مدونة المناهج السعودية

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الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

CHAPTER 2 : MOTION &ENERGY

Formulas & Constants

Average speed: $\bar{v} = \frac{d}{t} = \frac{v_f + v_i}{2}$	$a = \frac{v_f - v_i}{t}$	$v_f^2 - v_i^2 = 2\ a.d$	$v_f = v_i + g.t$ $v = g.t\ (v_i = 0)$	$d = ½\ a.t^2 + v_i.t$ $d = ½\ g.t^2\ (v_i = 0)$	ΣE = constant (energy consrv.)
$F = m.a$	$w = m.g$	$P = W / t$	$W = F . d . \cos\theta$	$PE = m.g.h$ $KE = ½\ m.v^2$	$V_f = \sqrt{2\ g.h}$
$F_{A\ on\ B} = F_{B\ on\ A}$	$R^2 = X^2 + Y^2$	$\tan\theta = Y / X$	1 m/s = 3.6 km/h	$g = 10\ m/s^2$	1 hp = ¾ kW

Key Terms & Definitions

Acceleration	تسارع	Horizontal	أفقي	Resultant	محصِّلة
Action	فعل	Inertia	القصور الذاتي	Reaction	ردة فعل
Air resistance	مقاومة الهواء	Instantaneous	لحظي	Resolution	تحليل
Average	متوسط	Interaction	تفاعل	Speed	السرعة القياسية
Component	عنصر / مُكوِّن / مُرَكَّب	Kinetic energy	الطاقة الحركية	Static	سكوني
Direction	اتجاه	Mass	كتلة	Support force	قوة الدعم
Displacement	إزاحة	Magnitude	مقدار	Tension	توتر
Distance	مسافة	Mechanical	ميكانيكي	Terminal speed	السرعة الحدية
Dynamic	حركي	Motion	حركة	Vector	كمية متجهة
Energy	طاقة	Net force	قوة إجمالية / صافية	Velocity	السرعة المتجهة
Equilibrium	اتزان	Normal force	القوة العمودية	Vertical	رأسي أو عمودي
Force	قوة	Potential energy	طاقة الوضع	Volume	حجم
Free fall	سقوط حر	Power	قدرة	Weight	وزن
Friction	احتكاك	Projectile	قذيفة أو مقذوف	Work	شغل
Gravity	جاذبية	Projection	إسقاط		

Vectors

1. Scalar is a quantity that does not need:
A value
B magnitude
C direction√
D unit

2. Vector is a quantity that needs:
A direction only
B magnitude only
C unit only
D magnitude and direction√

3. Example of a scalar is:
A velocity
B distance√
C acceleration
D force

4. Example of a vector is:
A velocity√
B distance
C speed
D time

5. For linear motion, the angle between the velocity and acceleration vectors is:

A always 0 º
B always 180º
C 0 º or 180º√
D always 90º

6. Adding two perpendicular vectors ($\vec{A}$) and ($\vec{B}$) gives a resultant ($\vec{R}$) with magnitude:
A-R = $\sqrt{A^2 + B^2}$√
B-R = $A^2 + B^2$
C- R = $\sqrt{A + B}$
D- R = 1 / $\sqrt{A^2 + B^2}$

محصلة أي متجهين متعامدين تحسب مقدارها من نظرية فيثاغورس

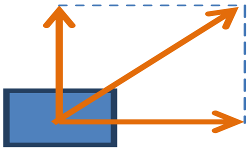
7. Two perpendicular forces, $F_1 = 40$ N and $F_2 = 30$ N, act on a brick. The magnitude of the net force (F_{net}) on the brick is:

A 70 N

B 50 N√

C 0 N

D 10 N



$$R = \sqrt{(F_1^2 + F_2^2)} = \sqrt{(40^2 + 30^2)}$$
$$= \sqrt{2500} = 50\ \text{N}$$

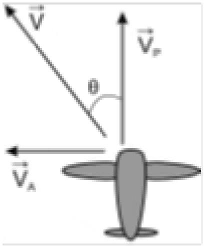
8. If an airplane heading north with speed $v_p = 400$ km/h faces a westbound wind (رياح نحو الغرب) of speed $v_A = 300$ km/h, the resultant velocity of the plane ($\vec{V}$) is:

A 500 km/h, north-west√

B 700 km/h, north-east

C 500 km/h, north-east

D 700 km/h, north-west



$$R = \sqrt{(v_p^2 + v_A^2)}$$
$$= \sqrt{(400^2 + 300^2)}$$
$$= \sqrt{25000} = 500\ \text{N}$$

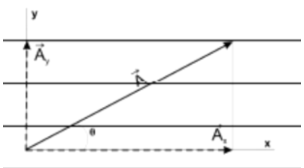
9. Decomposing (or resolving) a vector ($\vec{A}$) into two components in perpendicular directions (A_x and A_y) gives :

A $-A_x + A_y = A$

B- $A_x + A_y = A^2$

C- $A_x^2 + A_y^2 = A$

D- $A_x^2 + A_y^2 = A^2$√



Linear Motion, Velocity, Acceleration

10. To calculate an object's average speed we need to know the:

A acceleration and time

B velocity and time

C distance and time√

D velocity and distance

11. A horse gallops (يجري) a distance of 10 kilometers in 30 minutes. Its average speed is:

A 15 km/h

B 20 km/h√

C 30 km/h

D 40 km/h

$$\bar{v} = \frac{d}{t} = \frac{10\ km}{\frac{1}{2}\ h} = \frac{2 \times 10}{1} = 20\ km/h$$

12. A car maintains a constant velocity of 100 km/h for 10 seconds. During this interval its acceleration is:

A 0 km/h²√

B 1 km/h²

C 10 km/h²

D 100 km/h²

بما ان الجسم خلال حركته كانت سرعته ثابتة واتجاه ثابت (خط مستقيم) فذلك يعني ان التسارع يساوي الصفر .

13. While an object near Earth's surface is in free fall, its ____________ increases:

A velocity√

B acceleration

C mass

D height

14. The speed at a specific moment is called __________ speed:

A average

B instantaneous√

C initial

D final

15. Acceleration is the rate of change in:

A force

B distance

C speed

D velocity√

16. If the speed is constant, the acceleration must be:

A constant

B zero

C negative

D unknown√

لان التسارع كمية متجهة فلكي يكون صفر فلابد ان تكون السرعة والاتجاه ثابت (أي خط مستقيم)

17. A car moves along a straight road with constant acceleration. If its initial and final speeds are v_i =10 m/s, v_f = 20 m/s, its average speed is:

A 12 m/s
B 15 m/s√
C 10 m/s
D 20 m/s

$$\bar{v} = \frac{v_i + v_f}{2} = \frac{10+20}{2} = \frac{30}{2} = 15\ m/s$$

23. If a stone drops in a free fall from the edge of a high cliff, its speed after 5 seconds is:

A 10 m/s
B 40 m/s
C 50 m/s√
D 100 m/s

سرعة الجسم الساقط سقوط حر في أي لحظة من سقوطه من بدء السقوط

$$v = gt = 10 \times 5 = 50\ m/s$$

18. If an object in linear motion moves a distance of 20m in 5 seconds, its average speed is:

A 4 m/s√
B 5 m/s
C 10 m/s
D 20 m/s

$$\bar{v} = \frac{d}{t} = \frac{20}{5} = 4\ m/s$$

24. If a stone drops in a free fall from the edge of a high cliff, the distance it covers after 4 seconds is:

A 40 m
B 80 m√
C 120 m
D 160 m

المسافة التي يقطعها جسم يسقط سقوط حرفي أي لحظة من بدء السقوط

$$d = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times t^2 = 5 \times t^2 = 5 \times 4^2 = 5 \times 16 = 80\ m$$

19. If an object is in linear motion, and its speed changes from 10 m/s to 20 m/s in 10 seconds, its acceleration is:

A 20 m/s^2
B 10 m/s^2
C 5 m/s^2
D 1 m/s^2√

$$a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t} = \frac{20-10}{10} = \frac{10}{10} = 1\ m/s^2$$

25. If an object in free fall has an initial speed of 10 m/s, its speed after 10 seconds is:

A 80 m/s
B 90 m/s
C 100 m/s
D 110 m/s√

سرعة الجسم الساقط سقوط حر بعد مرور ١٠ ثواني من اكتسابه سرعة ابتدائية

$$v_f = v_i + g\,t = 10 + (10 \times 10) = 10 + 100 = 110\ m/s$$

20. If your average speed is 80 km/h on a 4-hour trip, the total distance you cover is:

A 40 km
B 80 km
C 120 km
D 320 km√

$$d = \bar{v} \times t = 80 \times 4 = 320\ km$$

26. Neglecting air resistance, if a player throws a ball straight up with a speed of 30 m/s, the ball will reach its maximum height after:

A 6 seconds
B 5 seconds
C 4 seconds
D 3 seconds√

حركة الاجسام المقذوفة الى اعلى وبخط مستقيم عند اهمال مقاومة الهواء تتبع قوانين السقوط الحر ولكن تختلف عنها في ان السرعة ستقل كل ثانية عن التي تليها بمعدل ١٠ م/ ث

$$v = g\,t \rightarrow t = \frac{v}{g} = \frac{30}{10} = 3\ s$$

21. If you travel 300 km in 4 hours, your average speed is:

A 50 km/h
B 75 km/h√
C 80 km/h
D 100 km/h

$$\bar{v} = \frac{d}{t} = \frac{300}{4} = 75\ km/h$$

Free Fall

22. If air resistance on a falling rock can be neglected, we say that this rock is in:

A outer space
B terminal speed
C free fall√
D slow motion

بما أن مقاومة الهواء مهملة فان أي جسم ساقط يعتبر في حالة سقوط حر

27. If an object is in free fall, the distance it travels every seconds is:

A the same as the previous (السابق) second
B more than the previous second√
C less than the previous second
D undefined

المسافة التي يقطعها جسم ساقط سقوط حر تزداد كل ثانية عن الثانية التي تسبقها

28. If an object is in free fall, its speed every seconds is:
A the same as the previous (السابق) second
B more than the previous second√
C less than the previous second
D undefined

سرعة الجسم الساقط سقوط حر تزداد كل ثانية عن الثانية التي تسبقها بمعدل ١٠ م /ث

Newton's 1st Law of Motion; Inertia; Equilibrium

29. If no external forces act on a moving object, it will:
A continue moving at the same speed
B continue moving at the same velocity√
C move slower and slower until it finally stops
D make a sudden stop

30. If an object is in mechanical equilibrium, we can say that:
A a nonzero net force acts on it
B it has constant velocity √
C it has small acceleration
D it has large acceleration

عندما يكون الجسم في حالة اتزان ميكانيكي فانه سوف يتحرك بسرعة ثابتة وبخط مستقيم وذلك لان مجموع القوى المؤثرة عليه تساوي الصفر

3١. Inertia means that:
A an object at rest tries to remain at rest, and a moving object tries to stop
B an object at rest tries to move, and a moving object tries to stop
C an object at rest tries to move, and a moving object tries to keep moving
D an object at rest tries to remain at rest, and a moving object tries to keep moving√

حيث ان قانون نيوتن الاول يسمى بقانون القصور الذاتي

3٢. The SI unit of inertia is the:
A kilogram
B newton
C joule
D none of these√

لان القصور الذاتي ليس كمية فيزيائية قابلة للقياس

33. If two equal forces act on a moving cart in opposite directions, we can say about it that:
A it has acceleration
B it is in static equilibrium
C it is in dynamic equilibrium√
D nonzero net force acts on it

اذا اثرت قوتان متساوية في المقدار ومتعاكسة في الاتجاه على جسم متحرك فإنها ستلغي بعضها البعض أي ان مجموعها يساوي الصفر ويكون الجسم في حالة اتزان ديناميكي

34. If two equal forces act on a stationary (ساكن) book in opposite directions, we can say about it that:
A it has acceleration
B it is in static equilibrium√
C it is in dynamic equilibrium
D a nonzero net force acts on it

اذا اثرت قوتان متساوية في المقدار ومتعاكسة في الاتجاه على جسم ساكن فإنها ستلغي بعضها البعض أي ان مجموعها يساوي الصفر ويكون الجسم في حالة اتزان ديناميكي

3٥. If you stand at rest on a pair of identical bathroom scales, the readings on the two scales will always be:
A each equal to your weight
B each equal to half your weight√
C each equal to double your weight
D different from each other

عند الوقوف على زوج من المقاييس في حالة سكون فان الوزن سينقسم بالتساوي حيث تكون قراءة كل مقياس نصف الوزن

36. A man weighing 800 N stands at rest on two bathroom scales so that his weight is distributed evenly between them. The reading on each scale is:
A 400 N √
B 200 N
C 1600 N
D 800 N

بما ان وزن الرجل 800 N فكل ميزان ستكون قراءته نصف الوزن أي 400 N

37. A 80-kg painter stands on a 20-kg painting staging (سقالة دهان)that hangs on two ropes. If the staging is at rest and both ropes have the same tension, the tension in each rope is:

A 200 N

B 500 N√

C 800 N

D 1000 N

بما ان النظام في حالة سكون أي في حالة اتزان أي لابد ان تكون محصلة القوى تساوي الصفر

$\Sigma F = 0$

$\Sigma T + \Sigma W = 0$

$\Sigma T = \Sigma W \rightarrow \Sigma T = w_P + w_s = (80 \times 10) + (20 \times 10) = 1000\ N \rightarrow$

$T_1 = T_2 = \frac{\Sigma T}{2} = \frac{1000}{2} = 500\ N$

Force; Support Force; Friction

38. The support force is on an object results from the ____________ of atoms in the surface:

A compression√

B speed

C acceleration

D energy

39. The support force on a 2-kg book lying on a level table is:

A 1 N

B 2 N

C 10 N

D 20 N√

$F_N = W = 2 \times 10 = 20\ N$

40. In the following, check the correct statement:

A force is a vector, mass is a scalar√

B force is a vector, weight is a scalar

C mass is a vector, weight is a scalar

D force is a vector, mass is a vector

41. Two forces act on an object: $\vec{F_1}$ = (6 N, east); $\vec{F_2}$ = (8N, west). The net force ($\Sigma\vec{F}$) on it is:

A (14 N, east)

B (14 N, west)

C (2 N, west)√

D (-2 N, west)

مقدار محصلة القوى يكون حاصل طرح مقداري القوتين وذلك اذا كانت متعاكسة في الاتجاه . اما اتجاه المحصلة فيكون في اتجاه القوة الاكبر وذلك اذا كانت مختلفة ايضا في المقدار ومتعاكسة في الاتجاه

42. Two forces act on an object: $\vec{F_1}$= (10 N, up); $\vec{F_2}$= (10N, down) . The net force (($\Sigma\vec{F}$) on it is:

A (20 N, up)

B (20 N, down)

C (10 N, up)

D zero√

محصلة قوتين متساوية في المقدار ومتعاكسة في الاتجاه تساوي الصفر

43. Two forces act on a crate and the crate is in equilibrium. These two forces are:

A (100 N, right), (100 N, left)√

B (100 N, right), (50 N, left)

C (50 N, right), (100 N, left)

D (100 N, right), (100 N, right)

بما ان الجسم في حالة اتزان أي ان محصلة القوى تساوي الصفر فلابد ان تكون القوتين متساوية في المقدار ومتعاكسة في الاتجاه

44. If the force of friction on a moving object is 10N, the force needed to keep it at constant velocity is:

A 0 N

B 5 N

C 10 N√

D more than 10 N

لكي يكمل الجسم المتحرك حركته بسرعة متجهة ثابتة فلابد ان تكون قوة الحركة المعاكسة للاحتكاك مساوية لها في المقدار وذلك حتى تكون محصلة القوة تساوي الصفر

45. When an object falling through air stops gaining speed, we say that it has reached its __________speed:

A average

B instantaneous

C final

D terminal√

عندما يسقط الجسم في الهواء فلا يعتبر سقوطه سقوط حر واثناء سقوطه تزداد سرعته حتى تصل الى حد معين تسمى بالسرعة الحدية وذلك عندما يتساوى وزن الجسم الساقط مع قوة مقاومة الهواء

46. Air drag depends on a falling object's:

A size and speed√

B size and density

C density and speed

D none of these

العوامل المؤثرة على مقاومة الهواء هي سرعة الجسم الساقط و المساحة السطحية المواجهة للهواء اثناء السقوط

Mass; Weight

47. Mass is a measure of an object's:
A inertia√
B volume
C density
D speed

48. Mass is an object's quantity of:
A energy
B matter√
C dimensions
D momentum

49. The SI unit for weight is the:
A newton√
B kilogram
C gram
D pound

50. Two identical barrels (برميل), one filled with oil and one with cotton, should have:
A same mass and different inertia
B same inertia and different weight
C same volume and different mass√
D same weight and different density

51. If the Earth's gravitational pull is 6 times that of the Moon, an object taken to the Moon will have:
A same mass and less weight√
B same weight and less mass
C same mass and same weight
D less mass and less weight

اذا كانت قوة سحب الجاذبية الارضية تزيد ٦ مرات عن قوة سحب الجاذبية للقمر فان الجسم اذا انتقل من الارض الى القمر سيكون له نفس الكتلة ولكن وزنه سيقل

Newton's 2nd Law

52. An object's acceleration is directly proportional to the:
A net force√
B average speed
C mass
D inertia

وذلك من قانون نيوتن الثاني

$$a = \frac{F_{net}}{m}$$

53. If an object's mass decreases while a constant force is applied to it, its acceleration:
A decreases
B increases√
C remains constant
D changes according to volume

لان العلاقة عكسية بين الكتلة والتسارع عند ثبوت القوة

54. If the net force acting on an object decreases, its acceleration:
A decreases√
B increases
C remains constant
D changes direction

لان العلاقة طرية بين القوة المحصلة والتسارع عند ثبوت الكتلة

5° . The net force on an 50-kg crate is 100 N, its acceleration is:
A 0.5 m/s²
B 1 m/s²
C 2 m/s²√
D 5 m/s²

$$a = \frac{F_{net}}{m} = \frac{100}{50} = 2\ m/s^2$$

56. A 1-kg falling ball encounters 10 N of air resistance. The net force on the ball is:
A 0 N√
B 4 N
C 6 N
D 10 N

$$F_{net} = w - R = mg - R = (1 \times 10) - 10 = 10 - 10 = 0\ N$$

Newton's 3rd Law

57. The number of forces involved (الداخلة) in an interaction between two objects is:
A 0
B 1
C 2√
D 3

58 . A force is defined (تعريفها) as:
A part of an interaction between two objects√
B a push from an object on itself
C a pull from an object on itself
D a push and a pull on the same object

59. Newton's 3rd law states that, for two objects X and Y, whenever X exerts a force on Y, then:
A Y exerts double that force on X
B Y moves in the opposite direction
C Y exerts half that force on X
D Y exerts an equal but opposite force on X√

60. In an interaction between two objects, the action and reaction forces:
A are perpendicular
B do not cancel each other√
C add up to zero
D are on the same object

61. When a man pushes on a wall with force F, the wall pushes back on him with force of magnitude:
A zero
B F/2
C F√
D 2 F

حسب قانون نيوتن الثالث فان قوتا الفعل ورد الفعل تكون متساوية في المقدار ومتعاكسة في

62. When a cannon shoots a cannonball with acceleration a_b, the cannon recoils (يرتد)with acceleration a_c such that:
A $a_c = a_b$
B a_c is much larger than a_b
C a_c is much smaller than a_b√
D $a_c = 0$

عند اطلاق المدفع فان ارتداد الدفع للخلف اقل من تسارع كرة المدفع الى الامام وذلك بسبب اختلاف كتلة كل منهما

63. When a cannon shoots a cannonball with force F_b, the cannon recoils (يرتد) with force F_c such that:
A $F_c = F_b$√
B F_c is much larger than F_b
C F_c is much smaller than F_b
D $F_c = 0$

في تفاعل القوى بين المدفع وكرة المدفع فان القوتين متساوية في المقدار وذلك حسب قانون نيوتن الثالث

64. When a cannon shoots a cannonball, the cannon's recoil (يرتد) is much slower than the cannonball because:
A the force on the cannon is much less
B the mass of the cannon is much greater√
C the cannon's mass is more distributed (موزع)
D there is more air resistance

62. When a man stretches a spring with a 100-N force (within its elasticity range), the spring pulls him back with:
A 0 N
B 50 N
C 100 N√
D 200 N

Work; Energy

66. Work is produced only if there is:
A force and motion√
B force and elevation ((ارتفاع)
C force and time
D time and elevation

ينتج الشغل اذا وجد فقط قوة في اتجاه الحركة وحركة للجسم

67. Work is proportional to:
A (force) and (1/distance)
B (force) and (distance)√
C (1/force) and (distance)
D (force) and (distance)^2

الشغل يتناسب طرديا مع كل من القوة والمسافة

68. The SI unit of work is:
A Newton
B watt
C joule√
D ampere

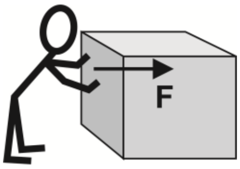
$$work = F \times S = N.m = joule$$

69. A joule is equivalent to:
A N/m2
B m/N
C N/m
D N.m√

70. A cart moves 10 m in the same direction as a 20-N force acting on it. The work done by this force is:
A 200 J√
B 2 J
C 0.5 J
D 20 J

$$work = F \times S = 20 \times 10 = 200\,J$$

71. A man does 2000-J work in pushing a crate a distance of 10 m on a frictionless floor. The force applied by the man is:
A 20 N
B 200 N√
C 2000 N
D 20000 N



$$work = F \times S \rightarrow F = \frac{work}{s} = \frac{2000}{10} = 200\ N$$

Power

72. An engine (محرك) can do 100,000-J work in 10 s. The power of this engine is:
A 1 MW
B 100 kW
C 1000 W
D 10 kW√

$$power = \frac{work}{time} = \frac{100000}{10} = 10000\ Watt = 10Kw$$

73. An engine (محرك) can do 75-kJ work in 10 s. The power of this engine in horsepower is:
A 10 hp√
B 1 hp
C 0.1 hp
D 100 hp

$$power = \frac{work}{time} = \frac{75\ kJ}{10} = \frac{75 \times 10^3}{10} = 7500\ watt = \frac{7500}{750} = 10\ hp$$

74. The SI unit of power is:
A Newton
B watt√
C joule
D ampere

$$power = \frac{work}{time} = \frac{J}{s} = watt$$

75. A watt is equivalent to:
A $kg.m^3/s^2$
B $kg^2.m^2/s^3$
C $kg.m^2/s^3$√
D $kg^2.m^2/s$

$$power = \frac{work}{time} = \frac{F \times S}{t} = \frac{m.g.s}{t} = \frac{kg.\frac{m\ m}{s^2}}{s} = kg.\frac{m^2}{s^3}$$

76. Of the following quantities, the ones that have the same unit are:
A work and energy√
B work and power
C energy and power
D work and pressure

Mechanical Energy

77. Mechanical energy results from an object's:
A position only
B position and/or motion√
C motion only
D neither position nor motion

78. Mechanical energy consists of:
A kinetic energy and power
B potential energy and power
C potential and kinetic energy√
D power and work

Potential Energy

79. Of the following, the form of energy that is NOT potential is the energy of:
A a moving car√
B a stretched bow (مشدود قوس)
C a compressed spring (مضغوط زنبرك)
D water in a high reservoir (خزان)

80. Potential energy is the energy stored in an object because of its:
A speed
B position√
C charge
D mass

81. A 20-kg box rests on a 2-m high shelf. Its potential energy relative to the ground is:
A 100 J
B 200 J
C 400 J√
D 800 J

$$PE = m.g.h = 20 \times 10 \times 2 = 400\ J$$

82. The **mass** of a box of **200-J** potential energy when resting on a **2-m**-high shelf is:
A 10 kg√
B 20 kg
C 40 kg
D 80 kg

$$PE = m.g.h$$
$$m = \frac{PE}{g.h} = \frac{200}{10\times 2} = \frac{200}{20} = 10\ kg$$

83. If a **5-kg** box sitting on a shelf of height (h) has **100-J potential energy** relative to the ground, **h equals:**
A 1 m
B 2 m√
C 4 m
D 8 m

$$PE = m.g.h \rightarrow h = \frac{PE}{m.g} = \frac{100}{5\times 10} = \frac{100}{50} = 2\ m$$

84. **Three 5-kg rocks** are raised to **a height of 5 m**, with Rock1 raised with a rope, Rock2 raised on a ramp (منحدر)), and Rock3 raised with an lift (مصعد). The rock that attains the most potential energy is:
A Rock1
B Rock2
C Rock3
D all the same√

بما ان لها نفس الكتلة ونفس الارتفاع
فإنها ستمتلك نفس طاقة الوضع

Kinetic Energy

85. **Kinetic energy** is the energy stored in an object because of its:
A motion√
B position
C charge
D mass

86. The kinetic energy of a **1000-kg** car traveling at a speed of **20 m/s** is:
A 50 kJ
B 100 kJ
C 200 kJ√
D 400 kJ

$$KE = \frac{1}{2}\,m\,v^2 = \frac{1}{2}\times 1000\times 20^2 = 200000\ J = 200\ kJ$$

87. The mass of a bicycle of **4000-J** kinetic energy traveling at **10 m/s** is:
A 40 kg
B 50 kg
C 60 kg
D 80 kg√

$$KE = \frac{1}{2}\,m\,v^2 \rightarrow m = \frac{2\,KE}{v^2} = \frac{2\times 4000}{10^2} = \frac{8000}{100} = 80\ kg$$

88. The **speed** of a **40-kg** bicycle of **1620-J** kinetic energy is:
A 9 m/s√
B 3 m/s
C 27 m/s
D 90 m/s

$$KE = \frac{1}{2}\,m\,v^2 \rightarrow v = \sqrt{\frac{2\,KE}{m}}$$
$$v = \sqrt{\frac{2\times 1620}{40}} = \sqrt{\frac{3240}{40}}$$
$$v = \sqrt{81} = 9\ m/s$$

89. If an object's **speed doubles**, its **kinetic energy**:
A remains the same
B doubles
C triples
D quadruples√

$$KE_1 = \frac{1}{2}\,m\,v_1^2$$
$$if\ v_2 = 2v_1$$
$$KE_2 = \frac{1}{2}\,m\,v_2^2 = \frac{1}{2}\,m\,(2\,v_1)^2 = \frac{1}{2}\,m\times 4\,v_1^2 = 4\times\frac{1}{2}\,m\,v_1^2$$
$$KE_2 = 4KE_1$$

90. If an object's **mass doubles** while moving at a **constant speed**, its **kinetic energy**:
A remains the same
B doubles√
C triples
D quadruples

$$KE_1 = \frac{1}{2}\,m_1\,v^2$$
$$if\ m_2 = 2m_1$$
$$KE_2 = \frac{1}{2}\,m_2\,v^2 = \frac{1}{2}\times 2m_1\,v^2 = 2\times\frac{1}{2}\,m_1\,v^2$$
$$KE_2 = 2KE_1$$

91. The kinetic energy of a car traveling at 20 m/s is 500 kJ. If it travels at 40 m/s, its kinetic energy becomes:

A 500 kJ
B 1000 kJ
C 2000 kJ√
D 4000 kJ

$$if\ v_2 = 2v_1 \rightarrow KE_2 = 4KE_1$$
$$40 = 2 \times 20 \rightarrow KE_2 = 4 \times 500\text{kJ}$$
$$KE_2 = 2000\text{kJ}$$

92. The work done by the engine of a 1000-kg car to move it from rest to a speed of 20 m/s is:

A 50 kJ
B 100 kJ
C 200 kJ√
D 400 kJ

$$work = KE = \frac{1}{2}\, m\, v^2$$
$$work = \frac{1}{2} \times 1000 \times (20)^2$$
$$work = 200000\ \text{J} = 200\ kJ$$

93. The force exerted by the engine of a 1000-kg car to move it from rest to a speed of 20 m/s within 100 m is:

A 1000 N
B 2000 N√
C 4000 N
D 5000 N

$$work = KE \rightarrow \ F \times S = \frac{1}{2}\, m\, v^2$$
$$F = \frac{KE}{S} = \frac{\frac{1}{2}\, m\, v^2}{S} = \frac{\frac{1}{2} \times 1000 \times 20^2}{100}$$
$$= \frac{200000}{100} = 2000\ N$$

Conservation of Energy

94. The total energy of an object of mass (m), falling at height (h) with speed (v) can be written as:

A E = ½ mv^2 + 2 mgh
B E = ½ mv^2 + mgh√
C E = mv^2 + ½ mgh
D E = ½ mv^2 + ½ mgh

الطاقة الكلية لجسم على له كتلة m ويسقط من ارتفاع h تساوي مجموع طاقة الوضع والطاقة الحركية له

95. As an object falls, its potential energy __________and its kinetic energy __________.

A increases, decreases
B decreases, decreases
C decreases, increases√
D increases, increases

عندما يسقط جسم ما فانه طاقة الوضع له تتناقص بينما تزداد طاقته الحركية

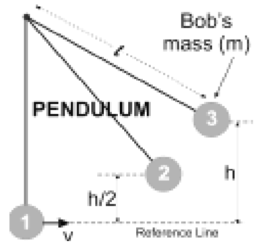
96. The ram of pile-driver (مدك) falls from a height of 20 m. Its speed just before touching ground is:

A 2 m/s
B 5 m/s
C 10 m/s
D 20 m/s√

$$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 20} =$$
$$v = \sqrt{400} = 20\ m/s$$

97. A simple pendulum's bob has speed (v) at its lowest point (1); its highest point (3) has height (h). If h = 20 cm, v equals:

A 2 m/s√
B 5 m/s
C 10 m/s
D 20 m/s



$$PE_3 = KE_1 \rightarrow v = \sqrt{2gh}$$
$$= \sqrt{2 \times 10 \times 0.20} = \sqrt{4}$$
$$= 2\ m/s$$

98. When a simple pendulum's bob of mass m = 0.5 kg is at its highest point (3), its height is h = 40 cm. Its kinetic energy at its lowest point (1) is:

A 0 J
B 2 J√
C 5 J
D 10 J

$$KE_1 = PE_3 = mgh = 0.5 \times 10 \times 0.4 = 2\text{J}$$

99. When a simple pendulum's bob of mass m = 0.5 kg is at its highest point (3), its height is h = 40 cm. Its kinetic energy at point (2) of height ½ h is:

A 5 J
B 2 J
C 1 J√
D 0 J

$$KE_2 = PE_2 = mg\frac{h}{2} = 0.5 \times 10 \times \frac{0.4}{2} = 1\text{J}$$

100. When a simple pendulum's bob of mass m = 0.5 kg is at its highest point (3), its height is h = 40cm. Its total energy at point (2) of height ½ h is:

A 5 J

B 2 J√

C 1 J

D 0 J

$$E_{TOTAL} = PE_2 + KE_2 = 1J + 1J = 2J$$

CHAPTER 3: HEAT & MATTER

Formulas & Constants

mass density = $\frac{m}{V}$	weight density = $\frac{mg}{V}$	stress (S) = $\frac{F}{A}$	$T_C = \frac{5}{9}(T_F - 32°)$	$T_F = \frac{9}{5}(T_C) + 32°$
$T_K = T_C + 273$	1 cal = 4.19 J	$Q = c.m.\Delta T$	melting: $Q = m.L_f$ vaporization: $Q = m.L_v$	$F = k.\Delta\ell$ (Hooke's Law)

Key Terms & Definitions

Absolute zero	الصفر المطلق	Evaporation	تبخير	Neutral	متعادل
Absorption	امتصاص	Expansion	تمدد	Nucleus	نواة
Atom	ذرّة	Fluid	مائع	Particle	جُسيْم
Boiling	غليان	Freezing	تجمد	Phase	طوْر
Bonding	ترابط	Fusion	انصهار	Pressure	ضغط
Charge	شحنة	Gas	غاز	Saturated	مشبع
Compound	مركب	Heat	حرارة	Solid	صلب
Compression	ضغط	Heat transfer	انتقال الحرارة	Solidification	تصلب
Condensation	تكثف	Humidity	رطوبة	Specific Heat	الحرارة النوعية
Deform	يشوه	Inelastic	غير مرن	Strain	انفعال
Density	كثافة	Liquid	سائل	State	حالة
Dew	ندى	Latent Heat	الحرارة الكامنة	Stress	إجهاد
Diffusion	انتشار	Matter	مادة	Substance	صنف
Elastic limit	حد المرونة	Melting	ذوبان	Temperature	درجة الحرارة
Elastic range	حيز المرونة	Metal	معدن، فِلِز	Tension	توتر
Elasticity	مرونة	Mixture	خليط أو مزيج	Vaporization	تبخر
Element	عنصر	Molecule	جُزَيْء	Volume	حجم

Temperature

1. Converting 77 degrees F to Celsius gives:
A 25 degrees C√
B 55 degrees C
C 75 degrees C
D 95 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(77 - 32^0) = 25\ ^0C$$

2. Converting 113 degrees F to Celsius gives:
A 35 degrees C
B 45 degrees C√
C 110 degrees C
D 165 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(113 - 32^0) = 45\ ^0C$$

3. Converting 257 degrees F to Celsius gives:
A 55 degrees C
B 220 degrees C
C 125 degrees C√
D 335 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(257 - 32^0) = 125\ ^0C$$

4. Converting 10 degrees F to Celsius gives:
A 25 degrees C
B 5 degrees C
C 0 degrees C
D -12 degrees C√

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(10 - 32^0) = -12\ ^0C$$

5. Converting 20 degrees F to Celsius gives:

A -7 degrees C√
B 30 degrees C
C 42 degrees C
D -12 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(20 - 32^0) = -7\ ^0C$$

10. Converting 145 degrees C to Fahrenheit gives:

A 177 degrees F
B 293 degrees F√
C 112 degrees F
D 217 degrees F

$$T_F = \frac{9}{5}(T_C) + 32^0$$
$$T_F = \frac{9}{5}(145) + 32^0 = 293^0F$$

6. Converting -50 degrees F to Celsius gives:

A -46 degrees C√
B -32 degrees C
C -23 degrees C
D -18 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(-50 - 32^0) = -45.5\ ^0C =$$
$$T_C = -46\ ^0C$$

11. Converting 35 degrees C to Fahrenheit gives:

A 59 degrees F
B 77 degrees F
C 95 degrees F√
D 3 degrees F

$$T_F = \frac{9}{5}(T_C) + 32^0$$
$$T_F = \frac{9}{5}(35) + 32^0 = 95^0F$$

7. Converting -40 degrees F to Celsius gives:

A -20 degrees C
B -30 degrees C
C -40 degrees C√
D -50 degrees C

$$T_C = \frac{5}{9}(T_F - 32^0)$$
$$T_C = \frac{5}{9}(-40 - 32^0) = -40\ ^0C$$

12. Converting 95 degrees C to Fahrenheit gives:

A 63 degrees F
B 127 degrees F
C 275 degrees F
D 203 degrees F√

$$T_F = \frac{9}{5}(T_C) + 32^0$$
$$T_F = \frac{9}{5}(95) + 32^0 = 203^0F$$

8. The Fahrenheit and Celsius temperature scales have the same reading at:

A 32 degrees
B 0 degrees
C -32 degrees
D -40 degrees√

$$T_C = T_F \rightarrow T_C = \frac{5}{9}(T_F - 32^0)$$
$$T = \frac{5}{9}(T - 32^0) \rightarrow T = \frac{5}{9}T - \frac{5}{9} \times -32$$
$$T - \frac{5}{9}T = \frac{5}{9} \times -32 \rightarrow \frac{9-5}{9}T = \frac{5}{9} \times -32$$
$$\frac{4}{9}T = \frac{5}{9} \times -32 \rightarrow T = \frac{5}{9} \times -32 \times \frac{9}{4}$$
$$T = -40\ ^0C$$

13. Converting 75 degrees C to Kelvin gives:

A 348 K√
B 198 K
C 32 K
D 212 K

$$T_K = T_C + 273$$
$$T_K = 75 + 273 = 348\ K$$

14. Converting 25 degrees C to Kelvin gives:

A 248 K
B 298 K√
C 47 K
D 237 K

$$T_K = T_C + 273$$
$$T_K = 25 + 273 = 298\ K$$

9. Converting 15 degrees C to Fahrenheit gives:

A 59 degrees F√
B 47 degrees F
C 21 degrees F
D -12 degrees F

$$T_F = \frac{9}{5}(T_C) + 32^0$$
$$T_F = \frac{9}{5}(15) + 32^0$$
$$T_F = 59^0F$$

15. Converting -50 degrees C to Kelvin gives:

A -40 K
B 323 K
C 223 K√
D -273 K

$$T_K = T_C + 273$$
$$T_K = -50 + 273 = 223\ K$$

16. Converting 406 degrees K to Celsius gives:

A 337 degrees C
B 276 degrees C
C 579 degrees C
D 133 degrees C√

$$T_K = T_C + 273 \rightarrow T_C = T_K - 273$$
$$T_C = 406 - 273 = 133^0\mathrm{C}$$

22. Find the amount of heat in kcal generated by 7510 J of work.

A 1.43 kcal
B 1.79 kcal√
C 8.11 kcal
D 31.7 kcal

$$Q = \frac{7150\,J}{4190} = 1.79\ kcal$$

17. Converting 175 degrees K to Celsius gives:

A -98 degrees C√
B 112 degrees C
C -213 degrees C
D 45 degrees C

$$T_K = T_C + 273 \rightarrow T_C = T_K - 273$$
$$T_C = 175 - 273 = -98\ ^0\mathrm{C}$$

23. Find the amount of work in MJ that is equivalent to 3850 kcal.

A 3.17 MJ
B 0.918 MJ
C 16.1 MJ√
D 8.23 MJ

$$work = 3850\ kcal \times 4190\frac{joule}{\mathrm{kcal}}$$
$$work = 16.1 \times 10^6 J = 16.1\ MJ$$

18. Converting 6000 degrees K to Celsius gives:

A 6273 degrees C
B 5727 degrees C√
C 5911 degrees C
D 6196 degrees C

$$T_K = T_C + 273 \rightarrow T_C = T_K - 273$$
$$T_C = 6000 - 273 = 5727\ ^0\mathrm{C}$$

24. Find the amount of work in kJ that is equivalent to 7.65 kcal of heat.

A 17.7 kJ
B 9.18 kJ
C 1.83 kJ
D 32.1 kJ√

$$work = 7.65 kcal \times 4190\frac{joule}{\mathrm{kcal}}$$
$$work = 32.01 \times 10^3 J = 32.1\ kJ$$

19. The melting point of pure iron is 1505 degrees C. What Fahrenheit temperature is this?

A 1689 degrees F
B 3563 degrees F
C 2741 degrees F√
D 4112 degrees F

$$\mathrm{T_F} = \frac{9}{5}(\mathrm{T_C}) + 32^0$$
$$\mathrm{T_F} = \frac{9}{5}(1505) + 32^0$$
$$\mathrm{T_F} = 2741\ ^0F$$

25. Find the mechanical work equivalent (in kJ) of 8550 cal of heat.

A 35.8 kJ√
B 2.04 kJ
C 15.3 kJ
D 23.1 kJ

$$work = 8550\ cal \times 4.19\frac{joule}{\mathrm{cal}}$$
$$work = 35.8 \times 10^3 J = 35.8\ kJ$$

20. The melting point of mercury is -38.0 degrees F. What Celsius temperature is this?

A -36 degrees C
B -37 degrees C
C -38 degrees C
D -39 degrees C√

$$\mathrm{T_C} = \frac{5}{9}(\mathrm{T_F} - 32^0)$$
$$\mathrm{T_C} = \frac{5}{9}(-38.0 - 32^0)$$
$$\mathrm{T_C} = -38.8\ ^0\mathrm{C} = -39\ ^0\mathrm{C}$$

26. Find the heat equivalent (in kcal) of 763 kJ of work.

A 17.5 kcal
B 182 kcal√
C 1232 kcal
D 3200 kcal

$$Q = 763\ kJ = \frac{763 \times 10^3\mathrm{J}}{4190} = 182\ kcal$$

Heat

21. Find the amount of heat in cal generated by 95 J of work.

A 23 cal√
B 25 cal
C 27 cal
D 24 cal

$$Q = \frac{95\,J}{4.19} = 22.6 = 23\ cal$$

27. How much work must a person do to offset eating a piece of cake containing 625 Cal?

A 39.2 kJ
B 92.4 kJ
C 2.62 MJ√
D 13.3 MJ

$$work = 625\ Cal \times 4190\frac{joule}{\mathrm{Cal}}$$
$$work = 2.61 \times 10^6 J = 2.61 MJ$$

28. How much work must a person do to offset eating a 200-g bag of potato chips if 28 g of chips contain 150 Cal?

A 320 kJ

B 610 kJ

C 1.2 MJ

D 4.5 MJ√

$$28\ g \rightarrow 150\ Cal$$
$$200 g \rightarrow ?\ Cal$$
$$Q = \frac{200 \times 150}{28} = 1071.4\ Cal$$
$$Work = 1071.4\ Cal\ \times 4190\ \frac{Joule}{Cal}$$
$$Work = 4.5 \times 10^6 J = 4.5\ MJ$$

29. A fuel yields 11.5 kcal/g when burned. How many joules of work are obtained by burning 1 kg of the fuel?

A 48 MJ√

B 36 MJ

C 24 MJ

D 12 MJ

$$work = 11.5 \frac{Kcal}{g} \times 1000\ g \times 4190 \frac{Joule}{Kcal}$$
$$work = 48 \times 10^6 J = 48\ MJ$$

30. A fuel produces 16 kcal/g when burned. If 500 g of the fuel is burned, how many joules of work are produced?

A 22 MJ

B 34 MJ√

C 47 MJ

D 65 MJ

$$work = 16 \frac{Kcal}{g} \times 500\ g \times 4190 \frac{Joule}{Kcal}$$
$$work = 33.5 \times 10^6 J = 34\ MJ$$

31. Natural gas burned in a gas turbine has a heating value of 110 kcal/g. If the turbine is 25% efficient and 2.5 g of gas is burned each second, find the power output in kilowatts.

A 35 kW

B 160 kW

C 290 kW√

D 1900 kW

$$work = 110 \frac{Kcal}{g} \times 2.5\ g \times 4190 \frac{Joule}{Kcal} \times 0.25$$
$$work = 288 \times 10^3 J = 288 kJ$$
$$power = \frac{work}{time} = \frac{288\ kJ}{1\ s} = 288\ kW \approx 290\ kw$$

32. An industrial engine produces 38,000 kcal of heat. What is the mechanical work equivalent of the heat produced?

A 33 MJ

B 85 MJ

C 120 MJ

D 160 MJ√

$$work = 38000\ kcal \times 4190 \frac{Joule}{Kcal}$$
$$work = 159 \times 10^6\ J \approx 160 \times 10^6 J$$
$$work = 160\ MJ$$

Heat; Change of Phase

33. What heat is needed to change the temperature of 100 kg of copper (c = 0.092 kcal/kg degree-C) from 100 to 200 degrees-C?

A 920 kcal√

B 9.2 kcal

C 92 kcal

D 9200 kcal

$$Q = mc\Delta T$$
$$Q = 100 \times 0.092 \times (200 - 100)$$
$$Q = 100 \times 0.092 \times 100 = 920\ kcal$$

34. What heat is needed to change the temperature of 10 kg of water (c = 1.00 kcal/kg degree-C) from 10 to 20 degrees-C?

A 10 kcal

B 100 kcal√

C 200 kcal

D 419 kcal

$$Q = mc\Delta T$$
$$Q = 10 \times 1.00 \times (20 - 10)$$
$$Q = 10 \times 1.00 \times 10 = 100\ kcal$$

35. What heat is needed to change the temperature of 100 kg of steel (c = 0.115 kcal/kg degree-C) from 1000 to 1100 degrees-K?

A 100 kcal

B 300 kcal

C 1150 kcal√

D 4600 kcal

$$Q = mc\Delta T$$
$$Q = 100 \times 0.115 \times (1100 - 1000)$$
$$Q = 100 \times 0.115 \times 100 = 1150\ kcal$$

36. What heat should be given off by 10 kg of aluminum (c = 0.22 kcal/kg degree-C) to change their temperature from 200 to 100 degrees-C?
A 51 kcal
B 430 kcal
C 910 kcal
D 220 kcal√

$$Q = mc\Delta T$$
$$Q = 10 \times 0.22 \times (100 - 200)$$
$$Q = 10 \times 0.22 \times -100 = -220\ kcal$$
والإشارة السالبة للدلالة على انها مفقودة

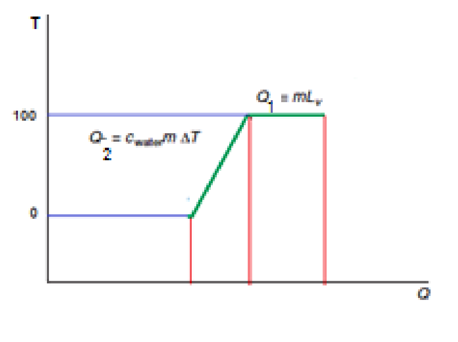
37. How many calories of heat are required to melt 7 g of ice at 0 degrees C? (L-fusion = 80 cal/g)
A 560 cal√
B 135 cal
C 2300 cal
D 1500 cal

$$Q = mL_f$$
$$Q = 7 \times 80 = 560\ cal$$

38. How many calories of heat are given off by 10 g of steam at 100 degrees C to condense to water at 100 degrees C? (L-vaporization = 540 cal/g)
A 540 cal
B 5400 cal√
C 54000 cal
D 540000 cal

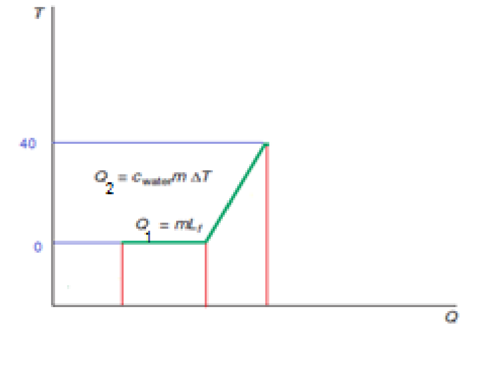
$$Q = mL_v$$
$$Q = 10 \times 540 = 5400\ cal$$

39. How many calories of heat are given off by 10 g of steam at 100 degrees C to condense to water at 0 degrees C? (c-water = 1 cal/g degree C, L vaporization = 540 cal/g)
A 640000 cal
B 64000 cal
C 6400 cal√
D 640 cal



$$Q = Q_1 + Q_2$$
$$Q = m\,L_v + m\,c\,\Delta T$$
$$Q = (10 \times 540) + (10 \times 1 \times (0 - 100))$$
$$Q = 5400 + 1000 = 6400\ cal$$

40. How many calories of heat are required by 50 g of ice at 0 degrees C to melt to water at 40 degrees C? (c-water = 1 cal/g degree C, L-fusion = 80 cal/g)
A 2000 cal
B 4000 cal
C 5000 cal
D 6000 cal√



$$Q = Q_1 + Q_2$$
$$Q = m\,L_f + m\,c\,\Delta T$$
$$Q = (50 \times 80) + (50 \times 1 \times (40 - 0))$$
$$Q = 4000 + 2000 = 6000\ cal$$

Elasticity; Stress; Hooke's Law

41. When a deforming (مشوه) force acts on an elastic object, the object is:
A never deformed
B permanently (بشكل دائم) deformed
C temporarily (وقتيا) deformed√
D broken into pieces

عندما تؤثر قوة على جسم مرن فان التشوه الحادث به يكون مؤقتا بحيث يعود الجسم لوضعه الطبيعي بعد زوال القوة المؤثرة عليه .

42. An elastic material can be:
A dough (عجين)
B clay (طين)
C lead (رصاص)
D rubber (مطاط)√

43. When a 10-N force is applied on a 20-cm spring, it extends to 25 cm. What would be its length when a 30-N force is applied to it within its elastic range?

A 35 cm√

B 15 cm

C 30 cm

D 20 cm

$$L_0 = 20\ cm \rightarrow L_1 = 25\ cm \rightarrow \Delta L_1 = 25 - 20 = 5\ cm$$
$$F_1 = 10\ N \rightarrow \Delta L_1 = 5\ cm$$
$$F_2 = 30\ N \rightarrow \Delta L_2 = ?$$
$$\Delta L_2 = \frac{F_2\,\Delta L_1}{F_1} = \frac{30 \times 5}{10} = 15\ cm$$
$$L_2 = L_0 + \Delta L_2 = 20 + 15 = 35\ \text{cm}$$

44. When a 100-N force is applied on a 20-cm spring, it extends to 21 cm. What would be its length when a 1000-N force is applied to it within its elastic range?

A 25 cm

B 30 cm√

C 35 cm

D 5 cm

$$L_0 = 20\ cm \rightarrow L_1 = 21\ cm \rightarrow \Delta L_1 = 21 - 20 = 1\ cm$$
$$F_1 = 100\ N \rightarrow \Delta L_1 = 1\ cm$$
$$F_2 = 1000\ N \rightarrow \Delta L_2 = ?$$
$$\Delta L_2 = \frac{F_2\,\Delta L_1}{F_1} = \frac{1000 \times 1}{100} = 10\ cm$$
$$L_2 = L_0 + \Delta L_2 = 20 + 10 = 30\ \text{cm}$$

45. When a 50-N force is applied on a 20-cm spring, it extends to 22 cm. What would be its length when a 75-N force is applied to it within its elastic range?

A 3 cm

B 21 cm

C 23 cm√

D 30 cm

$$L_0 = 20\ cm \rightarrow L_1 = 22\ cm \rightarrow \Delta L_1 = 22 - 20 = 2\ cm$$
$$F_1 = 50\ N \rightarrow \Delta L_1 = 2\ cm$$
$$F_2 = 75\ N \rightarrow \Delta L_2 = ?$$
$$\Delta L_2 = \frac{F_2\,\Delta L_1}{F_1} = \frac{75 \times 2}{50} = 3\ cm$$
$$L_2 = L_0 + \Delta L_2 = 20 + 3 = 23\ \text{cm}$$

46. When a 10-N force is applied on a 20-cm spring, it is compressed to 18 cm. What would be its length when a 30-N compressing force is applied to it within its elastic range?

A 6 cm

B 16 cm

C 26 cm

D 14 cm√

$$L_0 = 20\ cm \rightarrow L_1 = 18\ cm \rightarrow \Delta L_1 = 20 - 18 = 2\ cm$$
$$F_1 = 10\ N \rightarrow \Delta L_1 = 2\ cm$$
$$F_2 = 30\ N \rightarrow \Delta L_2 = ?$$
$$\Delta L_2 = \frac{F_2\,\Delta L_1}{F_1} = \frac{30 \times 2}{10} = 6\ cm$$
$$L_2 = L_0 - \Delta L_2 = 20 - 6 = 14\ \text{cm}$$

وعملية الطرح لان الزنبرك (النابض) يحدث له تقلص عند الضغط عليه

47. A block of lead with dimensions (10 cm × 5 cm × 4 cm) has a mass of 2.3 kg. It exerts the greatest stress on a flat surface when it lies on the side with dimensions:

A 5 cm × 10 cm

B 5 cm × 4 cm√

C 10 cm × 4 cm

D same stress on all sides

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

بما ان العلاقة عكسية بين الاجهاد والمساحة
بالتالي يكون الاجهاد اكبر ما يمكن عندما يوضع الجسم على الوجه الاصغر مساحة

48. A cube (مكعب) of iron of 10-cm sides weighs 80 N. The stress it exerts on a flat surface is:

A 80 Pa

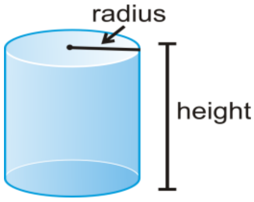
B 800 Pa

C 8000 Pa√

D 80,000 Pa

$$S = \frac{F}{A} = \frac{80}{(0.1)^2} = 8000\ \text{Pa}$$

49. A cylinder of lead is of 5.64-cm radius, 20-cm height, and 23-kg mass. The stress it exerts on a flat surface when it lies on its flat side is:
A 23 Pa
B 230 Pa
C 2.3 k Pa
D 23 k Pa√



$$S = \frac{F}{A} = \frac{m\,g}{\pi r^2} = \frac{23 \times 10}{\pi (0.0564)^2}$$

$$S = 23 \times 10^3 Pa = 23k\ Pa$$

52. A 500-g block of wood with dimensions (10 cm × 5 cm × 4 cm) has density of:
A 2500 kg/m^3√
B 2.5 kg/m^3
C 0.8 kg/m^3
D 800 kg/m^3

$$D_m = \frac{m}{v} = \frac{500}{10 \times 5 \times 4} = \frac{500g}{200cm^3}$$

$$D_m = \frac{500g}{200cm^3} = \frac{500 \times 10^{-3}}{200 \times 10^{-6}}$$

$$D_m = 2.5 \times 10^3 = 2500 kg/m^3$$

Density

50. Density of a substance (صنف) depends on the _______ and ________ of its atoms.

A mass, charge (شحنة)
B mass, spacing√
C spacing (تباعد), charge
D mass, color

تعتمد كثافة المادة على كتلة الذرات والمسافات التي تفصل بينها

51. A 500-g block of wood with dimensions (10 cm × 5 cm × 4 cm) has density of:
A 0.5 g/cm^3
B 1.5 g/cm^3
C 2.5 g/cm^3√
D 3.5 g/cm^3

$$D_m = \frac{m}{v} = \frac{500}{10 \times 5 \times 4} = \frac{500}{200} = 2.5\ g/cm^3$$

53. A 500-g block of wood with dimensions (10 cm × 5 cm × 4 cm) has weight density of:
A 2.5 kN/m^3
B 5 kN/m^3
C 10 kN/m^3
D 25 kN/m^3√

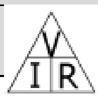
$$D_m = 2500 kg/m^3$$

$$D_W = 2500 \times 10 = 25000 \frac{N}{m^3}$$

$$D_W = 25 \times 10^3 N/m^3 = 25 kN/m^3$$

CHAPTER 4: ELECTRICITY

Formulas & Constants

$e = 1.6 \times 10^{-19}$ C $1/e = 6.25 \times 10^{18}$	$q_{proton} = +e$ $q_{electron} = -e$	$F = k\frac{q_1 \cdot q_2}{d^2}$	$k = 9 \times 10^9$ N.m²/C²	Electric field: $\mathcal{E} = \frac{F}{q}$
Elec. potential energy: E_p	$E_p = k\frac{Q \cdot q}{d}$; $V = \frac{E_p}{q}$	$I = \frac{\Delta Q}{\Delta t}$	$R = \rho\frac{l}{A}$; $A = \pi \cdot r^2$	
$V = I.R$		$P = V.I = \frac{V^2}{R} = I^2.R$	$R_{series} = R_1 + R_2 + \cdots$	$\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$

Key Terms & Definitions

Alternating current	تيار متردد	Electric field	المجال الكهربائي	Potential difference	فرق الجهد
Capacitor	مكثف	Electric potential	الجهد الكهربائي	Power	قدرة
Charge	شحنة	Electricity	كهرباء	Resistance	مقاومة
Conductor	موصِّل	Electrostatics	الكهرباء الساكنة	Resistivity	مقاومية
Current	تيار	Insulator	عازل	Semiconductor	شبه موصِّل
Direct current	تيار مباشر	Parallel circuit	دائرة متوازية	Series circuit	دائرة متتالية أو مسلسلة

Electric Charges; Coulomb's Law

1. Normally, an atom's net charge is:
A negative
B positive
C zero√
D a vector

2. The number of electrons needed to make up one coulomb of charge is:
A 1.6×10^{-19}
B $1.6 \times 10^{+19}$
C 6.25×10^{-18}
D 6.25×10^{18}√

$$q = n \times e \rightarrow n = \frac{q}{e} = \frac{1\ c}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}\ electron$$

3. A positively charged object is an object with:
A extra electrons
B lack (نقص) of protons
C extra neutrons
D lack of electrons√

Positive object

$N_P > N_e$

4. A negatively charged object is an object with:
A extra electrons√
B extra protons
C extra neutrons
D lack of (نقص) electrons

negative object

$N_e > N_p$

5. The electrostatic force equation for two charged objects, q_1 and q_2, gives a positive result if:
A q_1 is positive and q_2 is negative
B q_1 is negative and q_2 is positive
C q_1 and q_2 have the same sign√
D q_1 and q_2 are neutral

كون القوة الكهروستاتيكية موجبة اذا كانت
قوة تنافر أي ان الجسمان لهما نفس الاشارة

6. The electrostatic force equation for two charged objects, q_1 and q_2, gives a negative result if:
A q_1 repels q_2
B $q_2 = q_1$
C $q_1 = ½ q_2$
D q_1 attracts q_2√

تكون القوة الكهروستاتيكية سالبة اذا كانت قوة تجاذب أي ان الجسمان يختلفان في الاشارة

7. The electrostatic force between two charged objects, q_1 and q_2, is located at:
A q_1
B q_2
C q_1 for force from q_2, and q_2 for force from q_1√
D halfway between q_1 and q_2

8. The attractive force between two charges $q_1 = \frac{1}{3}$ C and $q_2 = -\frac{1}{3}$ C separated by 1 km is:
A 1000 N√
B 100 N
C 10 N
D 1 N

$$F_{elec} = k\frac{q_1 q_2}{d^2} = 9\times10^9 \frac{\frac{1}{3}\times\frac{-1}{3}}{(1\times1000)^2} = 9\times10^9 \frac{-\frac{1}{9}}{10^6} = \frac{10^9}{10^6} = -10^3\ N$$

9. The repulsive force between two identical 1-C charges separated by 300 m is:
A 100 N
B 1 kN
C 10 kN
D 100 kN√

$$F_{elec} = k\frac{q_1 q_2}{d^2} = 9\times10^9 \frac{1\times1}{(300)^2} = \frac{9\times10^9}{9\times10^4} = 1\times10^5\ \text{N} = 100\ \text{k}\,N$$

Electric Field; Electric Potential

10. The following quantities are all scalar, except for:
A electric current
B electric field√
C electric charge
D electric potential

11. A group of charges (Q) exert a net force F = 10 N on a charge q = 0.2 C located at point (X). This means that the magnitude of the electric field resulting from Q at X equals:
A 0.2 N/C
B 5 N/C
C 10 N/C
D 50 N/C√

$$E = \frac{F}{q} = \frac{10}{0.2} = 50\ N/C$$

12. The electric field around a negative point-charge (Q) points (يتجه):
A radially away from Q
B radially toward Q√
C in circles around Q
D in ellipsoids (مجسم بيضوي) around Q

13. The electric field around a positive point-charge (Q) points (يتجه):
A radially away from Q√
B radially toward Q
C in circles around Q
D in ellipsoids (مجسم بيضوي) around Q

14. The electric field between two point charges (+Q) and (–Q) separated by a distance (d) points (يتجه):
A on a straight line from +Q to –Q√
B radially toward Q
C radially toward –Q
D on a straight line from –Q to +Q

15. The electric field around two point charges (+Q) and (–Q) separated by a distance (d) is:
A concentric (متداخل) cubes
B radially toward Q
C radially toward -Q
D concentric ellipsoids (مجسم بيضوي)√

16. The SI unit for the electric potential energy is the:
A ampere
B watt
C volt
D joule√

17. The SI unit for the electric potential is the:
A ampere
B watt
C volt√
D joule

18. One volt is equal to:
A 1 joule/second
B 1 joule/coulomb√
C ampere/second
D ampere/coulomb

19. A charge q = 0.5 C located at point (X) has electric potential energy PE = 10 J caused by a group of charges (Q). This means that the electric potential resulting from Q at X equals:
A 0.5 V
B 5 V
C 10 V
D 20 V√

$$V = \frac{Electric\ P.E}{q} = \frac{10}{0.5} = 20V$$

Capacitor; Resistance

20. Electric energy can be stored in a:
A resistance
B capacitor√
C switch
D light bulb

21. A capacitor consists of:
A a conductor between two insulating plates
B an insulator between two conducting plates√
C two insulating plates in vacuum
D two conducting plates in vacuum

22. When a capacitor is connected to a battery, the plate connected to the _____ terminal becomes ______:
A positive, positive√
B negative, positive
C positive, negative
D positive, neutral

23. If a capacitor is connected to a battery of potential difference V, the capacitor becomes fully charged when the potential difference between its plates equals:
A 0
B V√
C V/2
D 2V

24. A 10-km copper wire (resistivity = 1.7 × 10^{-8} Ω.m) has cross-sectional area = 1 mm^2. Its resistance is:

A 1.7 Ω
B 17 Ω
C 170 Ω✓
D 1700 Ω

$$R = \rho\frac{L}{A} = 1.7 \times 10^{-8} \times \frac{10\text{km}}{1\ \text{mm}^2}$$

$$= 1.7 \times 10^{-8} \times \frac{10 \times 10^3 m}{1 \times 10^{-6} m^2}$$

$$= 1.7 \times 10^{-8} \times \frac{10^4}{10^{-6}}$$

$$= 1.7 \times 10^{-8} \times 10^{10}$$

$$= 1.7 \times 10^2 = 170\ \Omega$$

Ohm's Law; Electric Power; Electric Circuits

25. An electric circuit consists of a 24-. Resistance connected across the terminals of a 12-V battery. The electric current in this circuit is:
A 24 amperes
B 12 amperes
C 2 amperes
D 0.5 amperes√

$$V = I.R \rightarrow I = \frac{V}{R} = \frac{12}{24} = 0.5\ A$$

26. An electric circuit consists of a light bulb connected across the terminals of a 12-V battery. If the electric current in this circuit is 6 mA, the resistance of the light bulb is:

A 0.5 kΩ

B 2 kΩ√

C 20 Ω

D 2 Ω

$$V = I.R \rightarrow R = \frac{V}{I} = \frac{12}{6 \times 10^{-3}} = 2000\Omega = 2K\Omega$$

27. If the power rating of a vacuum cleaner is 550 W, the current it draws in a 220-V electric circuit is:

A 0.4 amperes

B 1.5 amperes

C 2.5 amperes√

D 5 amperes

$$P = I.V \rightarrow I = \frac{P}{V} = \frac{550}{220} = 2.5\ A$$

28. If a light bulb in a 220-V electric circuit draws 0.5 amperes, its power rating is:

A 110 W√

B 440 W

C 40 W

D 75 W

$$P = I.V = 0.5 \times 220 = 110\ W$$

29. A classroom has ten 25-W compact fluorescent lamps (CFL). If these lamps are turned on for 10 hours_ every day, their energy consumption (استهلاك) in 20 days is:

A 1 kWh

B 5 kWh

C 10 kWh

D 50 kWh√

$$E = P \times t = (10 \times 25 \times 10^{-3}) \times (10 \times 20) = 50\ kWh$$

30. In electricity, the kilowatt-hour is a unit of:

A electric current

B electric power

C electric potential

D electric energy√

$$E = P \times t = Kw.h$$

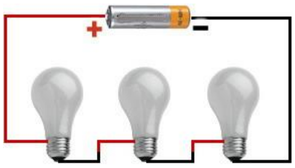
31. Three identical light bulbs, each of resistance 12Ω ,are connected in series to a 12-V battery. Their equivalent resistance is:

A 4 Ω

B 12 Ω

C 24 Ω

D 36Ω√



$$R_{series} = R_1 + R_2 + R_3 = 12 + 12 + 12 = 36\Omega$$

32. Three identical light bulbs, each of resistance 12Ω ,are connected in series to a 12-V battery. The potential difference across each light bulb is:

A 0 V

B 4 V√

C 8 V

D 12 V

$$V_1 = V_2 = V_3 \rightarrow V_1 = I_{TOTAL}.R_1$$

$$V_1 = \frac{V_{TOTAL}}{R_{TOTAL}}.R_1 = \frac{12}{(12+12+12)} \times 12 = \frac{144}{36} = 4\ V$$

او حل آخر: بما ان المقاومات متماثلة في قيمها والتيار له قيمة ثابتة في التوصيل على التوالي فان فروق الجهد بين اطراف المقاومات ستكون ايضا متماثلة حيث ان :

$$V_1 = V_2 = V_3 \rightarrow V_1 = \frac{V_{TOTAL}}{3} = \frac{12}{3} = 4\ V$$

33. Three identical light bulbs, each of resistance 12 Ω, are connected in series to a 12-V battery. The current passing through each light bulb is:

A $\frac{1}{3}$ A√

B $\frac{2}{3}$ A

C 1 A

D 3 A

$$I_1 = I_2 = I_3 = I_{TOTAL} = \frac{V_{TOTAL}}{R_{TOTAL}}$$

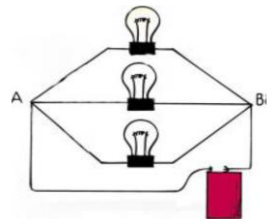
$$I_{TOTAL} = \frac{12}{(12+12+12)} = \frac{12}{36} = \frac{1}{3}\ A$$

34. Three identical light bulbs, each of resistance 12 Ω , are connected in parallel to a 12-V battery. Their equivalent resistance is:

A 4 Ω√
B 12Ω
C 24Ω
D 36 Ω

$$\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \rightarrow \frac{1}{R_{parallel}} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} = \frac{3}{12}$$

$$\rightarrow \frac{1}{R_{parallel}} = \frac{3}{12} \rightarrow R_{parallel} = \frac{12}{3} = 4\ \Omega$$



35. Three identical light bulbs, each of resistance 12Ω ,are connected in parallel to a 12-V battery. The potential difference across each light bulb is:

A 0 V
B 4 V
C 8 V
D 12 V√

$$V_1 = V_2 = V_3 = V_{TOTAL} = 12\ V$$

وذلك لان التوصيل على التوازي

36. Three identical light bulbs, each of resistance 12 Ω , are connected in parallel to a 12-V battery. The current passing through each light bulb is:

A $\frac{1}{3}$ A
B $\frac{2}{3}$ A
C 1 A√
D 3 A

بما ان التوصيل على التوازي فان قيمة التيار الكلي ستنقسم الى تيارات فرعية وكل تيار فرعي ستكون قيمته مماثلة لبقية قيم التيارات الفرعية الاخرى وذلك لان كل منها بها نفس مقدار المقاومة وعلى هذا فان :

$$I_1 = I_2 = I_3 \rightarrow I_1 = \frac{V_{TOTAL}}{R_1} = \frac{12}{12} = 1\ A$$

37. In an electric circuit consisting of two resistances (10 Ω and 5 Ω) connected in series, if the current through the 10Ω resistance is 1 A, the current through other resistance is:

A 0 A
B 0.5 A
C 1 A√
D 2 A

بما ان التوصيل على التوصيل على التوالي فان قيمة التيار ستكون ثابتة في جميع نقاط الدائرة وعلى هذا فان :

$$I_1 = I_2 = I_{TOTAL} \rightarrow I_2 = 1A$$

38. In an electric circuit consisting of two resistances (10 Ω and 5Ω) connected in parallel, if the current through the 10Ω. resistance is 1 A, the current through other resistance is:

A 0 A

B 0.5 A

C 1 A

D 2 A√

بما ان التوصيل على التوازي فان قيمة فرق الجهد ستكون ثابتة بين اطراف جميع المسارات الفرعية والتي ستكون هي نفس قيمة فرق الجهد بين طرفي البطارية. وبما ان قيمة التيار في المقاومة الاولى 10 Ω هي 1 A وحيث ان قيمة المقاومة الثانية 5Ω تقل عن قيمة المقاومة الاولى بمقدار النصف فان قيمة التيار في المقاومة الثانية ستزيد عن قيمة التيار المار في المقاومة الاولى بمقدار الضعف وذلك لان العلاقة بين التيار والمقاومة عكسية حسب قانون اوم :

$$R_1 = 10\Omega \rightarrow I_1 = 1A \rightarrow V_1 = I_1 . R_1 = 1 \times 10 = 10V$$

$$R_2 = 5\ \Omega \rightarrow I_2 = \frac{V_{TOTAL}}{R_2} = \frac{10}{5} = 2\ A$$

وذلك لان فرق الجهد في التوصيل على التوازي :

$$V_1 = V_2 = V_{TOTAL} = 10\ V$$

CHAPTER 5: OPTICS

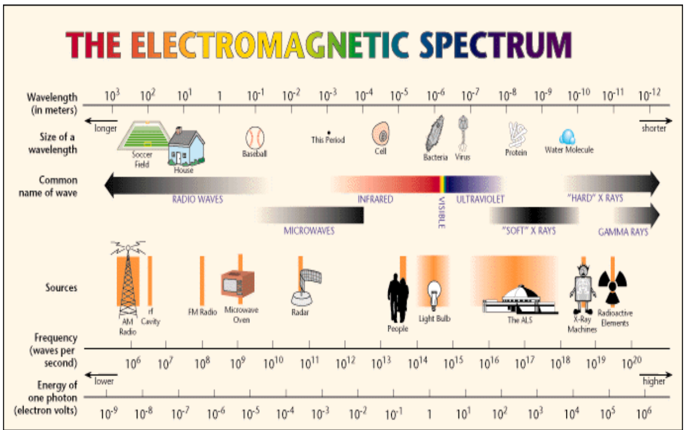
Formulas & Constants

$f = c / \lambda$ or: $c = f \cdot \lambda$ f =frequency; λ =wavelength)	$f = 1 / T$ (frequency = 1/(time of 1 cycle))	$E = h f$ (photon energy = constant × wave frequency)	$c = 3 \times 10^{8}$ m/s $h = 6.6 \times 10^{-34}$ J.s
10^{0} to 10^{24+} Hz (frequencies in the e-m spectrum)	4×10^{14} to 8×10^{14} Hz (frequency range of visible light)	$\theta_i = \theta_r$ (law of reflection)	$1\ Hz = 1\ s^{-1}$
Snell's law: $n_i \sin \theta_i = n_r \sin \theta_r$ (i = incidence; r = refraction)	Index of refraction: $n = \frac{c}{v}$ (v = speed of light in medium)	$\frac{1}{f} = \frac{1}{s_o} + \frac{1}{s_i}$ or: $s_i = \frac{s_o \cdot f}{s_o - f}$ (o = object; i = image)	$M = \frac{h_i}{h_o} = -\frac{s_i}{s_o}$ $= \frac{1}{1 - s_o/f}$

Key Terms & Definitions

Aberration	زيغ	Focal point	البؤرة	Prism	منشور
Absorption	امتصاص	Frequency	تردد	Rainbow	قوس المطر
Amplitude	ارتفاع الموجة	Electromagnetic	كهرومغناطيسي	Ray	شعاع
Astigmatism	انحراف في القرنية	Incidence	سقوط	Real image	صورة حقيقية
Beam	حزمة	Infrared	تحت الحمراء	Reflection	انعكاس
Chromatic	لونيّ	Inverted image	صورة مقلوبة	Refraction	انكسار
Concave	مقعر	Least time principle	قاعدة الزمن الأقصر	Resonance	رنين
Converge	يركز	Lens	عدسة	Source	مصدر
Convex	محدب	Magnify	يكبّر	Spectrum	طيف
Cornea	القرنية	Medium	وسط	Specular	مرئي؛ بصري
Critical angle	الزاوية الحرجة	Microwaves	الموجات شديدة القصر	Transparent	شفاف
Defect	خلل	Mirage	سراب	Ultraviolet	فوق البنفسجي
Deformation	تشوّه	Mirror	مرآة	Upright image	صورة قائمة
Diffuse	مبعثر أو منتشر	Oscillation	ارتجاج أو اهتزاز	Violet	بنفسجي
Dispersion	انتشار	Period	فترة الموجة	Virtual image	صورة وهمية
Diverge	يوزع	Photon	فوتون	Visible light	الضوء المرئي
Fiber optics	تلألياف البصرية	Plane	مسطح	Wave	موجة
Focal distance	البعد البؤري	Polished	مصقول	Wavelength	طول الموجة

Electromagnetic Waves & Spectrum



1. Light is the oscillation of:
A electric & sound fields
B electric & magnetic fields√
C sound & magnetic fields
D electric & gravitational fields

الضوء هو عبارة عن
تذبذب المجال الكهربائي
والمجال المغناطيسي

2. Shaking an electrically charged rod to-and-fro in empty space produces:
A air waves
B sound waves
C electromagnetic waves√
D vacuum waves

3. Electromagnetic waves start from a vibrating:
A fork (شوكة)
B string (وتر)
C spring (زنبرك)
D charge√

تنشأ الموجة الكهرومغناطيسية من تذبذب شحنة كهربائية

4. In an electromagnetic wave, the electric and magnetic fields are:
A perpendicular to each other and to the direction of motion√
B parallel to each other and to the direction of motion
C perpendicular to each other and parallel to the direction of motion
D parallel to each other and perpendicular to the direction of motion

5. A wave's frequency is:
A the number of waves repeating (تتكرر) every second√
B the time duration for one complete wave
C the maximum value of a wave
D the length of a single wave

تردد الموجة هو عدد الموجات التي تتكرر في الثانية الواحدة

6. A wave's wavelength is:
A the number of waves repeating every second
B the time duration for one complete wave
C its maximum value
D the length of a single wave√

الطول الموجي للموجة هو طول موجة واحدة

7. Going from left to right in the electromagnetic spectrum, the following happens:
A both wavelength and frequency increase
B both wavelength and frequency decrease
C wavelength increases and frequency decreases
D wavelength decreases and frequency increases√

8. In the electromagnetic spectrum, the narrowest range is that of:
A radio waves
B x-ray waves
C visible light waves√
D ultraviolet waves

في الطيف الكهرومغناطيسي فان أضيق مدى سيكون لموجات الضوء المرئي

9. Electromagnetic waves that travel in vacuum slower than light are:
A gamma-ray waves
B x-ray waves
C ultraviolet waves
D none of these√

لأنه في الفراغ تنتقل جميع الموجات الكهرومغناطيسية بنفس السرعة

10. In the electromagnetic spectrum, the highest energy is that of:
A gamma-ray waves√
B x-ray waves
C visible light waves
D ultraviolet waves

في الطيف الكهرومغناطيسي فان الموجات التي لها اعلى طاقة هي أشعة جاما

11. In the electromagnetic spectrum, the lowest frequency is that of:
A ultraviolet waves
B x-ray waves
C red light waves
D radio waves√

في الطيف الكهرومغناطيسي فان الموجات التي لها اقل تردد هي موجات الراديو

12. Among the following electromagnetic waves, the longest wavelength is for:
A infrared waves
B microwave√
C visible light waves
D ultraviolet waves

من الموجات الكهرومغناطيسية التالية فان التي لها اعلى طول موجي هي موجات الميكروويف

13. The wavelength of 300-MHz microwave is:
A 1 μm
B 1 mm
C 1 cm
D 1 m√

$$f = \frac{c}{\lambda} \rightarrow \lambda = \frac{c}{f} = \frac{3 \times 10^8}{300\ \text{MHz}}$$

$$\lambda = \frac{3 \times 10^8}{300 \times 10^6} = \frac{3 \times 10^8}{3 \times 10^8} = 1\ m$$

14. The frequency of 0.5-μm green light is:
A 2×10^{14} Hz
B 4×10^{14} Hz
C 6×10^{14} Hz√
D 8×10^{14} Hz

$$f = \frac{c}{\lambda} = \frac{3 \times 10^8}{0.5\ \mu\text{m}} =$$

$$f = \frac{3 \times 10^8}{0.5 \times 10^{-6}} = 6 \times 10^{14}\ \text{Hz}$$

Reflection

15. Wave reflection means that it always:
A enters into a new medium (وسط)
B returns to the medium from which it came√
C returns along the same line where it came
D slides along the border between two media

معنى انعكاس الموجات بانها دائما تعود الى الوسط الذي قدمت منه

16. We see most things around us because:
A they are primary sources of light
B they are secondary sources of light
C they reflect light√
D they absorb light

نستطيع رؤية الاشياء من حولنا لأنها تعكس الضوء

17. If light beam (X) falls obliquely on a mirror and reflects into beam (Y), we can say that:
A X is always perpendicular to the mirror
B Y is always perpendicular to the mirror
C X and Y make equal angles with the mirror√
D X and Y are perpendicular to each other

عند سقوط الشعاع الضوئي على المرآة فانه دائما تكون زاوية السقوط مساوية لزاوية الانعكاس

18. When a light beam is reflected, it keeps a constant:
A speed
B frequency
C wavelength
D all of these√

عند انعكاس الشعاع الضوئي فان الشعاع المنعكس لا تتغير سرعته او تردده او طوله الموجي فقط الذي يتغير اتجاهه .

19. The angle of reflection is always:
A equal to the angle of incidence√
B smaller than the angle of incidence
C larger than the angle of incidence
D equal to the angle of refraction

20. An object placed in front of a plane mirror forms an image that is of _______ size and _________ distance to the mirror.
A same; same√
B larger; same
C same; nearer
D same; farther

اذا وضع الجسم امام مرآة مستوية فإنها دائما تكون صورة خيالية (خلف المرآة) لها نفس حجم الجسم ولها نفس بعد الجسم عن المرآة

21. An object placed between a concave (مقعر) mirror and its focus forms an image that is of _______ size and _________ distance to the mirror.
A smaller; farther
B larger; nearer
C smaller; nearer
D larger; farther√

اذا وضع جسم بين مرآة مقعرة وبؤرتها (أي انه يكون داخل نطاق البؤرة) بالتالي يكون
$S_0 < f$
فتتكون له صورة خيالية (خلف المرآة) معتدلة مكبرة وبعيدة

22. An object placed in front of a convex (محدب) mirror forms an image that is of _______ size and _________ distance to the mirror.
A smaller; farther
B larger; nearer
C smaller; nearer√
D larger; farther

اذا وضع الجسم امام مرآة محدبة فإنها تكون صورة للجسم تكون خيالية(خلف المرآة) ومصغرة وقريبة من المرآة

23. An image formed behind a mirror is virtual for:
A plane, convex and concave√
B plane and concave, and real for convex
C plane and convex, and real for concave
D convex and concave, and real for plane

الصورة المتكونة خلف المرآة هي صورة خيالية وتنتج عن جميع انواع المرايا سواء كانت مستوية او منحنية بنوعيها (مقعرة ومحدبة)

24. Diffuse reflection occurs when light is incident on a surface that is:
A smooth (أملس)
B polished (مصقول)
C transparent (شفاف)
D rough (خشن)√

الانعكاس المشتت (الغير منتظم) يحدث عند سقوط الشعاع الضوئي على اسطح خشنة .

25. Specular (بصري) reflection occurs when light is incident on a:
A lens
B mirror√
C painted wall
D page of a book

الانعكاس البصري (منتظم) يحدث عند سقوط الشعاع الضوئي على اسطح مصقولة مثل المرآة .

26. After diffuse reflection, light goes in:
A one direction
B two opposite directions
C no direction
D all directions√

بعد حدوث الانعكاس المشتت فان الضوء المنعكس ينتشر في جميع الاتجاهات .

27. You can see the road ahead of your car at night because of:

A specular reflection
B absorption
C diffuse reflection√
D refraction

نستطيع رؤية الطريق امام السيارة ليلا بسبب حدوث الانعكاس المشتت للأشعة الضوئية .

28. If a convex mirror of 2-m focal length is placed 8 m away from a 2.5-m-high door, the image of the door will appear in the mirror at a distance of:

A 1.6 m√
B 2.4 m
C 0.8 m
D 3.2 m

$$s_i = \frac{s_o . f}{s_o - f} = \frac{8 \times -2}{8-(-2)} = \frac{-16}{10} = -1.6\ m$$

ملاحظة: البعد البؤري للمرآة المفرقة (المحدبة) يكون دائما سالب .والاشارة السالبة في بعد الصورة لانها خيالية

29. If a convex mirror of 2-m focal length is placed 8 m away from a 2.5-m-high door, the height of the door's image will be:

A 0.1 m
B 0.5 m√
C 1 m
D 1.25 m

$$\frac{h_i}{h_o} = \frac{-s_i}{s_o} \rightarrow \frac{h_i}{2.5} = \frac{-(-1.6)}{8}$$

$$h_i = \frac{2.5 \times 1.6}{8} = 0.5\ m$$

30. If a convex mirror of 2-m focal length is placed 8 m away from a 2.5-m-high door, the magnification of the door in the mirror will be:

A 5
B 2
C 0.5
D 0.2√

$$M = \frac{h_i}{h_o} = \frac{0.5\ m}{2.5\ m} = 0.2$$

او حل آخر :

$$M = \frac{-s_i}{s_o} = \frac{-(-1.6)\ m}{8\ m} = 0.2$$

31. If a convex mirror of 2-m focal length is placed 8 m away from a 2.5-m-high door, the image of the door will be:

A upright and reduced√
B upright and enlarged
C inverted and reduced
D inverted and enlarged

صفات الصورة المتكونة عن المرآة المحدبة تكون دائما خيالية (خلف المرآة) معتدلة ومصغرة

32. If a concave mirror of 2-m focal length is placed 7 m away from a 2.5-m-high door, the image of the door will appear in the mirror at a distance of:

A 1.4 m
B 2.8 m√
C 0.7 m
D 5.6 m

$$s_i = \frac{s_o . f}{s_o - f} = \frac{7 \times 2}{7-2} = \frac{14}{5} = 2.8\ m$$

33. If a concave mirror of 2-m focal length is placed 7 m away from a 2.5-m-high door, the height of the door's image will be:

A 0.1 m
B 0.5 m
C 1 m√
D 1.25 m

$$\frac{h_i}{h_o} = \frac{-s_i}{s_o} \rightarrow \frac{h_i}{2.5} = \frac{-2.8}{7}$$

$$h_i = \frac{2.5 \times -2.8}{7} = -1\ m$$

والاشارة السالبة للدلالة على ان الصورة مقلوبة

34. If a concave mirror of 2-m focal length is placed 7 m away from a 2.5-m-high door, the magnification of the door in the mirror will be:

A -2
B +2
C -0.4√
D +0.4

$$M = \frac{h_i}{h_o} = \frac{-1\ m}{2.5\ m} = -0.4$$

او حل آخر :

$$M = \frac{-s_i}{s_o} = \frac{-2.8\ m}{7\ m} = -0.4$$

35. If a concave mirror of 2-m focal length is placed 7 m away from a 2.5-m-high door, the image of the door will be:

A upright and reduced
B upright and enlarged
C inverted and reduced√
D inverted and enlarged

بما ان بعد الجسم اكبر من البعد البؤري للمرآة المقعرة أي ان

$$s_o > f$$

بالتالي فان الصورة المتكونة تكون حقيقية ومقلوبة
اما بالنسبة لحجمها فيحسب كالتالي :

$$s_i = \frac{s_o . f}{s_o - f} = \frac{7 \times 2}{7-2} = \frac{14}{5} = 2.8\ m$$

$$\frac{h_i}{h_o} = \frac{-s_i}{s_o} \rightarrow \frac{h_i}{2.5} = \frac{-2.8}{7}$$

$$h_i = \frac{2.5 \times -2.8}{7} = -1\ m$$

حيث ان ارتفاع الصورة اقل من ارتفاع الجسم
والاشارة السالبة تدل على الصورة مقلوبة

Refraction

36. The process of light bending when passing obliquely from one medium into another is called:

A specular reflection
B absorption
C diffuse reflection
D refraction√

عملية انحراف الضوء عن مساره عند انتقاله من وسط الى اخر تسمى بالانكسار .

37. When light is refracted, it keeps a constant:

A speed

B frequency√

C wavelength

D all of these

عند انكسار الضوء فان التردد يبقى ثابتا

38. When light is refracted in passing from air into water, its angle of refraction is:

A equal to the angle of incidence

B more than the angle of incidence

C less than the angle of incidence√

D zero

عند انتقال الضوء من وسط قليل الكثافة الضوئية الى وسط عالي الكثافة الضوئية مثل انتقاله من الهواء الى الماء فإنه ينكسر مقتربا من العمود المقام فتصبح زاوية الانكسار اقل من زاوية السقوط

39. Mirage (السراب) happens on hot days because light rays coming toward us from the sky:

A bend toward the ground√

B bend away from the ground

C bounce (يرتد) off the ground

D stick to the ground

يحدث السراب في الايام الحارة بسبب ان الشعاع الضوئي القادم من السماء يحدث له انحناء بالقرب من الارض

40. What we actually see in a mirage (سراب):

A water vapor collecting above the road

B water that evaporates very fast

C sky light that appears like water√

D only an imaginary image

في السراب تنعكس صورة السماء لتبدو وكأنها ماء على الطريق

41. If the speed of light in water is 0.75 c, the index of refraction of water is:

A 1.33√

B 0.75

C 2.25

D 0.25

$$n = \frac{c}{v} = \frac{c}{0.75\,c} = \frac{1}{0.75} = 1.33$$

42. The index of refraction of water is 4/3. A beam of light incident from air into water at 30° (sin 30° = ½) refracts at an angle of:

A 13°

B 9°

C 49°

D 22°√

الشعاع الضوئي انتقل من الهواء الى الماء وبالتالي فان وسط السقوط الهواء والوسط الذي حدث فيه انكسار الماء

$$n_1 \sin i = n_2 \sin r$$

$$1 \times \sin 30 = \frac{4}{3} \sin r$$

$$\sin r = \frac{1}{2} \times \frac{3}{4}$$

$$r = \sin^{-1}\left(\frac{1}{2} \times \frac{3}{4}\right) \rightarrow r = \sin^{-1}\left(\frac{3}{8}\right)$$

$$r = \sin^{-1}(0.375) = 22°$$

43. The index of refraction of water is 4/3. A beam of light incident from water into air at 30° (sin 30° = ½) refracts at an angle of:

A 42° √

B 90°

C 49°

D 22°

الشعاع الضوئي انتقل من الماء الى الهواء وبالتالي فان وسط السقوط الماء والوسط الذي حدث فيه انكسار الهواء

$$n_1 \sin i = n_2 \sin r$$

$$\frac{4}{3} \times \sin 30 = 1 \times \sin r$$

$$\sin r = \frac{4}{3} \times \frac{1}{2}$$

$$r = \sin^{-1}\left(\frac{4}{3} \times \frac{1}{2}\right) \rightarrow r = \sin^{-1}\left(\frac{4}{6}\right)$$

$$r = \sin^{-1}(0.666) = 41.8 \approx 42°$$

44. The index of refraction of water is 4/3. This means that the critical angle of water (into air) is:

A 42°

B 90°

C 49°√

D 22°

الزاوية الحرجة هي زاوية سقوط وبما ان المطلوب الزاوية الحرجة للماء أي ان المطلوب زاوية السقوط للشعاع الضوئي من الماء الى الهواء

والزاوية الحرجة هي زاوية سقوط دائما تقابلها زاوية انكسار مقدارها ٩٠°

$$n_1 \sin i = n_2 \sin r$$

$$\frac{4}{3} \times \sin i_C = 1 \times \sin 90$$

$$\sin i_C = \frac{3}{4} \times 1$$

$$i_C = \sin^{-1}\left(\frac{3}{4}\right) = \sin^{-1}(0.75) = 48.5 \approx 49°$$

45. If a beam of light is incident from water into air at the critical angle, its angle of refraction in air is:

A 0°

B 90°√

C 60°

D 30°

اذا انتقل شعاع ضوئي من وسط عالي الكثافة الضوئية الى وسط اقل منه في الكثافة الضوئية مثل الانتقال من الماء الى الهواء وكان الانتقال أي السقوط بزاوية حرجة فانه ينكسر بزاوية مقدارها ٩٠ درجة

46. A beam of light is directed from the bottom of a swimming pool so as to hit the top surface at a 60°-angle. This beam will then undergo (يخضع) a total :

A dispersion

B diffuse reflection

C internal reflection√

D refraction

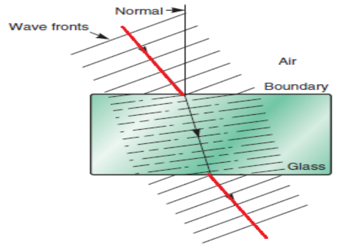
اذا سلط شعاع ضوئي من اسفل حوض للسباحة ليصطدم بالسطح (أي ان الشعاع انتقل من الماء الى الهواء اي من وسط عالي الكثافة الضوئية الى وسط اقل منه في الكثافة الضوئية) وكانت زاوية السقوط مقدارها ٦٠° وهي اكبر من الزاوية الحرجة للماء التي تعادل ٤٩° فسيخضع هذا الشعاع الى انعكاس كلي داخلي

$$\theta_i > \theta_c \rightarrow TIR$$

47. A beam of light falling obliquely on a pane (لوح) of glass leaves the pane such that it is:

A parallel to the pane
B perpendicular to the pane
C perpendicular to its original direction
D parallel to its original (أصلي) direction√

اذا سقط شعاع ضوئي على لوح زجاجي بشكل مائل فإن اتجاه الشعاع الخارج من اللوح يكون موازيا لاتجاه الشعاع الساقط (أي اتجاهه الاصلي)



48. A fish under water appears nearer because of:

A refraction√
B aberration
C reflection
D dispersion

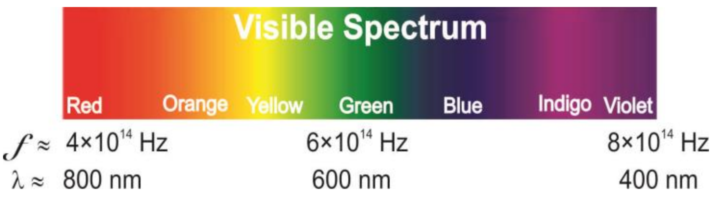
تبدو الاجسام المغمورة في الماء كالسمكة اقرب مما هي عليه في الواقع بسبب الانكسار

49. Light travels through an optical fiber by:

A dispersion
B diffuse reflection
C total internal reflection√
D total refraction

ينتقل الضوء عبر الالياف البصرية بواسطة الانعكاس الكلي الداخلي

Dispersion; Rainbow



50. In the visible light spectrum, red appears at the:

A right
B left√
C middle
D outside

في الطيف المرئي فان اللون الاحمر يبدو على اليسار

51. In the visible light spectrum, the longest-wavelength light is:

A red√
B blue
C green
D violet

في طيف الضوء المرئي فانه عند الانتقال من اليسار الى اليمين يقل الطول الموجي ويزداد التردد والطاقة ولذلك فان اللون الاحمر له اكبر طول موجي من الالوان الاخرى في الطيف المرئي .

52. In the visible light spectrum, the highest frequency light is:

A red
B blue
C green
D violet√

في طيف الضوء المرئي فانه عند الانتقال من اليسار الى اليمين يقل الطول الموجي ويزداد التردد والطاقة ولذلك فان اللون البنفسجي له اكبر تردد من الالوان الاخرى في الطيف المرئي .

53. The light component that travels the fastest through glass or water is:

A blue light
B red light√
C violet light
D green light

الترددات المنخفضة من الطيف المرئي تنتقل بسرعة عالية في المواد الشفافة (مثل الماء والزجاج) بينما تنتقل الترددات العالية من الطيف المرئي بسرعة بطيئة في المواد الشفافة لذك ينتقل اللون الاحمر بأعلى سرعة في المواد الشفافة من الالوان الاخرى في الطيف المرئي .

54. Separation of light falling on a prism into colors is called:

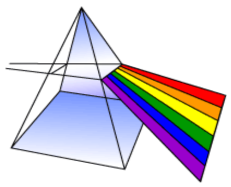
A dispersion√
B reflection
C absorption
D mirage

عملية فصل اللون الابيض المرئي الى مجموعة من الالوان مرتبة حسب ترددها تسمى التفرق او التشتت .

55. When white light falls on a prism (as shown), its color components separate so that the highest (from base) is:

A blue light
B green light
C violet light
D red light√

عند سقوط الضوء الابيض على منشور فانه يتحلل الى مكوناته من للطيف المرئي بحيث يكون اعلاها من القاعدة اللون الاحمر.



56. You can see a rainbow on a humid day only if the sunlight is coming from:

A above
B nowhere
C behind you√
D in front of you

لكي نستطيع رؤية قوس المطر فلابد ان تكون قطرات المطر في الجهة المقابلة لأشعة الشمس لذلك فاذا كان قوس المطر امامنا فلابد ان تكون الاشعة الضوئية قادمة من خلفك

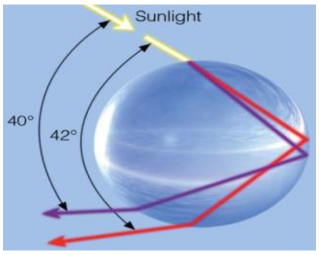
57. Rainbow results from that:

A raindrops make the shape of prisms in the air
B light disperses inside raindrops√
C raindrops form water ponds on the ground
D raindrops reflect light at different angles

ينشأ قوس المطر نتيجة تفرق اشعة الشمس في قطرات الماء

58. Rainbow is formed in the following sequence
A refraction _ reflection_ refraction √
B reflection _ refraction _ reflection
C refraction _ refraction _ reflection
D reflection _ reflection_ refraction

يتكون قوس المطر نتيجة لحدوث العمليات التالية بالترتيب : انكسار – انعكاس – انكسار



Lenses

59. A converging lens has __________ surfaces and is _________ at its center than its edges:
A convex (محدبة); thinner
B concave (مقعرة); thinner
C concave; thicker
D convex; thicker√

العدسة المجمعة لها اسطح محدبة وتكون سميكة في الوسط اكثر من الاطراف

60. A diverging lens has __________ surfaces and is _________ at its center than its edges:
A convex (محدبة); thinner
B concave (مقعرة); thinner√
C concave; thicker
D convex; thicker

العدسة المفرقة لها اسطح مقعرة وتكون رقيقة في الوسط اكثر من الاطراف

61. A converging lens converges a beam of light that is parallel to its principal axis into:
A the focal point on the other side√
B the focal point on the same side
C the center of curvature on the same side
D the center of curvature on the other side

العدسة المجمعة (المحدبة) تجمع الاشعة الضوئية الساقطة بشكل موازي للمحور الرئيسي في البؤرة الموجودة في الجهة الاخرى من العدسة

62. A diverging lens diverges a beam of light that is parallel to its principal axis so as to appear coming from:
A the focal point on the other side
B the focal point on the same side√
C the center of curvature on the same side
D the center of curvature on the other side

العدسة المفرقة (المقعرة) تفرق الاشعة الضوئية الساقطة بشكل موازي للمحور الرئيسي بحيث تبدو بعد تفرقها وكأنها قدمت من البؤرة الموجودة في جهة السقوط

63. Light passing through the center of a lens:
A bends up for a diverging lens
B bends up for a converging lens
C passes without deviation for both types√
D gets reflected for both types

الشعاع الضوئي الذي يمر من مركز العدسة (بنوعيها المحدبة والمقعرة) لا يحدث له أي انحراف عن مساره

64. When an object is placed inside the focal point of a converging lens, its image is:
A real and farther
B real and nearer
C virtual and nearer
D virtual and farther√

اذا وضع جسم داخل نطاق البؤرة لعدسة مجمعة (محدبة) أي أن بعد الجسم اقل من البعد البؤري فإن الصورة تكون خيالية (أي تتواجد في نفس جهة الجسم) ومكبرة وبعيدة ومعتدلة .

65. When an object is placed outside the focal point of a converging lens, its image is:
A real and inverted (مقلوبة)√
B real and upright (قائمة)
C virtual and upright
D virtual and inverted

اذا وضع جسم خارج نطاق البؤرة لعدسة مجمعة (محدبة) أي ان بعد الجسم اكبر من البعد البؤري فإن الصورة تكون حقيقة (أي في الجهة الاخرى من العدسة) ومقلوبة .

66. Distortion (تشويه) in the image of a lens is called:
A conversion
B aberration√
C dispersion
D refraction

التشويه الحادث في الصورة الناتجة عن العدسة يسمى الزيغ

67. Distortion (تشويه) in the image of a lens caused by different speeds of the color components (مكونات) of light is called:
A spherical aberration
B linear aberration
C astigmatic aberration
D chromatic aberration√

التشويه الحادث في الصورة الناتجة عن العدسة بسبب اختلاف سرعات مكونات الضوء (الوان الطيف المرئي) عند عبورها العدسة يسمى بالزيغ اللوني

68. An eye defect (خلل) where the cornea (القرنية) is curved unevenly (تقوس بشكل غير مستوي) is called:
A conversion
B dispersion
C astigmatism√
D refraction

الخلل في العين الذي يحدث نتيجة انحناء القرنية بشكل غير متساوي يسمى الإستجماتزم .

69. If a converging lens of 2-m focal length is placed 7 m away from a 2.5-m-high door, the distance of the door's image from the lens will be:

A 1.4 m
B 2.8 m√
C 0.7 m
D 5.6 m

$$s_i = \frac{s_o.f}{s_o - f} = \frac{7 \times 2}{7-2} = \frac{14}{5} = 2.8\ m$$

70. If a converging lens of 2-m focal length is placed 7 m away from a 2.5-m-high door, the height of the door's image will be:

A 0.1 m
B 0.5 m
C 1 m√
D 1.25 m

$$\frac{h_i}{h_o} = \frac{-s_i}{s_o} \rightarrow \frac{h_i}{2.5} = \frac{-2.8}{7}$$
$$h_i = \frac{2.5 \times -2.8}{7} = -1\ m$$

والاشارة السالبة للدلالة على ان الصورة مقلوبة

71. If a converging lens of 2-m focal length is placed 7 m away from a 2.5-m-high door, the magnification of the door in the lens will be:

A -2
B +2
C -0.4√
D +0.4

$$M = \frac{h_i}{h_o} = \frac{-1\ m}{2.5\ m} = -0.4$$

او حل آخر :

$$M = \frac{-s_i}{s_o} = \frac{-2.8\ m}{7\ \ m} = -0.4$$

72. If a converging lens of 2-m focal length is placed 7 m away from a 2.5-m-high door, the image of the door will be:

A upright and virtual
B inverted and virtual
C upright and real
D inverted and real√

بما ان بعد الجسم اكبر من البعد البؤري للمرآة المقعرة أي ان

$s_o > f$

بالتالي فان الصورة المتكونة تكون حقيقية ومقلوبة

73. If a diverging lens of 2-m focal length is placed 8 m away from a 2.5-m-high door, the distance of the door's image from the lens will be:

A 1.6 m√
B 2.4 m
C 0.8 m
D 3.2 m

$$s_i = \frac{s_o.f}{s_o - f} = \frac{8 \times -2}{8-(-2)} = \frac{-16}{10} = -1.6\ m$$

ملاحظة : البعد البؤري للعدسة المفرقة (المقعرة) دائما سالب. والاشارة السالبة في بعد الصورة تدل على ان الصورة خيالية

74. If a diverging lens of 2-m focal length is placed 8 m away from a 2.5-m-high door, the height of the door's image will be:

A 0.2 m
B 0.5 m√
C 1 m
D 2 m

$$\frac{h_i}{h_o} = \frac{-s_i}{s_o} \rightarrow \frac{h_i}{2.5} = \frac{-(-1.6)}{8}$$
$$h_i = \frac{2.5 \times 1.6}{8} = 0.5\ m$$

ملاحظة : بعد الصورة بالسالب لان العدسة المفرقة (المقعرة) تكون دائما صور خيالية لكن طولها يكون بالموجب لأنها معتدلة

75. If a diverging lens of 2-m focal length is placed 8 m away from a 2.5-m-high door, the magnification of the door in the lens will be:

A -0.4
B +0.4
C -0.2
D +0.2√

$$M = \frac{h_i}{h_o} = \frac{0.5\ m}{2.5\ m} = 0.2$$

او حل آخر :

$$M = \frac{-s_i}{s_o} = \frac{-(-1.6)\ m}{8\ \ m} = 0.2$$

76. If a diverging lens of 2-m focal length is placed 8 m away from a 2.5-m-high door, the image of the door will be:

A upright and virtual√
B inverted and virtual
C upright and real
D inverted and real

صفات الصورة المتكونة عن العدسة المفرقة (المقعرة) تكون دائما خيالية (في نفس جهة الجسم) ومعتدلة

Extra Question On Chapter 5

77- The frequency of a radio wave that repeats 5000 times every second is:

A 0.0002 Hz
B 20000 Hz
C.150000 Hz,
D 5000 Hz√

$$f = \frac{5000}{1} = 5000\ Hz$$

78.The only waves that we cannot see are:

A red light
B green light
C blue light
D. ultraviolet light√

موجات الضوء الابيض هي المرئية فقط اما الموجات التي ترددها اعلى او اقل من تردد الضوء الابيض فهي غير مرئية

79. The speed of light in glass is:

A.3/2 C
B.2/3 C √
C.4/3
D.¾ C

$$n = \frac{c}{v} \rightarrow \frac{3}{2} = \frac{c}{v} \rightarrow v = \frac{2}{3}c$$

80. A beam of light incident at 30^0 from air into glass refracts at an angle of light.

A . 45^0
B. 30^0
C . 60^0
D. $< 30^0$√

اذا انتقل الشعاع الضوئي من وسط منخفض في الكثافة الضوئية الى وسط اكبر منه في الكثافة الضوئية كما في حالة عند انتقال الشعاع الضوئي من الهواء الى الزجاج فإن الشعاع الضوئي سوف ينكسر مقتربا من العمود المقام وبالتالي فان زاوية الانكسار تكون اقل من زاوية السقوط

81.total internal reflection is possible for a beam of light incident from

A .glass into water√
B .water into glass
C. air into glass
D. air into water

يحدث الانعكاس الكلي الداخلي:
١ـ عند انتقال الشعاع الضوئي من وسط مرتفع في الكثافة الضوئية الى وسط اقل منه في الكثافة الضوئية.
٢ ـ تكون زاوية السقوط اثناء هذا الانتقال اكبر من الزاوية الحرجة .
وذلك حتى يحدث انعكاس كلي للشعاع

82. Rainbow appears on a :

A. sunny and dry day
B. sunny and humid day√
C. dark and humid day
D. dark and dry day

83. The image produced by a converging lens cannot be

A real and enlarged
B. virtual and inverted√
C real and inverted
D virtual and enlarged