت أن $Q = 3\text{C}$ و $F = 7\text{N}$

$$E = \frac{F}{Q} = \frac{7}{3} \text{ N/C}$$

* Electric Field Lines *

- 1- Directed From $\oplus$ to $\ominus$
- 2- Imaginary / non real / discontinuous
- 3- Don't intersect
- 4- Tangent Line

Ø Flux → Number of Electric Fields Lines Per unit Area. (scalar)

$\theta = 0^\circ$ → maximum Flux → Parallel

$\theta = 90^\circ$ → minimum Flux → Perpendicular

1. The materials in which all of electrons are bound to atoms and cannot move freely through material is (insulator)
2. A region around a stationary electric charge (Electric Field)
3. Coulomb is the unit of which quantity (charge)
4. Coulomb's Law is valid for (only point charged)
5. Coulomb's Law is valid for any distance between the particles? (False)
6. Which one of the following is similar between electrostatic force and gravitational force?
(Force is inversely proportional to the distance between the bodies)

True or False

- 1- electric dipole moment is a scalar quantity. (X)
- 2- For a charge Q_1 , the effect of charge Q_2 on Q_1 will be $F_{12} = -F_{21}$. (X)
- 3- Flux is scalar physical quantity. (✓)
- 4- Test charge always equals one coulomb. (✓)

Written

- 1- Find the force between $2C$ and $-1C$ separated by a distance $1m$ in air (in newton)?

$$F = K \frac{Q_1 Q_2}{r^2} = 9 \times 10^9 \frac{2 \times 1}{1^2} = 1.8 \times 10^{10} N$$

- 2- Calculate electric flux through charges $2C$, $-7C$, $10C$, $3C$

$$\phi = \frac{\sum q}{\epsilon_0} = \frac{2 - 7 + 10 + 3}{8.85 \times 10^{-12}} = 9.03 \times 10^{11} N \cdot m^2 / C$$

3. compute electro static force between electron and proton where distance between them $80 \text{ \AA}$.

$$F = K \frac{Q_1 Q_2}{r^2} = 9 \times 10^9 \frac{(1.6 \times 10^{-19})^2}{(80 \times 10^{-10})^2} = 3.6 \times 10^{-12} \text{ N}$$

الضوء الهندسي

* Newton's Particles theory

الضوء جسيمات متناهية الصغر تسير بسرعات كبيرة في خطوط مستقيمة.

[1678] → Huygens' wave theory

الضوء موجات تنتقل خلال وسط

[1873] → Maxwell's electromagnetic theory

الضوء موجات كهرومغناطيسية

Hevitz

أثبت أن الضوء موجات

الاحتش (Photoelectric effect)

[1900] → بلانك

الضوء عبارة عن فوتونات

أينشتاين

الضوء عبارة عن فوتونات لها طاقة على شكل

حزم تتناسب مع التردد [1905]

Ex N → Waves

De Broglie

Duality

Particles

تفاعل الضوء ← جسيم Particle

انتشار الضوء ← موجة Wave

* فسر أينشتاين Photoelectric effect

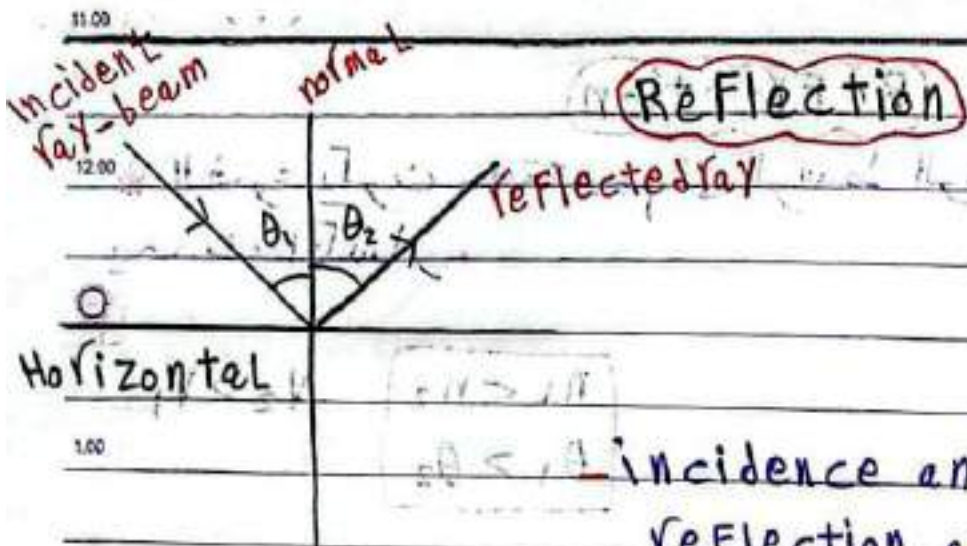
ReFRAction

(انكسار)

ReFlection

(انعكاس)

- one medium
- mirror



incidence angle equal
ReFlection angle $\theta_1 = \theta_2$

* الشعاع الساقط والمنعكس والعمودي على السطح يقعوا في نفس المستوى ونفس الوسط.

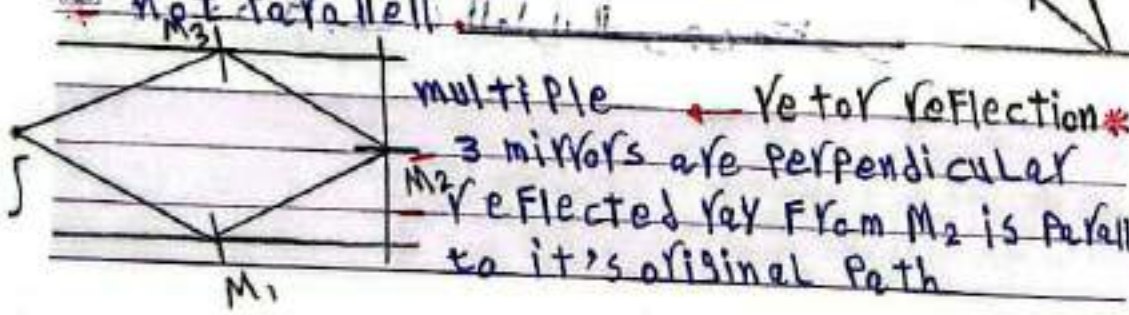
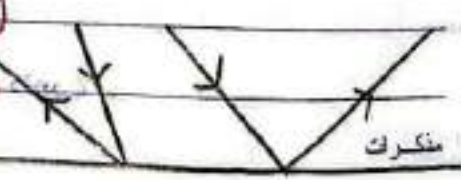
Smooth surface * الأشعة المنعكسة متوازية
Specular ReFlection (regular)

- ReFlected beam travel in one direction.
- ReFlected beam are Parallel.



Rough surface * الأشعة المنعكسة عشوائية وغير منتظمة
Diffuse ReFlection (irregular)

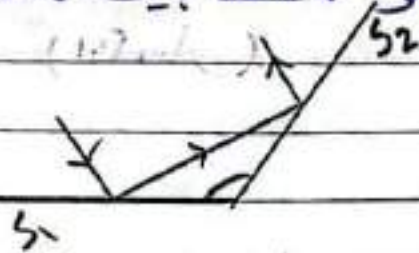
- Different / Various Directions.
- not Parallel.



multiple * Vector ReFlection
3 mirrors are perpendicular
ReFlected ray From M_2 is Parallel to it's original Path

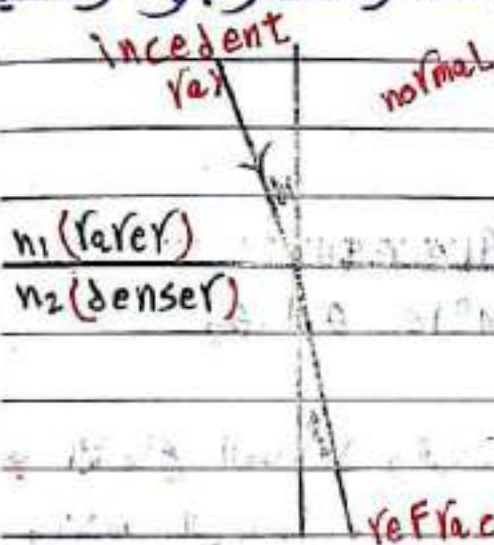
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	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30

* لو الضوء سقط بين متحنيين هيكرو غير متوازيين
(Double Reflection)



Refraction

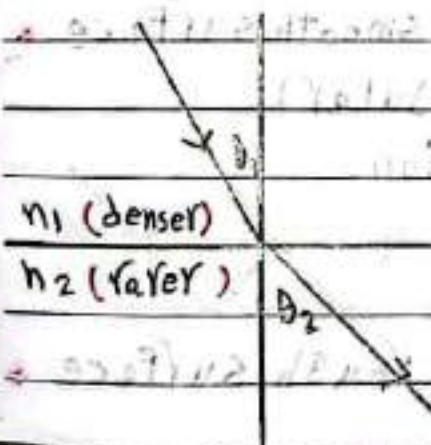
* الضوء يكون مستقيماً في الوسط الواحد وعند وجود وسطين يحدث انكسار.



$$n_1 < n_2 \quad v_2 < v_1$$

$$\theta_1 > \theta_2$$

* ينكسر الشعاع مقرباً من العمودي
toward



$$n_1 > n_2 \quad v_1 < v_2$$

$$\theta_1 < \theta_2$$

* ينكسر الشعاع مبتعداً من العمودي
outward

* سرعة الضوء ثابتة في نفس الوسط المتجانس.
* التردد ثابت الطول الموجي متغير.

معامل الانكسار Refractive index

$$n = \frac{c}{v} > 1$$

ليست له وحدة قياس unitless

$$v = f \cdot \lambda$$

التردد

Ratio between speed of light in air and medium.

* $f \rightarrow$ constant

Shell Law

معامل الانكسار n_1 النسبي n_2

$$\frac{n_1}{n_2} = \frac{\sin \theta_2}{\sin \theta_1} = \frac{\lambda_2}{\lambda_1} = \frac{v_2}{v_1} = \text{constant}$$

* في حالة الانكسار في الهواء $(n=1 \rightarrow \frac{c}{v})$

* الشعاع الساقط والعمودي على السطح والمنكسر يقصروا في نفس المستوى ولا يقصروا في نفس الوسط.

Thermodynamic

It is branch of Physics that studies the conversion of Heat energy into other types of energies.

→ It depends on the change in Pressure (P) or temperature (T) or Volume (V).

1. Temperature

It is Property of system which determines the hotness of the system, measure the movement of Particles inside the system.

* $T \uparrow \rightarrow K.E \uparrow$, $T \downarrow \rightarrow K.E \downarrow$

Units of Temperature → (Celsius $^{\circ}C$, Kelvin $^{\circ}K$, Fahrenheit $^{\circ}F$)

* Heat → It is amount of energy which transfer from hot system to cold system.

Unit of heat → (calorie, Joule, erg)

* $1 \text{ cal} = 4.18 \text{ J}$

* $1 \text{ J} = 10^7 \text{ erg}$

Thermal equilibrium

Two systems have the same temperature and have the exchange of heat equal to zero.

Thermal contact

Two systems have the exchange of heat without exerting work done.

* **Thermometer**: Device used to measure the temperature. It depends on change of physical property with temperature.

Zeroth law of thermodynamics

Two objects are separately in thermodynamic equilibrium with a third object, they are in thermal equilibrium with each other.

$$T_K = T_C + 273 \quad , \quad T_C = T_K - 273$$

$$T_F = \frac{9}{5} T_C + 32 \quad , \quad T_C = \frac{5}{9} (T_F - 32)$$

$$\Delta T_F = \frac{9}{5} \Delta T_C \quad , \quad \Delta T_K = \Delta T_C$$

Thermal expansion

Linear

(α_L)

1

Area

(α_A)

2

Volume

(α_V)

3

تغير أبعاد التمدد الحراري

$$\Delta L = \alpha_L \cdot L_0 \cdot \Delta T$$

$$L = L_0 (1 + \alpha_L \cdot \Delta T)$$

$$\Delta A = \alpha_A \cdot A_0 \cdot \Delta T$$

$$A = A_0 (1 + \alpha_A \cdot \Delta T)$$

$$\Delta V = \alpha_V \cdot V_0 \cdot \Delta T$$

$$V = V_0 (1 + \alpha_V \cdot \Delta T)$$

$$\beta = 3\alpha$$

$$\Delta V = 3\alpha \cdot V_0 \cdot \Delta T$$

$$3\alpha = \frac{\Delta V}{V_0 \cdot \Delta T}$$

EX: iron wire of Length 30m at 0°C

$$\alpha_{\text{iron}} = 11 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$$

1- What is Length at 40°C?

$$L = L_0 (1 + \alpha_L \cdot \Delta T)$$

$$L = 30 (1 + 11 \times 10^{-6} \cdot 40) = 30.0132 \text{ m}$$

$$\Delta L = L - L_0$$

$$\Delta L = 30.0132 - 30 = 0.0132 \text{ m}$$

10.00

2. Suppose that the two ends of wire are fixed by a force for preventing expansion when the temperature increase to 40°C , what is the stress exerted on it?

$$(Y = 20 \times 10^{10} \text{ N/m}^2)$$

(مثال زیاده)

$$\text{Stress} = Y \cdot \frac{\Delta L}{L_0} = 20 \times 10^{10} \cdot \frac{0.0132}{30} = 88 \times 10^6 \text{ N/m}^2$$

3. What will happen to the wire when the temperature decrease from 0°C to -40°C ?

It will contract بمقدار ΔL

* units of Heat *

→ Calorie: amount of energy required to rise the temperature of 1 gm of water from 14.5°C to 15.5°C .

→ Joule: It is amount of energy required to rise the temperature of one gram of water by 1°C .

→ British thermal unit (BTU): It is amount of energy required to rise the temperature of one gram of water from 63°F to 64°F .

مكرن

Specific Heat (C)

It is amount of energy required to rise the temperature of one gram of water by 1°C .

$$C = \frac{Q}{m \cdot \Delta T}$$

$$m \cdot \Delta T$$

Heat capacity السعة الحرارية

It is amount of energy required to rise the temperature of object 1°C

$$C = \frac{Q}{\Delta T}$$

* Heat Flow → transfer of energy between system and surrounding due to temperature difference (ΔT)

Heat → 1- not the warm that we feel, 2- not energy... in hot system, 3- internal energy for system, 4- not radiation.

اشعاع

$$v_{\text{rms}} = \sqrt{\frac{3k_B T}{m}}$$

* Macroscopic Description of an Ideal Gas *

$$PV = nRT \quad n = \frac{m}{M} \quad R = 8.314 \text{ J/mol}\cdot\text{K}$$

غالباً ما يعبر عن جزيئات الغاز المثالي باستخدام العدد الكلي للجزيئات N

$$N = n \cdot N_A \quad PV = \frac{N}{N_A} RT$$

عدد الجسيمات الغاز (عدد أفوجادرو) (6.02×10^{23})

$$k_B = \frac{R}{N_A} = 1.38 \times 10^{-23} \text{ J/K}$$

$$PV = N k_B T$$

Boltzmann's constant

Latent Heat (L)

amount of energy required to convert the substance from one phase to another phase without change temperature.

depend on: 1. intermolecular distance

2. Δm : change in mass

$$Q = \pm mL$$

Latent Heat of Fusion (melting): Solid $\rightarrow$ Liquid

Latent Heat of Vaporization: Liquid $\rightarrow$ Vapour

Latent Heat of Freezing: Water $\rightarrow$ Ice

EX: A 32.0 g silver spoon cools from 60°C to 20°C .
What is the change in thermal energy?

$$(c = 235 \text{ J/kg} \cdot \text{K})$$

$$Q = m \cdot \Delta T \cdot c$$

$$= \frac{32}{1000} \cdot -40 \cdot 235 = -301 \text{ J}$$

EX: $V = 100 \text{ cm}^3$, $t = 20^{\circ}\text{C}$, $P = 100 \text{ Pa}$

$n = ??$, $N = ??$

$$PV = nRT$$

$$100 \times 100 \times 10^{-6} = n \times 8.314 \times (20 + 273)$$

$$n = 4.105 \times 10^{-6}$$

$$N = n \cdot N_A = 4.105 \times 10^{-6} \times 6.02 \times 10^{23}$$

$$= 2.47 \times 10^{18}$$

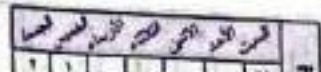
EX: $V_i = 15 \times 10^{-3} \text{ cm}^3$, $P_i = 200 \text{ kPa}$, $T_i = 300 \text{ K}$

$V_f = 12 \times 10^{-3} \text{ cm}^3$, $P_f = 350 \text{ kPa}$, $T_f = ??$

$$\frac{P_i V_i}{T_i} = \frac{P_f V_f}{T_f}$$

$$\frac{200 \times 10^3 \times 15 \times 10^{-3}}{300} = \frac{350 \times 10^3 \times 12 \times 10^{-3}}{T_f}$$

$$T_f = 420 \text{ K}$$



* First Law of Thermodynamic

Isolated system

is one that doesn't interact with its surrounding
it has no energy transfer $W = \text{zero}$, $Temp. = \text{zero}$
 $Q = \text{zero}$

$$\Delta U = Q - W$$

change in
Internal energy

$$W = P \cdot \Delta V$$

الشغل المبذول
الضغط الشغل
 $V_2 - V_1$
التغير في الحجم

قاعدة الاشارة في Heat

(+)

system gain Heat energy

(-)

system Lost heat energy

* Work depend on Path المسار الى بيرضح العلاقة بين P و V

Boyle's Law $\rightarrow P_1 V_1 = P_2 V_2 \rightarrow (T \text{ const.})$

Charles's Law $\rightarrow \frac{V_1}{V_2} = \frac{T_1}{T_2} \text{ كلف } (P \text{ const.})$

* Conservation of Energy: calorimetry *

$$Q_{\text{cold}} = -Q_{\text{hot}}$$

$$C_X = \frac{m_W C_W (T_F - T_W)}{m_X (T_X - T_F)}$$

الحرارة النوعية للمادة $\rightarrow$ درجة حرارة المذيب

(Electricity)

* Voltage (Potential difference)

It is work done necessary to move charge from position to infinity.

الشغل الذي يتم لإنهاء الشحنة الكهربائية من مكان ما إلى ما لا نهاية.

$$V = \frac{W}{q} \quad \text{Unit: Volt, J/C}$$

$$V = K \frac{q}{r} \quad (K = 9 \times 10^9) \quad \text{distance between charges}$$

* Voltage is scalar quantity. كمية قياسية

* F, E — Vector quantity * ملحوظة
القوة المجال

* ϕ, V — scalar quantity
الجهد الفيزيقي

$$\Delta V_{AB} = V_A - V_B$$

* Voltage is positive $\rightarrow V_A > V_B$

* Voltage is negative $\rightarrow V_A < V_B$

* Equipotential surface — surface which two points are in voltage or its potential difference between two points equal zero.

	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
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EX: Calculate the voltage where the charge 10 nC and distance between charge 3 mm ?

$$V = K \frac{q}{r} = 9 \times 10^9 \times \frac{10 \times 10^{-9}}{3 \times 10^{-3}} = 30000 \text{ Volt}$$

$$E = \frac{V}{d}$$

* العلاقة بين الجهد والجهد
units $\rightarrow \text{N/C}, \text{V/m}$

EX: Calculate the voltage as given electric field 10 N/C and distance between terminals of battery 5 m ?

$$V = E \cdot d = 10 \times 5 = 50 \text{ V}$$

Capacitors

It is electric device in electric circuit can store charge.

Description:

consists of two parallel plates between electric connected with terminals of battery

لوحين متوازيين بينهما مادة عازلة يوصل طرفي الكثف على بطارية

$$C = \frac{q}{V}$$

unit $\rightarrow \text{Farad (F)}$ و C/V

$$C = \epsilon_0 \frac{A}{d}$$

مساحة

مساافة

$$8.85 \times 10^{-12}$$

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

9.00 **EX:** calculate stored charge in capacitor where capacitance is $7\mu F$, Voltage is $4mV$?

10.00 $q = C \cdot V$
 $= 7 \times 10^{-6} \times 4 \times 10^{-3} = 28 \times 10^{-9} C$

11.00 **EX:** calculate capacitance of capacitor where it's area $5mm^2$, separation distance $8cm$?

12.00 $C = \epsilon_0 \frac{A}{d}$
 $= 8.85 \times 10^{-12} \times \frac{5 \times 10^{-6}}{8 \times 10^{-2}} = 5.53 \times 10^{-16} F$

1.00 * connection of capacitors:

2.00 1. **Parallel** توازي

3.00 $C_t = \sum C = C_1 + C_2 + C_3 + \dots$

* Voltage is constant

4.00 * current & charge are parted

5.00 2. **series** تسلسلي $V_{total} = \frac{I}{A} \cdot l$, $V_{ANP} = I$

$\frac{1}{C_t} = \frac{C_1 C_2}{C_1 + C_2}$

6.00 $\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

7.00 * current is constant * Voltage is parted

* charge is not parted

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	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30

* Energy stored in capacitor *

$$U = \frac{q^2}{2C} = \frac{1}{2} q \cdot \Delta V = \frac{1}{2} C (\Delta V)^2$$

$$U = -P \cdot E$$

طاقة الرفع

اقرأ
مش قالها الدكتور

Dipole moment $\rightarrow P = 2a \cdot q$

عزم ثنائي القطب المسافة

Torque or Couple $\rightarrow T = P \cdot E$

عزم الازدواج عزم ثنائي القطب $\times$ شدة المجال

Electric current

Rate of Flow of charges per second

$$I = \frac{q}{t}$$

Unit: ampere A, C/s

$$I = q n A v$$

$$\frac{I}{A} = q n v$$

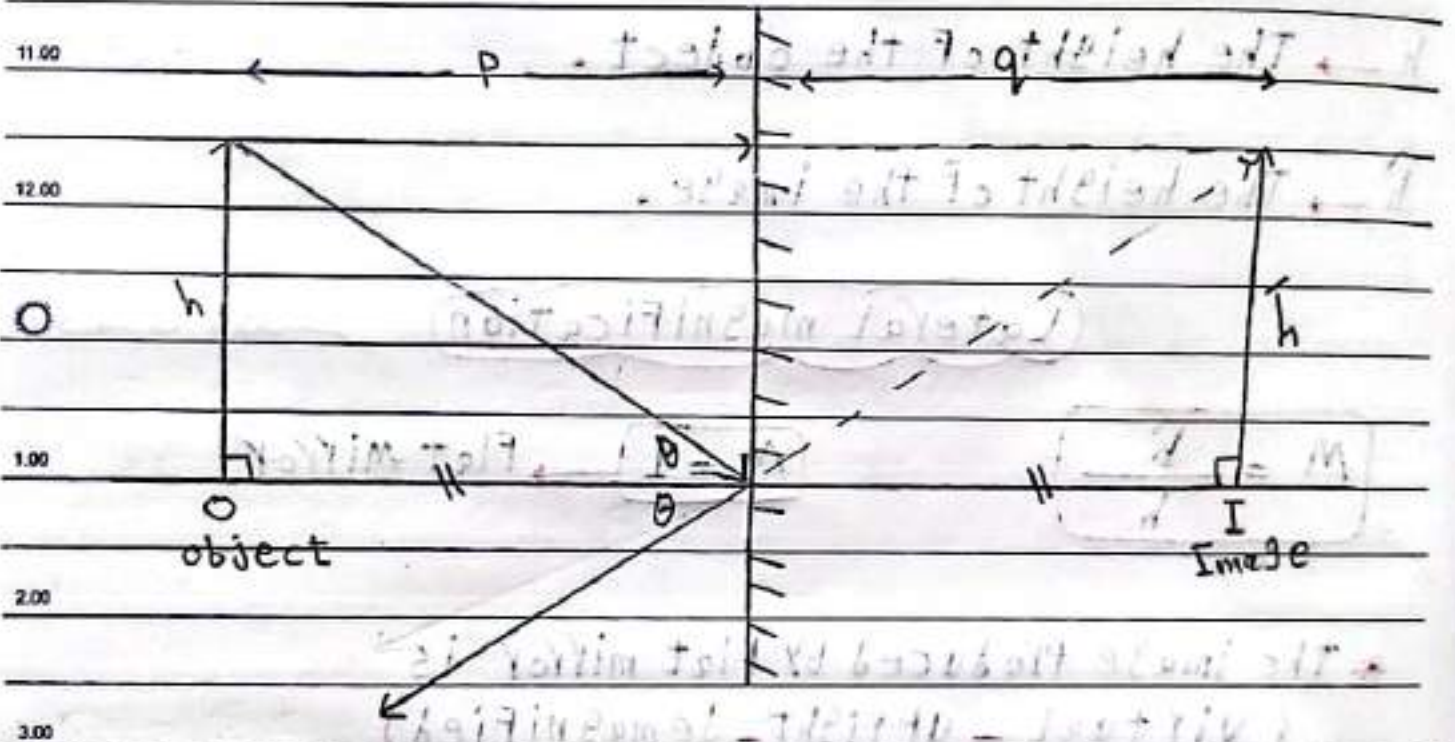
$$J = q n v$$

سرعة مسافة عدد الشحنات

$$I = \frac{q n A d}{t}$$

ضوء هندسي

Image Formed by Flat mirror :-



* Image Formation :-

① $p = q$
 object distance Image distance

② $h = h'$
 height of object height of image

$p \rightarrow$ is the distance between the object and the mirror.

$q \rightarrow$ is the distance between the image and the mirror.

$h \rightarrow$ The height of the object.

$h' \rightarrow$ The height of the image.

Lateral magnification ○ نسبة التكبير

$$M = \frac{h'}{h}$$

$M = 1 \rightarrow$ Flat mirror

* The image produced by Flat mirror is
(Virtual - Upright - demagnified)
كقديريّة محدولة غير مكبرة

* $M > 1 \rightarrow$ image enlarged (magnified)

* $M < 1 \rightarrow$ image minimized (small)

Flat mirror used in: titling / view mirror

$s \rightarrow$ side

$A \rightarrow$ Angle

SSS $\rightarrow$ ٣ أضلاع متساوية

SAS $\rightarrow$ ضلعين متساويين وبينهم زاوية

ASA $\rightarrow$ زاويتين وضلع ثالث

$$2 \text{ Angles} = 90^\circ$$

اثبات ASA

$$\theta_1 = \theta_2 \text{ طبقا لقانون الانعكاس}$$

$$2 \text{ Angles} \text{ تقابل بالرأس}$$

ضلع مشترك common side

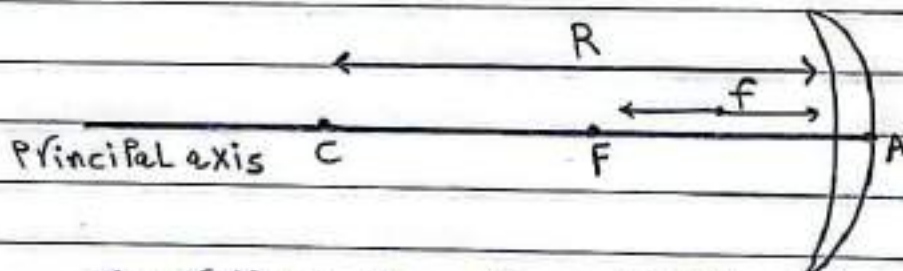
$$P = Q$$

Image Formed by spherical mirrors

1 - concave mirror
(converging)

2 - convex mirror
(diverging)

1 - Concave mirror



R → The radius of curvature for mirror

C → It is the center of curvature

V → Is the center of spherical segment

A line drawn from (C) to (V) is principle axis.

F → The Focal Point

f → Focal length (cm)

$$C = R = 2f$$

مذكور

Properties Matter

* Dimensions * units of measure

Mass	«M»	kg	gm	slug	
Length	«L»	m	cm	Foot	
time	«T»	sec	sec	sec	
		MKS	CGS	Bu	

Area = $L \cdot L = L^2$ « m^2 »

Volume = $L \cdot L \cdot L = L^3$ « m^3 »

Velocity = $\frac{L}{T}$ « m/s » $\rightarrow L \cdot T^{-1}$

Acceleration = $\frac{\text{Velocity}}{T}$ « m/s^2 » $\rightarrow L \cdot T^{-2}$

Force = $m \cdot a$ الكتلة $\times$ التسارع $\rightarrow M L T^{-2}$

Work = $F \cdot d$ القوة $\times$ المسافة $\rightarrow M L^2 T^{-2}$

energy

① K.E = $\frac{1}{2} m v^2 \rightarrow M (L T^{-1})^2$
 " Kinetic Energy " $\rightarrow M L^2 T^{-2}$

② P.E = $m g h \rightarrow M L T^{-2} \cdot L$
 " Potential Energy " $\rightarrow M L^2 T^{-2}$

Pressure = $\frac{F}{A} = \frac{M L T^{-2}}{L^2} \rightarrow M L^{-1} T^{-2}$

Density = $\frac{m}{V} = \frac{M}{L^3} \rightarrow M L^{-3}$

Inertia = $m \cdot r^2 \rightarrow M L^2$

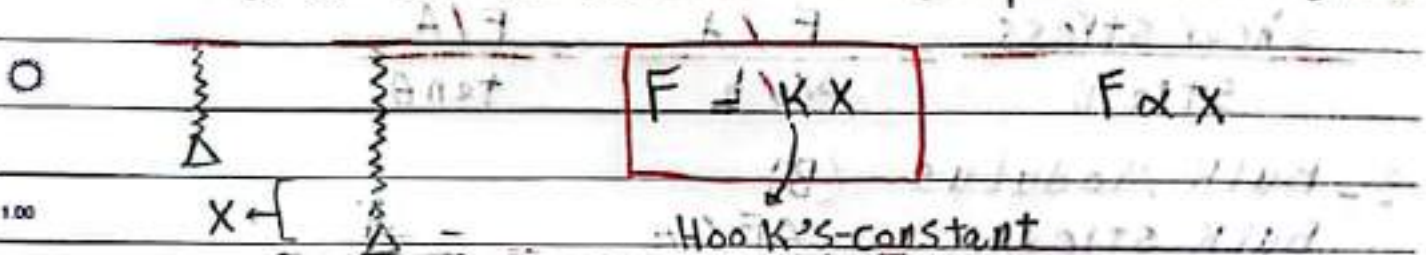
عزم القصور

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

9.00 **Elasticity** is a physical property of material which return to their original shape and size after the forces deforming. إزالة

11.00 **Hooke's Law** → The extension of elastic object is directly proportional to the force

12.00 مقدار استطالة جسم ما يتناسب طردياً مع القوة المؤثرة



2.00 **Stress** → refers to the cause of the change

3.00
$$\text{stress} = \frac{F}{A} \quad \begin{matrix} \text{القوة} \\ \text{المساحة} \end{matrix} \rightarrow (N/m^2)$$

4.00 * dimension Equation of stress $\frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$

5.00 **Strain** → refers to a change in some spatial dimension (Length, angle, Volume) الأبعاد الميكانيكية

6.00
$$\text{Strain} = \frac{\Delta L}{L_0} \quad \begin{matrix} \text{التغير في الطول} \\ \text{الطول الأصلي} \end{matrix}$$

7.00 تم مسح

Types of modulus

1 Young modulus (Y)

$$\frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta L/L} = \frac{F}{\Delta L} \cdot \frac{L}{A}$$

2 Shear modulus (S)

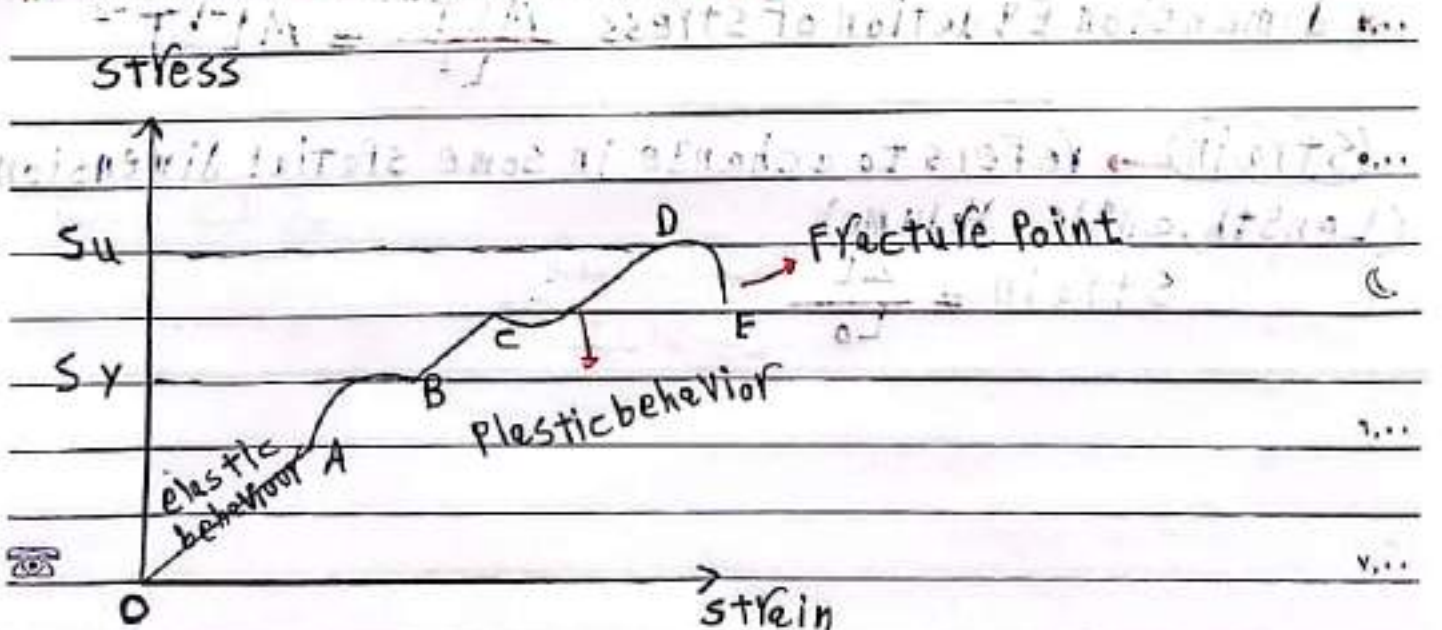
$$\frac{\text{Shear stress}}{\text{Strain}} = \frac{F/A}{\Delta x/h} = \frac{F}{\Delta x} \cdot \frac{h}{A} = \frac{F}{\tan \theta}$$

3 Bulk Modulus (B)

$$\frac{\text{Bulk stress}}{\text{Strain}} = \frac{-\Delta P}{\Delta V/V_i} = \frac{-\Delta P}{\Delta V/V_i}$$

* Poisson Ratio → It is Ratio Between Lateral strain and Axial strain. (transverse)

* Stress strain curve *



(O → A) Linear curve, obey Hook's Law, elastic.
 (A → B) not Linear curve, stress and strain are not
 Proportional, Point (B) Yield Point, elastic Limit
 (B → D) The Load Increased, (C) Point Plastic deformation
 at Point D → Ultimate strength begins.
 at E the Fracture, the Fracture occurs.
 (breaking)

Gas, Liquid → Fluid mechanics

$$P = \frac{F}{A}$$

$$P = P_0 + \rho gh$$

الارتفاع
 الكثافة
 العمق

Unit: N/m^2 or $dyne/cm^2$

* Barometer: Long tube closed at one end Filled With
 mercury then inverted into a dish of mercury to measure
 the Pressure.

$1 \text{ atm} = 1.013 \times 10^5 P_0$

$\rho_{Hg} = 13600 \text{ kg/m}^3$

$\rho_{H_2O} = 1000 \text{ kg/m}^3$

$P = \rho gh$ → Barometer

* Manometer → used to measure the atmospheric pressure. Mercury is used because it has high density isn't affected by external factors.

1 - $P = \rho gh$ → ارتفاع السائل في الأنبوبة = ارتفاع السائل في المستوي

2 - $P = P_a + \rho gh$ → ارتفاع السائل في الأنبوبة أعلى

3 - $P = P_a - \rho gh$ → ارتفاع السائل في الأنبوبة أقل

Pascal's Law

$$P_1 = P_2$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$A = \pi r^2$$

→ The hydraulic Press → تطبيق على قاعدة باسكال

* Buoyant Forces and Archimedes's Principle *

Any object partially or totally immersed / submerged في سائل في سائل
in fluid exerts on object an upward force equal to the displacement

$$B = \rho V g$$

الحجم

$$F_b = F_w$$

* $F_b > F_w$ → Float

* $F_w > F_b$ → sink

→ The Equation of continuity for fluids:

$$A_1 V_1 = A_2 V_2 = A_3 V_3 = \text{constant}$$

السرعة

9.00

Bernoulli's equation

10.00

$$P + \frac{1}{2} \rho v^2 + \rho gh = \text{constant}$$

↓
المحرك

11.00

12.00

○

1.00

2.00

3.00

4.00

(3)

Electricity

* Types of current :

1- Dc $\rightarrow$ Direct تيار مستمر From battery
 $\rightarrow$ Constant Intensity and direction...

2- Ac $\rightarrow$ Alternating تيار متردد From dynamo...
 $\rightarrow$ change Intensity and direction

3- Conventional current $\rightarrow$ +ve $\rightarrow$ -ve

4- Actual current $\rightarrow$ -ve $\rightarrow$ +ve

ohm's Law

$$V \propto I$$

$$V = RI$$

$$R = \frac{V}{I}$$

$J \propto E$ الجهد الكهربائي

$$J = \sigma E$$

كثافة التيار

conductivity التوصيلية

current density

unit $\rightarrow$ $\Omega^{-1} m^{-1}$

$$J = \frac{I}{A} = nev \text{ / unit } \rightarrow A/m^2$$

R $\rightarrow$ resistance (Ω) , $\rho_e \rightarrow$ resistivity ($\Omega \cdot m$)

$$R = \rho_e \frac{L}{A}$$

$$\sigma = \frac{1}{\rho_e}$$

Resistors connection

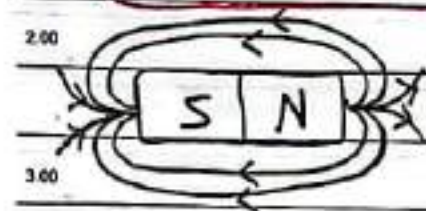
① series التوالي $R_t = R_1 + R_2 + R_3$

② Parallel توازي $R_t = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$

Magnetic Field المجال المغناطيسي

It is the region around a magnet or a current carrying conductor in which magnetic force can be detected.

$F = k_m \frac{m_1 m_2}{r^2}$ → $F = \frac{1}{4\pi M} \frac{m_1 m_2}{r^2}$



N N
Repulsion

S N
attraction

المجال المغناطيسي شدته B يؤثر على جسم مشحون بسرعة V عمودي

$F = q \vec{V} \cdot \vec{B}$

$F = qVB \sin \theta$

$F = \text{zero}$ موازي

القوة التي سيؤثر بها المجال المغناطيسي على سلك يمر به تيار كهربائي

$F = I \vec{L} \cdot \vec{B} \sin \theta$

الزاوية بين اتجاه السلك و
المجال المغناطيسي

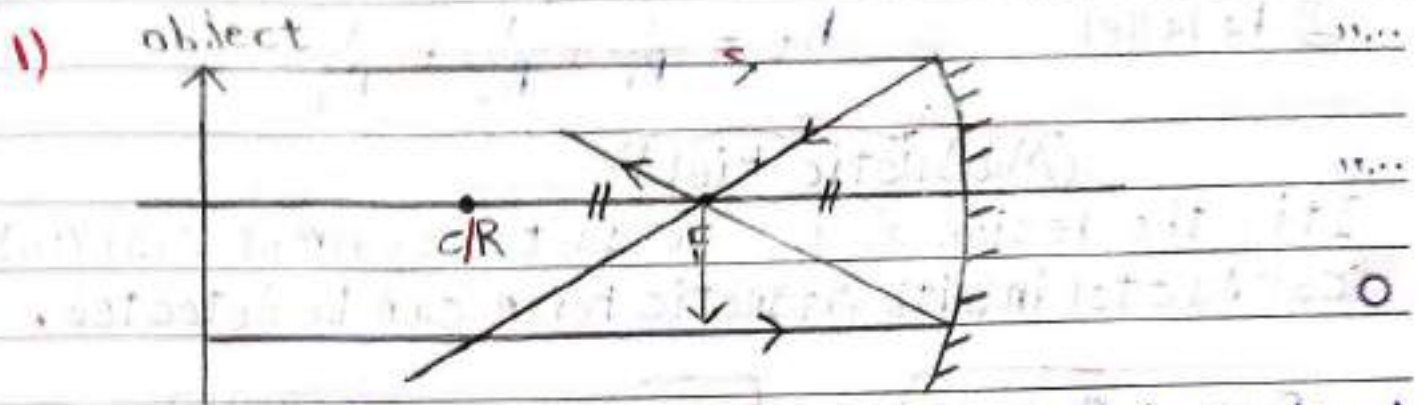
منكروت

(3)

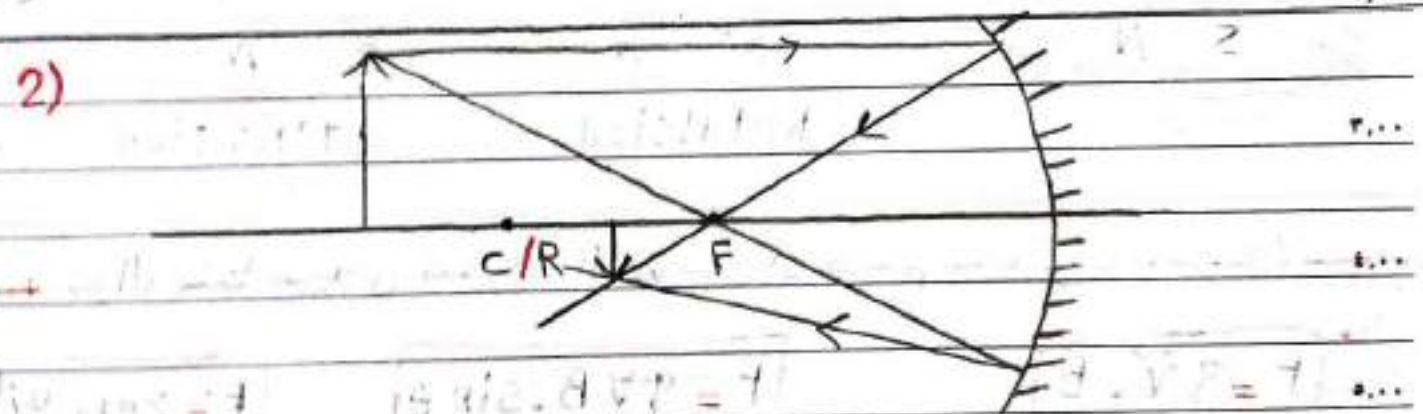
ضوء

spherical mirrors

	concave ✓	(converging)
	convex	(diverging)



$P = \infty$, $q = F$, real , inverted , extremely diminished
 البعد بين الجسم والصورة $P = \infty$, البعد البؤري بعد الصورة $q = F$, مقلوبة



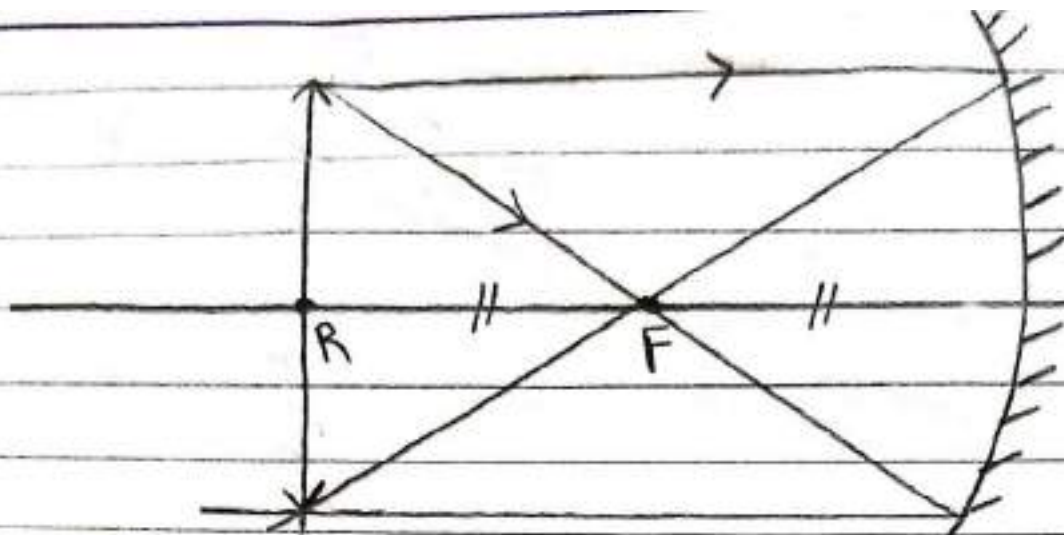
$P > R$, $R > q > F$, $m < 1$, real , inverted , diminished
 مقلوبة

3)

10.00

11.00

12.00



$P=R, q=R, m=1, \text{real, inverted}$
نسبة
مقلد

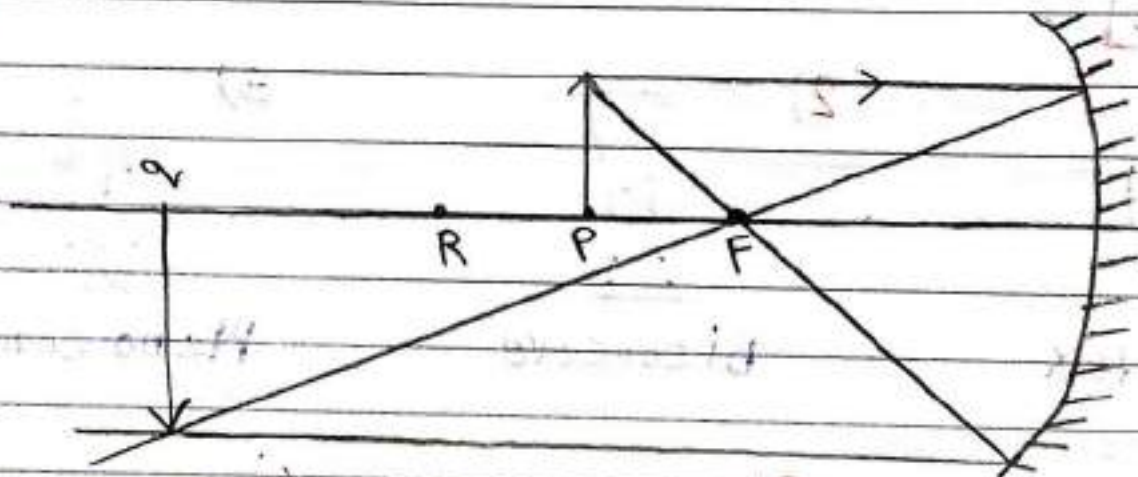
4)

1.00

2.00

3.00

4.00

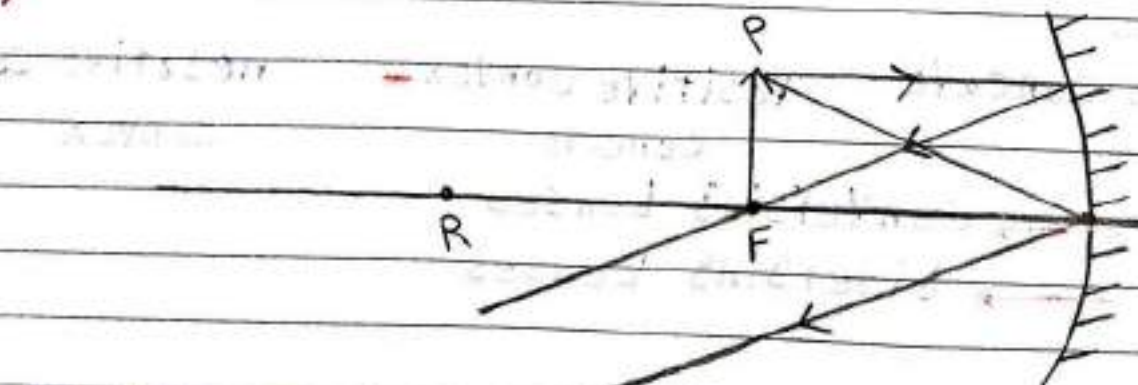


$R > P > F, q > R > F, m > 1, \text{real, inverted, enlarged}$

5)

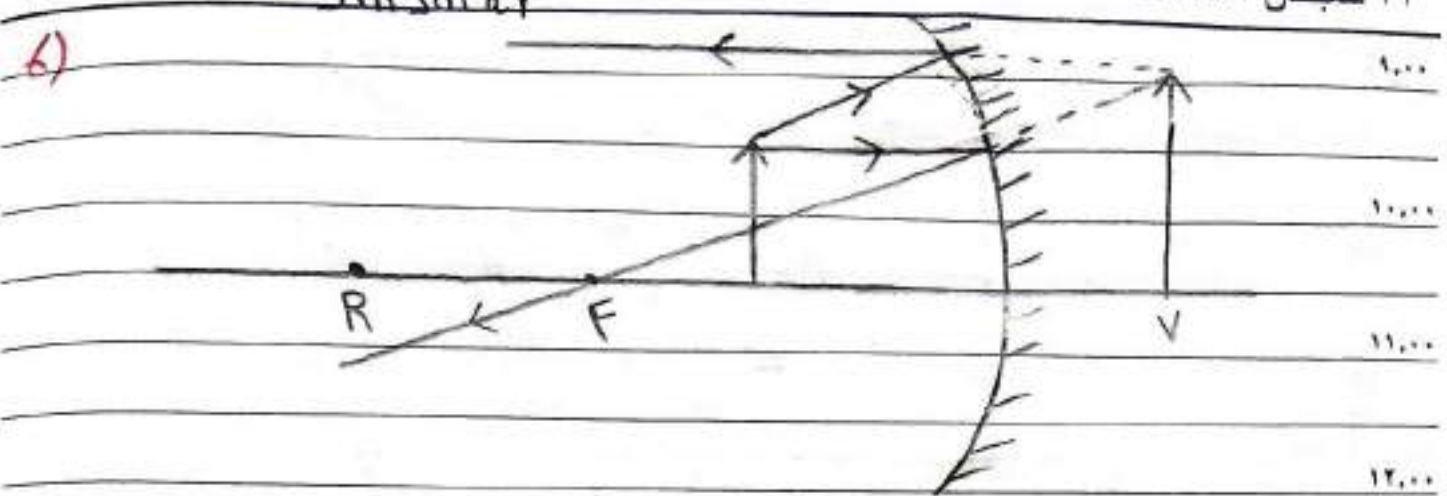
6.00

7.00



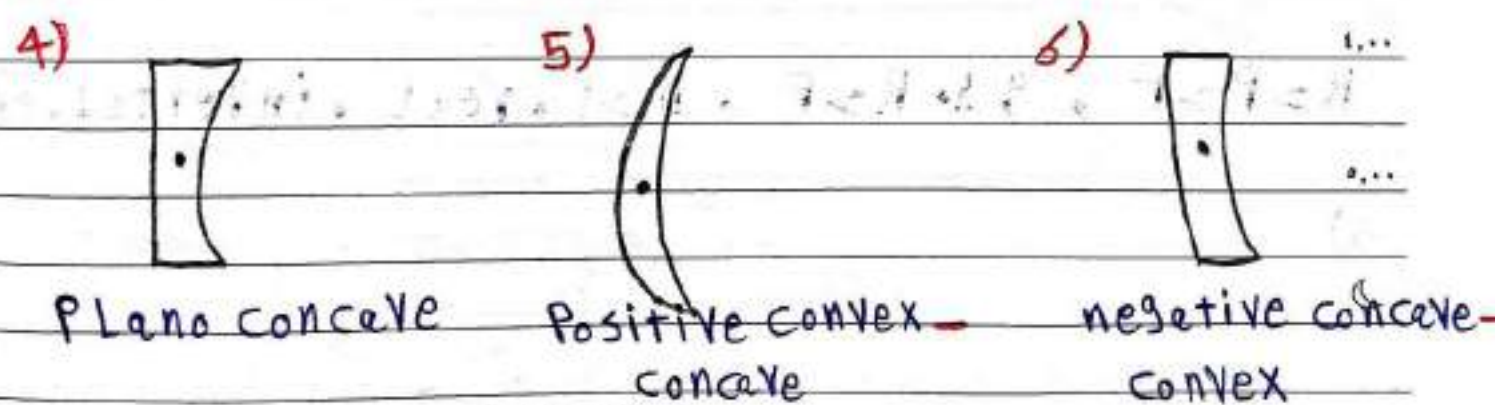
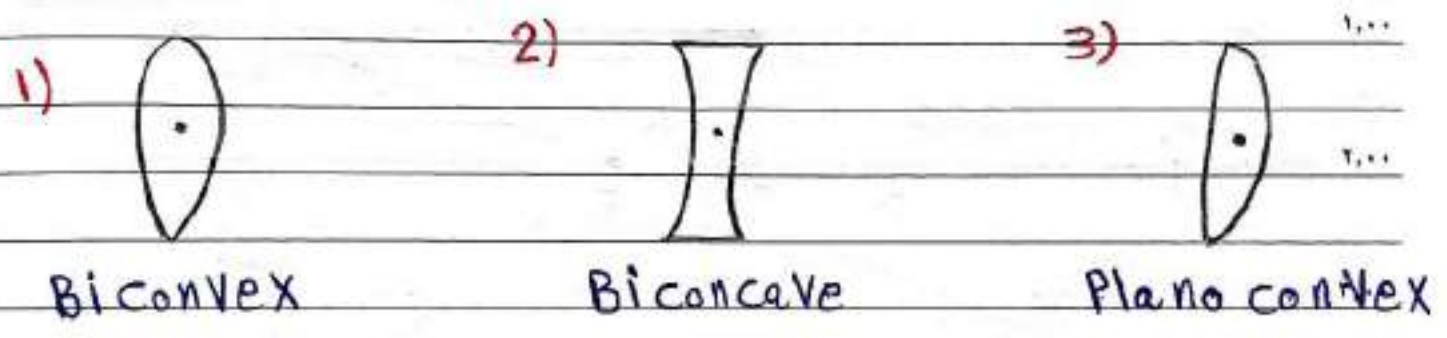
$P=F, q=\infty, m \gg 1, \text{real, inverted, highly enlarged}$

FEBRUARY	Sat	Sun	Mon	Tue	Wed	Thu	Fri
	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31



$F > P > V$, $m > 1$, enlarged, virtual, upright

Lenses

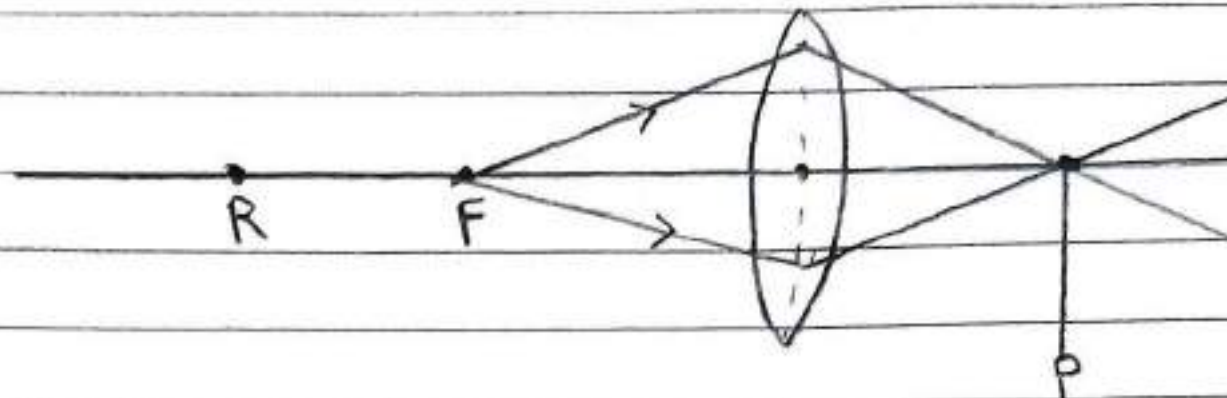


1, 3, 6 → converging Lenses
 2, 4, 5 → diverging Lenses

9.00

10.00

11.00



12.00

Lenses' Law $\rightarrow \frac{1}{F} = \frac{1}{p} + \frac{1}{q}$

ارتفاع الصورة
 $M = \frac{h}{h} = \frac{-q}{p}$

ارتفاع الجسم
 $P = \frac{1}{F(m)} = \frac{100}{F(cm)}$

2.00

$$F = \frac{pq}{p+q} \text{ (cm)}$$

3.00

4.00

5.00

