عمادة الخدمات التعليمية

INTRODUCTORY PHYSICS

MULTIPLE CHOICE QUESTIONS

PREPARED BY:

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Table of Contents

CHAPTER 1: INTRODUCTION, MEASUREMENTS, UNITS

Formulas & Constants

A = L × W (Rectangle's area)	A = π R^2 (Circle's area)	Volume = Area × Height	c = 299,792,458 m/s (speed of light in vacuum)	1 u = 1.6605 × 10^{-27} kg (atomic mass unit)
1 m/s = 3.6 km/h	1 giga (G) = 10^9	1 mega (M) = 10^6	1 kilo (k) = 10^3	1 centi (c) = 10^{-2}
1 milli (m) = 10^{-3}	1 micro (μ) = 10^{-6}	1 nano (n) = 10^{-9}	1 in. = 2.54 cm	1 ft = 12 in.
1 yd = 3 ft	1 mi =5280 ft	1 mi =1.61 km	1 L = 1000 cm^3	v = d / t
a = v / t	Dimension of length: [L]	Dimension of time: [T]	Dimension of mass: [M]	F = m. a; W = F . d

Key Terms & Definitions

Accuracy	دقة	~~Fact~~	~~حقيقة~~	Relationship	علاقة
Analysis	تحليل	~~Guess~~	~~تخمين~~	Rounding	تقريب
Base units	الوحدات الأساسية	~~Hypothesis~~	~~فرضية~~	Science	علم
Concept	مفهوم	Law	قانون	~~Scientific attitude~~	~~المنهج العلمي~~
Conversion	تحويل	Measurement	قياس	~~Scientific method~~	~~الطريقة العلمية~~
Data	بيانات	~~Model~~	~~نموذج~~	Scientific notation	الترميز العلمي
Decimal place	منزلة عشرية	~~Observation~~	~~ملاحظة~~	SI System	نظام الوحدات العالمي
Detect	يكشف	Order of magnitude	الترتيب المقداري	Significant figures	الأرقام المعنوية
Diameter	قطر دائرة	Percentage	نسبة مئوية	~~Speculation~~	~~تأمّل~~
Digit	منزلة رقمية	~~Phenomenon~~	~~ظاهرة~~	Standard	معيار
Dimension	بعد	Power-of-ten	أس العشرة	~~Technology~~	~~تقنية~~
Equation	معادلة	Precision	ضبط	~~Test~~	~~اختبار~~
Estimate	تقدير	~~Prediction~~	~~توقع~~	Theory	نظرية
~~Evidence~~	~~دليل~~	Prefix	أداة بادئة	Uncertainty	هامش الخطأ
Experiment	تجربة	Principle	مبدأ	Unit	وحدة

Science; Scientific Method; Scientific Attitude

1. ①The test of truth in science is:

A	experiment
B	speculation
C	hypothesis
D	facts

2. ①Good science is distinguished (يتميز) by:

A	inconsistency (عدم التوافق)
B	emotion (العاطفة)
C	imagination (الخيال)
D	measurements (القياس)

3. ②Our ability to measure something indicates (يشير إلى) how well we _______ that thing.

A	like
B	ignore (يجهل)
C	know
D	misunderstand (يسيء الفهم)

4. ②The scientific method does NOT include:

A	hypothesis (فرضية)
B	speculation (تأمّل)
C	experiment (تجربة)
D	prediction (توقع)

5. ①A scientific hypothesis is:

A	an experiment (تجربة)
B	a final conclusion (خلاصة)
C	an educated guess (تخمين مدروس)
D	a verified prediction (توقع محقق)

6. ②A scientific hypothesis:

A	is always true
B	is always false
C	can be tested for falsehood
D	is not important in science

7. ③The three main elements of a scientific method are:

A	hypothesis, prediction, conclusion
B	hypothesis, conclusion, speculation
C	speculation, hypothesis, experiment
D	hypothesis, prediction, experiment

8. ①Of the following, the only scientific hypothesis is:

A	souls (الأرواح) move faster than light
B	atoms are the smallest particles in the world
C	Einstein was the greatest scientist ever
D	space is filled with undetectable (غير مكتشف) matter

9. ①Which of these is NOT a scientific hypothesis?

A	atomic nuclei are the smallest particles in nature
B	a magnet will pick up a copper coin
C	cosmic rays cannot penetrate a physics textbook
D	sound is made of untestable waves

10. ①A nonscientific hypothesis is:

A	an electron is heavier than a proton
B	heavy objects fall faster than light objects
C	sunset helps poetry
D	the Moon is farther than the Sun

11. ①Which of these is NOT a scientific hypothesis?

A	protons carry electric charge
B	undetectable particles exist in the nucleus
C	charged particles bend in a magnetic field
D	electricity can travel in plastic

12. ③Characteristics (خصائص) of the scientific attitude include:

A	inquiry (استطلاع), integrity (نزاهة), humility
B	inquiry, integrity, pride (كبرياء)
C	submission (تسليم), integrity, humility (تواضع)
D	submission, inquiry, pride

Physics vs. Other Sciences

13. ①The physical sciences include:

A	biology (علم الأحياء)
B	botany (علم النبات)
C	entomology (علم الحشرات)
D	geology (علم طبقات الأرض)

14. ①The physical sciences do NOT include:

A	chemistry
B	zoology (علم الحيوان)
C	astronomy (علم الفلك)
D	geology (علم طبقات الأرض)

15. ①The most basic science is:

A	physics
B	chemistry
C	biology
D	geology

16. ②Physics is considered the basic science because:

A	it is most related to our daily experience
B	all other sciences depend on it
C	it is needed for understanding other sciences
D	all of these

Models, Theories, and Laws

17. ②A scientific model helps in __________ some scientific phenomena (ظواهر).

A	rejecting (رفض)
B	changing
C	understanding
D	combining (دمج)

18. ②A scientific model relates (ينسب) a difficult-to-see scientific phenomenon (ظاهرة) to something that is:

A	unfamiliar to us
B	ambiguous (غامض)
C	not discovered (يكتشف) yet
D	familiar to us

19. ②The picture that a scientific model gives for a studied phenomenon (ظاهرة) is:

A	approximate (تقريبي)
B	exact (دقيق)
C	unclear (غير واضح)
D	reverse (معكوس)

20. ②An agreement (توافق) by competent (أكفاء) scientists is a scientific:

A	hypothesis (فرضية)
B	fact (حقيقة)
C	observation (ملاحظة)
D	model (نموذج)

21. ②A hypothesis that has been repeatedly (تكراراً) tested without flaws (خلل) becomes a scientific:

A	prediction (توقع)
B	observation (ملاحظة)
C	law (قانون)
D	experiment (تجربة)

22. ②A synthesis (تجميع) of many well-verified (محقق) hypotheses (فرضيات) is a scientific:

A	prediction (توقع)
B	theory (نظرية)
C	law (قانون)
D	experiment (تجربة)

23. ②In science, a theory is:

A	an educated guess
B	less correct than a fact
C	a synthesis (تجميع) of many well-tested hypotheses
D	unchangeable

24. ②A scientific fact is rejected (يرفض) if scientists find that it:

A	is disproved (ينقض) by evidence (أدلة)
B	has become more than 500 years old
C	disagrees with local politics
D	actually, a fact is always a fact

25. ①The equations F = ma is an example of a physics:

A	theory
B	model
C	law
D	prediction

Uncertainty, Accuracy, and Precision

26. ②When are measurements absolutely (تماماً) precise?

A	usually
B	sometimes
C	always
D	never

27. ①There is uncertainty associated with every:

A	measurement
B	law
C	equation
D	principle

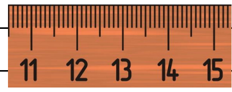
28. ①Main causes of uncertainty in measurements are limitations (محدودية) in:

A	instruments' accuracy and experiment time
B	instruments' (أجهزة) accuracy and human ability
C	experiment time and human ability
D	experiment time and lab conditions

29. ①When we use a ruler of 1 millimeter smallest divisions, the uncertainty is approximately (تقريباً) equal to:

A	0.1 mm
B	1 mm
C	2.5 mm
D	5 mm

30. ①Using a ruler with cm and mm divisions to measure a certain length, we get a value of 12.8 cm. Our measurement can then be written as:



A	L = 12.8 ± 1.0 cm
B	L = 12.8 ± 0.01 cm
C	L = 12.8 ± 0.2 cm
D	L = 12.8 ± 0.1 cm

31. ②Using a ruler with cm and mm divisions to measure a certain length, we get a value of 12.8 cm. Our measurement can then be written as:

A	L = 12.8 cm ± 1%
B	L = 12.8 cm ± 5%
C	L = 12.8 cm ± 10%
D	L = 12.8 cm ± 20%

32. ①The percent uncertainty in the measurement L = 20.2 ± 0.4 cm is:

A	0.5%
B	1%
C	2%
D	4%

33. ②The percent uncertainty in a measurement A = 2.03 m^2 is:

A	0.5%
B	2%
C	5%
D	10%

34. ③A scale (ميزان) has ± 0.05 g accuracy. Weighing a diamond (ماسة) on it gives 8.17 g one day and 8.09 g another day. These two measurements:

A	are unacceptable within the scale's accuracy
B	are acceptable within the scale's accuracy
C	prove that the scale's accuracy is incorrect
D	prove that these are two different diamonds

35. ①The ability of an instrument (جهاز) to repeatedly (تكراراً) give close (متقارب) measurements is called:

A	accuracy
B	uncertainty
C	deviation
D	precision

36. ①The ability of an instrument (جهاز) to give

measurements close (مقارب) to the true values is called:

A	accuracy
B	uncertainty
C	deviation
D	precision

Significant Figures

37. ①The number of reliably (بشكل موثوق) known digits (أرقام) in a number is its:

A	uncertainty
B	accuracy
C	significant figures
D	percent error

38. ①The number of significant figures in (23.20) is:

A	1
B	2
C	3
D	4

39. ②The number of significant figures in (0.062) is:

A	1
B	2
C	3
D	4

40. ①The number of decimal places in (0.062) is:

A	1
B	2
C	3
D	4

41. ①The area of a (10.0 cm × 6.5 cm) rectangle is correctly given as:

A	65 cm^2
B	65.0 cm^2
C	65.00 cm^2
D	65.000 cm^2

42. ②The significant figures in the product of two numbers ($P = A \times B$) should be the same as the _______ significant figures of A and B.

A	most (أكثر)
B	least (أقل)
C	average (متوسط)
D	inverse (عكسي)

43. ③The accuracy in the sum of two numbers ($S = A + B$) should be the same as the _______ accuracy of A and B.

A	most (أكثر)
B	least (أقل)
C	average (متوسط)
D	inverse (عكسي)

44. ②Taking accuracy into account, the difference $D = A - B$ between two numbers, A = 3.6 and B = 0.57, is correctly written as:

A	3.03
B	3.00
C	3.003
D	3.0

45. ②Taking accuracy into account, the sum $S = A + B$ of two numbers, A = 3.6 and B = 0.40, is correctly written as:

A	4.0
B	4.00
C	4
D	04.

46. ②Taking significant figures into account, the product $P = A \times B$ of two numbers, A = 12.0 and B = 12, is correctly written as:

A	144
B	140
C	150
D	100

47. ①Taking significant figures into account, the quotient $Q = A \div B$ of two numbers, A = 12.0 and B = 12, is correctly written as:

A	1.00
B	1
C	1.0
D	1.000

48. ①Dividing 2.0 by 3.0 with a calculator gives 0.66666666. Taking significant figures into account, this result should be written as:

A	0.7
B	0.6667
C	0.667
D	0.67

49. ①For A = 0.01234, B = 0.00123, and C = 0.00012, the number with the most significant figures is:

A	A only
B	B only

C	C only
D	they all are the same

50. ①For A = 0.01234, B = 0.00123, and C = 0.00012, the number with the most decimal places is:

A	A only
B	B only
C	C only
D	they all are the same

Scientific Notation

51. ②Scientific notation allows the number of significant figures to be:

A	clearly expressed
B	carefully hidden
C	neglected
D	avoided

52. ①In the scientific notation, 36900 is written as:

A	3.69×10^{3}
B	3.69×10^{4}
C	36.9×10^{3}
D	0.369×10^{4}

53. ①The scientific notation for 325 is:

A	3.25×10^{2}
B	3.25×10^{1}
C	32.5×10^{0}
D	32.5×10^{-1}

54. ①In the scientific notation, 0.0021 is written as:

A	21×10^{-2}
B	2.1×10^{-3}
C	21×10^{-3}
D	2.1×10^{-4}

55. ①The scientific notation for 7.33 is:

A	7.33×10^{2}
B	7.33×10^{1}
C	7.33×10^{0}
D	7.33×10^{-1}

56. ①The number 3.69×10^{2} is equivalent to:

A	369
B	36.9
C	3.69
D	0.369

57. ①The number 3.7×10^{-1} is equivalent to:

A	3.70
B	0.37
C	37.0
D	0.037

58. ①The decimal form for 7.62×10^{2} is:

A	7.62
B	762
C	76.2
D	0.762

59. ①The decimal form for 6.150×10^{-4} is:

A	0.0615000
B	0.0061500
C	0.0006150
D	0.0000615

60. ②Taking significant figures into account, the product P = A × B of two numbers, A = 2.079×10^{2} and B = 0.072×10^{-1}, is correctly written as:

A	1.49688
B	1.497
C	1.5
D	1.50

61. ②For A = 3.69×10^{4}, B = 3.690×10^{2}, and C = 3.6900×10^{-3}, the number with the most significant figures is:

A	A only
B	B only
C	C only
D	they have same number of significant figures

Units & Standards

62. ②A standard is a fixed reference (مرجع) for a:

A	model
B	equation
C	law
D	unit

63. ①The standard of the meter is the distance traveled by light in vacuum in 1/299792458 of a(an):

A	hour
B	second
C	minute
D	day

64. ①The old standard of the second was 1/86400 of an average solar (مسي□):

A	hour
B	minute
C	day
D	year

65. ①The new standard of the second is defined in terms of the frequency of radiation (□عاع) emitted by:

A	electronic devices
B	the sun
C	X-rays
D	cesium atoms

66. ①The standard of the kilogram, kept at the Bureau of weights and Measures in France, is a cylinder of:

A	platinum-iridium
B	gold-silver
C	wood-iron
D	radium-uranium

67. ①The SI unit of mass is the:

A	newton
B	kilogram
C	pound
D	gram

68. ①Which of the following is NOT an SI unit?

A	newton
B	kilogram
C	pound
D	ampere

SI Prefixes & Base Units

69. ①The SI abbreviation for 36 centimeters is:

A	36 centim
B	36 cmeter
C	36 cm
D	36 centimeters

70. ①1 Mm (mega-meter) equals:

A	1000 m
B	1000 km
C	1000000 km
D	100000 m

71. ①1 µg (microgram) equals:

A	0.0000001 g
B	0.0001 g
C	0.000001 g
D	0.00001 g

72. ①Of the following SI units, the only base unit is:

A	newton
B	watt
C	gram
D	ampere

73. ①Of the following SI units, the only derived (مشتق) unit is:

A	volt
B	kilogram
C	kelvin
D	meter

74. ②A time interval of 60.0 µs is equal to:

A	0.0600 s
B	0.00600 s
C	0.000600 s
D	0.0000600 s

75. ②An electric current of 3×10^{-9} A is equal to:

A	3 µA
B	3 MA
C	3 nA
D	3 mA

Unit Conversion

76. ①Converting 215 cm to meters gives:

A	0.0215 m
B	0.215 m
C	21.5 m
D	2.15 m

77. ①A distance of 0.05 km is equal to:

A	5000 cm
B	500 cm
C	50000 cm
D	500000 cm

78. ①A length of 286.6 mm is equal to:

A	28.66 cm
B	286.6 cm
C	2.866 m
D	0.00286 µm

79. ①Convert 84 in. to feet:

A	5 ft
B	6 ft

C	7 ft
D	8 ft

80. ①Convert 15 miles to the nearest kilometers:

A	18 km
B	24 km
C	33 km
D	42 km

81. ①Convert 258 cm^2 to m^2:

A	0.0258 m^2
B	0.258 m^2
C	2.58 m^2
D	25.8 m^2

82. ②Convert 0.65 cm^3 to mm^3:

A	6500 mm^3
B	6.5 mm^3
C	65 mm^3
D	650 mm^3

83. ②A distance of 10 ft is equal to:

A	305 m
B	305 cm
C	30.5 cm
D	30.5 m

84. ①Express 10 in. in centimeters:

A	0.254 cm
B	254 cm
C	25.4 cm
D	2.54 cm

85. ②Convert 2 h 15 min to seconds:

A	8100 s
B	2100 s
C	5900 s
D	3500 s ^{3}

86. ②A school speed-zone (نطاق) is 30 km/h. Three cars A, B, and C are going at speeds v_A = 8 m/s, v_B = 9 m/s, and v_c = 10 m/s. The cars that will receive speeding tickets are:

A	A, B, and C
B	C only
C	B and C
D	none

87. ②The maximum capacity in liters of a 3-m^3 water tank (خزان) is:

A	30 L
B	3000 L
C	300 L
D	3 L

88. ②One light year is:

A	the speed of light in vacuum
B	the time that sunlight takes to reach the Moon
C	the distance light travels in 1 year
D	the time that sunlight takes to reach the Earth

89. ③If there are 3×10^7 seconds in one year, a distance of one light year is equal to:

A	9×10^{15} m
B	9×10^{13} m
C	9×10^{11} m
D	9×10^{9} m

Order of Magnitude; Estimation

90. ②Rounding (تقريب) a number to one digit multiplied by its power-of-ten gives its:

A	precision
B	accuracy
C	uncertainty
D	order of magnitude

91. ②The 14 highest peaks in the world are between 8000 m and 9000 m high. The order-of-magnitude of their height (ارتفاع) is:

A	1×10^4 m
B	0.1×10^4 m
C	2×10^4 m
D	10×10^4 m

92. ②A lake (بحيرة) is roughly (تقريباً) circular, with a 1-km diameter and 10-m average depth (عمق). Its water capacity can be estimated as:

A	1×10^6 m^3
B	1×10^7 m^3
C	1×10^8 m^3
D	1×10^9 m^3

93. ①The thickness (سماكة) of a 200-page book is 1.0 cm. The thickness of one sheet of this book can be estimated as:

A	0.001 mm
B	0.01 mm
C	0.1 mm
D	1 mm

94. ②If an average human lives for 70 years, and if the

heartbeat rate is 80 beats/min, the number of heartbeats in a lifetime can be estimated as:

A	3×10^6
B	3×10^7
C	3×10^8
D	3×10^9

Dimensions

95. ①The dimensions of area are:

A	$L^2\ T$
B	L^2
C	L^3/T^2
D	$L^2\ T^{-1}$

96. ①The dimensions of volume are:

A	L^3
B	L^2
C	L^3/T^2
D	$L^2\ T^{-1}$

97. ②The dimensions of force are:

A	L M T
B	$L\ M\ T^{-2}$
C	$L^3\ M^2/T^2$
D	$L^2\ M\ T^{-1}$

98. ②The dimensions of acceleration are:

A	L T
B	$L\ T^{-2}$
C	L^3/T^2
D	$L^2\ T^{-1}$

99. ②The dimensions of momentum (p = mv) are:

A	L M T
B	$L\ M\ T^{-2}$
C	$L\ M\ T^{-1}$
D	$L^2\ M\ T^{-1}$

100. ②Which of the following is dimensionally correct?

A	speed = acceleration / time
B	distance = speed / time
C	force = mass × acceleration
D	density = mass × volume

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/s²	1 hp = ¾ kW

Key Terms & Definitions

Acceleration	تسارع	Horizontal	أفقي	Resultant	محصّلة
Action	فعل	Inertia	قصور ذاتي	Reaction	ردة فعل
Air resistance	مقاومة هواء	Instantaneous	حظي	Resolution	تحليل
Average	متوسط	Interaction	تفاعل	Speed	سرعة قياسية
Component	عنصر / مُكَوِّن / مُرَكِّب	Kinetic energy	طاقة حركية	Static	سكوني
Direction	اتجاه	Mass	كتلة	Support force	قوة دعم
Displacement	إزاحة	Magnitude	مقدار	Tension	توتر
Distance	مسافة	Mechanical	ميكانيكي	Terminal speed	سرعة حدية
Dynamic	حركي	Motion	حركة	Vector	كمية متجهة
Energy	طاقة	Net force	قوة إجمالية / صافية	Velocity	سرعة متجهة
Equilibrium	اتزان	Normal force	قوة عمودية	Vertical	رأسي أو عمودي
Force	قوة	Potential energy	طاقة وضع	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

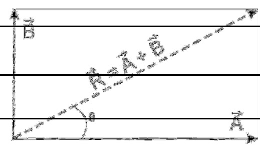
4. Example of a vector is:

A	velocity
B	distance
C	speed
D	time

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

A	always 0°
B	always 180°
C	0° or 180°
D	always 90°

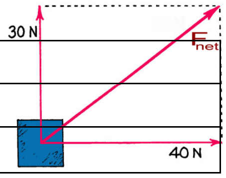
6. Adding two perpendicular vectors ($\vec{A}$) and ($\vec{B}$) gives a resultant ($\vec{R}$) with magnitude:



A	$R = \sqrt{A^2 + B^2}$
B	$R = A^2 + B^2$
C	$R = \sqrt{A + B}$
D	$R = 1 / \sqrt{A^2 + B^2}$

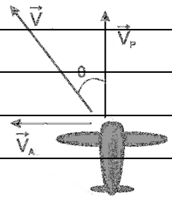
7. Two perpendicular forces, F_1 = 40 N and F_2 = 30 N, act on a brick. The magnitude of the net force (F_{net}) on the brick is:

A	70 N



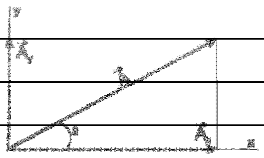
B	50 N
C	0 N
D	10 N

8. If an airplane heading north with speed v_P = 400 km/h faces a westbound wind (ريح 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

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

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

A	0 km/h^2
B	1 km/h^2
C	10 km/h^2
D	100 km/h^2

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

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

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

A	4 m/s
B	5 m/s
C	10 m/s
D	20 m/s

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

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

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

Free Fall

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

A	heavy
B	at terminal speed
C	in free fall
D	light

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

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

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

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

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

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

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

31. 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

32. The SI unit of inertia is the:

A	kilogram
B	newton
C	joule
D	none of these

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

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

35. 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

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

37. A 80-kg painter stands on a 20-kg painting staging (□قالة دها□) 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

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

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); $\vec{F}_2$ = (8 N, 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)

42. Two forces act on an object: $\vec{F}_1$ = (10 N, up); $\vec{F}_2$ = (10 N, down). The net force ($\Sigma\vec{F}$) on it is:

A	(20 N, up)
B	(20 N, down)
C	(10 N, up)
D	zero

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)

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

A	0 N
B	5 N
C	10 N
D	more than 10 N

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

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

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

Newton's 2nd Law

52. An object's acceleration is directly proportional to the:

A	net force
B	average speed
C	mass
D	inertia

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

54. If the net force acting on an object decreases, its acceleration:

A	decreases
B	increases
C	remains constant
D	changes direction

55. The net force on an 50-kg crate is 100 N, its acceleration is:

A	0.5 m/s^2
B	1 m/s^2
C	2 m/s^2
D	5 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

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 are:

A	perpendicular
B	in opposite directions
C	in the same direction
D	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

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	$a_c = 0$

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	$F_c = 0$

64. When a cannon shoots a cannonball, the cannon's recoil (ارتداد) 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

65. 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

67. Work is proportional to:

A	(force) and (1/distance)
B	(force) and (distance)
C	(1/force) and (distance)
D	(force) and $(\text{distance})^2$

68. The SI unit of work is:

A	newton
B	watt
C	joule
D	ampere

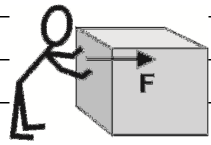
69. A joule is equivalent to:

A	N/m^2
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

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

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

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

74. The SI unit of power is:

A	newton
B	watt
C	joule
D	ampere

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	$kg^2.m^2/s$

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 (قوس مشدود)
C	a compressed spring (زنبرك مضغوط)
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

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

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

84. Three 5-kg rocks are raised to a height of 5 m, with $Rock_1$ raised with a rope, $Rock_2$ raised on a ramp (منحدر), and $Rock_3$ raised with an lift (مصعد). The rock that attains the most potential energy is:

A	$Rock_1$
B	$Rock_2$
C	$Rock_3$
D	all the same

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

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

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

89. If an object's speed doubles, its kinetic energy:

A	remains the same
B	doubles
C	triples
D	quadruples

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

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

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

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

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	$E = \frac{1}{2} mv^2 + 2\ mgh$
B	$E = \frac{1}{2} mv^2 + mgh$
C	$E = mv^2 + \frac{1}{2} mgh$
D	$E = \frac{1}{2} mv^2 + \frac{1}{2} mgh$

95. As an object falls, its potential energy ___________ and its kinetic energy ___________.

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

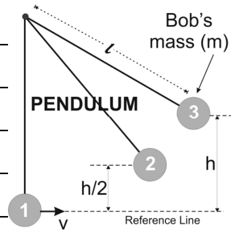
96. The ram of pile-driver (مِدَكّ) falls from a height of 20 m. Its speed just before touching ground is:

A	2 m/s
B	5 m/s
C	10 m/s
D	20 m/s

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



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

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

100. 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 total energy at point (2) of height ½ h is:

A	5 J
B	2 J
C	1 J
D	0 J

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	ش□نة	Gas	غاز	Saturated	مشبع
Compound	مركب	Heat	□رارة	Solid	صلب
Compression	ضغط	Heat transfer	انتقال الـ□رارة	Solidification	تصلب
Condensation	تكثف	Humidity	رطوبة	Specific Heat	الـ□رارة النوعية
Deform	يشوه	Inelastic	غير مرن	Strain	انفعال
Density	كثافة	Liquid	سائل	State	□الة
Dew	ندى	Latent Heat	الـ□رارة الكامنة	Stress	إجهاد
Diffusion	انتشار	Matter	مادة	Substance	صنف
Elastic limit	□د المرونة	Melting	ذوبان	Temperature	درجة الـ□رارة
Elastic range	□يز المرونة	Metal	معدِن؛ فِلِزّ	Tension	توتر
Elasticity	مرونة	Mixture	خليط أو مزيج	Vaporization	تبخر
Element	عنصر	Molecule	جُزيْء	Volume	□جم

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

2. Converting 113 degrees F to Celsius gives:

A	35 degrees C
B	45 degrees C
C	110 degrees C
D	165 degrees C

3. Converting 257 degrees F to Celsius gives:

A	55 degrees C
B	220 degrees C
C	125 degrees C
D	335 degrees C

4. Converting 10 degrees F to Celsius gives:

A	25 degrees C
B	5 degrees C
C	0 degrees C
D	-12 degrees C

5. Converting 20 degrees F to Celsius gives:

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

6. Converting -50 degrees F to Celsius gives:

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

7. Converting -40 degrees F to Celsius gives:

A	-20 degrees C
B	-30 degrees C
C	-40 degrees C

D	-50 degrees C

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

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

9. Converting 15 degrees C to Fahrenheit gives:

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

10. Converting 145 degrees C to Fahrenheit gives:

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

11. Converting 35 degrees C to Fahrenheit gives:

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

12. Converting 95 degrees C to Fahrenheit gives:

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

13. Converting 75 degrees C to Kelvin gives:

A	348 K
B	198 K
C	32 K
D	212 K

14. Converting 25 degrees C to Kelvin gives:

A	248 K
B	298 K
C	47 K
D	237 K

15. Converting -50 degrees C to Kelvin gives:

A	-40 K
B	323 K
C	223 K
D	-273 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

17. Converting 175 degrees K to Celsius gives:

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

18. Converting 6000 degrees K to Celsius gives:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Specific & Latent 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

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

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

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

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

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

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

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

Elasticity; Stress; Hooke's Law

41. When a deforming (مشوِّه) force acts on an elastic object, the object is:

A	never deformed
B	permanently (بشكل دائم) deformed
C	temporarily (وقتياً) deformed
D	broken into pieces

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

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

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

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

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:

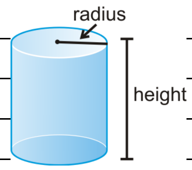
A	5 cm × 10 cm
B	5 cm × 4 cm
C	10 cm × 4 cm
D	same stress on all sides

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

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 kPa
D	23 kPa



Density

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

A	mass, charge (حنة□)

B	mass, spacing
C	spacing (باعد), charge
D	mass, color

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

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

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

Properties of Matter (optional)

54. Two or more atoms that bond together by sharing electrons are called a(n):

A	molecule
B	atom
C	mixture
D	ion

55. Examples of molecules do NOT include:

A	water
B	carbon
C	ammonia
D	methane

56. When two atoms of hydrogen bond with one atom of oxygen, they form a molecules of:

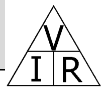
A	carbon dioxide
B	ammonia
C	water
D	methane

57. When atoms of different elements chemically bond together, they form a:

A	noble gas
B	new element
C	mixture
D	compound

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 → $k = 9 \times 10^9 \, N.m^2/C^2$	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	مكثّف	Electric potential	الجهد الكهربائي	Power	قدرة
Charge	ش□نة	Electricity	كهرباء	Resistance	مقاومة
Conductor	موصِّل	Electrostatics	الكهرباء ال□اكنة	Resistivity	مقاومية
Current	تيار	Insulator	عازل	Semiconductor	شبه موصِّل
Direct current	تيار مباشر	Parallel circuit	دائرة متوازية	Series circuit	دائرة متتالية أو م□لة

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}

3. A positively charged object is an object with:

A	extra electrons
B	lack (نقص) of protons
C	extra neutrons
D	lack of electrons

4. A negatively charged object is an object with:

A	extra electrons
B	extra protons
C	extra neutrons
D	lack of (نقص) electrons

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

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

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 = ⅓ C and q_2 = - ⅓ C separated by 1 km is:

A	1000 N
B	100 N
C	10 N
D	1 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

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

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

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

Ohm's Law; Electric Power; Electric Circuits

25. An electric circuit consists of a 24-Ω 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

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

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

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

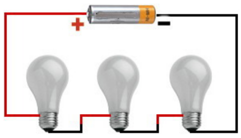
29. A classroom has ten 25-W compact fluorescent lamps (CFL). If these lamps are turned on for 10 hours every day, their energy consumption (استهلاك) in 20 days is:

A	1 kWh
B	5 kWh
C	10 kWh
D	50 kWh

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

A	electric current
B	electric power
C	electric potential
D	electric energy

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



A	4 Ω
B	12 Ω
C	24 Ω
D	36 Ω

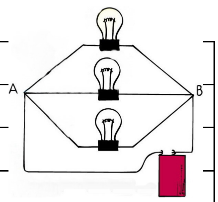
32. Three identical light bulbs, each of resistance 12 Ω, are connected in series to a 12-V battery. The potential difference across each light bulb is:

A	0 V
B	4 V
C	8 V
D	12 V

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	⅓ A
B	⅔ A
C	1 A
D	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	12 Ω
C	24 Ω
D	36 Ω

35. Three identical light bulbs, each of resistance 12 Ω, 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

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	⅓ A
B	⅔ A
C	1 A
D	3 A

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

A	0 A
B	0.5 A
C	1 A
D	2 A

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

A	0 A
B	0.5 A
C	1 A
D	2 A

CHAPTER 5: OPTICS

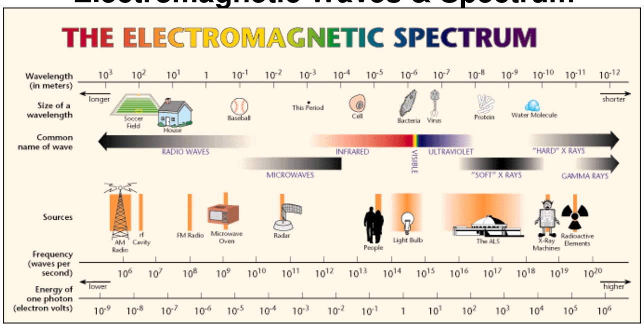
Formulas & Constants

$f = c / \lambda$ or: $c = f \cdot \lambda$ f =frequency; λ =wavelength)	$f = 1 / T$ (frequency = 1/(time of 1 cycle))	$E = hf$ (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

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 (شَوْكة)
B	string (وَتَر)
C	spring (زنبرك)
D	charge

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

6. A wave's wavelength is:

A	the number of waves repeating (تتكرر) every second
B	the time duration for one complete wave
C	its maximum value
D	the length of a single wave

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

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

10. In the electromagnetic spectrum, the highest energy is that of:

A	gamma-ray waves
B	x-ray waves
C	blue light waves
D	ultraviolet waves

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

12. Among the following electromagnetic waves, the longest wavelength is for:

A	infrared waves
B	microwaves
C	visible light waves
D	ultraviolet waves

13. The wavelength of 300-MHz microwave is:

A	1 μm
B	1 mm
C	1 cm
D	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

Reflection

15. Wave reflection means that the wave always:

A	enters from one medium into another
B	remains in the same medium
C	returns along the same line of incidence
D	slides along the border between two media

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

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

18. When a light beam is reflected, it keeps a constant:

A	speed
B	frequency
C	wavelength
D	all of these

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

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

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

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

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)

25. Specular (بصري) reflection occurs when light is incident on a:

A	lens
B	mirror
C	painted wall
D	page of a book

26. After diffuse reflection, light goes in:

A	one direction
B	two opposite directions
C	no direction
D	all directions

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

A	specular reflection
B	absorption
C	diffuse reflection
D	refraction

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

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

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

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

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

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

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

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

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

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

A	speed
B	frequency
C	wavelength
D	all of these

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

39. Mirage (سراب) 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

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

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

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

A	13°
B	9°
C	49°
D	22°

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

A	42°
B	90°
C	49°
D	22°

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°

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^o
B	90^o
C	60^o
D	30^o

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

A	dispersion
B	diffuse reflection
C	internal reflection

D	refraction

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

48. A fish under water appears nearer because of:

A	refraction
B	aberration
C	reflection
D	dispersion

49. Light travels through an optical fiber by:

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

Dispersion; Rainbow

$f \approx$ 4×10^{14} Hz 6×10^{14} Hz 8×10^{14} Hz

$\lambda \approx$ 800 nm 600 nm 400 nm

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

A	right
B	left
C	middle
D	outside

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

A	red
B	blue
C	green
D	violet

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

A	red
B	blue
C	green
D	violet

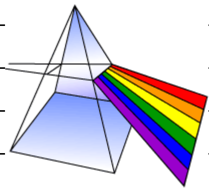
53. The light component that travels the fastest through glass or water is:

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

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

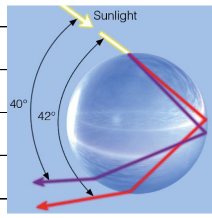
A	dispersion
B	reflection
C	absorption
D	mirage

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

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

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

58. Rainbow is formed in the following sequence (ترتيب):

A	refraction → reflection→ refraction
B	reflection → refraction → reflection
C	refraction → refraction → reflection
D	reflection → reflection→ refraction

Lenses

59. A converging lens usually has two ________ surfaces and is ________ at its center than its edges.

A	convex (محدب); thinner
B	concave (مقعر); thinner
C	concave; thicker
D	convex; thicker

60. A diverging lens usually has two _________ surfaces and is ________ at its center than its edges:

A	convex (محدب); thinner

B	concave (مقعر); thinner
C	concave; thicker
D	convex; thicker

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

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

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

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

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

66. Distortion (تشويه) in the image of a lens is called:

A	conversion
B	aberration
C	dispersion
D	refraction

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

68. An eye defect (خلل) where the cornea (القرنية) is curved unevenly (بعدم اتساق) is called:

A	conversion
B	dispersion
C	astigmatism
D	refraction

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

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

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

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

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

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

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

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

CHAPTER 6: MODERN PHYSICS

Formulas & Constants

$m = \frac{m_0}{\sqrt{1-(v/c)^2}}$ (m, m_0: relativistic & rest masses)	$L = L_0 . \sqrt{1-(v/c)^2}$ (L, L_0: relativistic & rest lengths)	**Correspondence principle**: When quantum physics explains issues that can be successfully explained by classical physics, both explanations must agree.

Key Terms & Definitions

Anode	مصعد؛ آنود	Energy levels	مستويات الطاقة	Radioactivity	نشاط إشعاعي
Beta rays	أشعة بيتا	Environment	البيئة	Radon (86)	غاز الرادون (٨٦)
Cathode	كاثود؛ القطب السالب	Gamma rays	أشعة غاما	Relativity	النظرية النسبية
Correspondence	تناظر	Rad (Radiation Absorption Dose)	جرعة الإشعاع الممتص	Rem (Roentgen Equivalent Man)	مكافئ رونجين للشخص
Cosmic radiation	الأشعة الكونية	Radiation-dose	جرعة إشعاعية	Stable	مستقر
Electron beam	حزمة إلكترونية	Radiation-therapy	المعالجة بالأشعة	X-rays	أشعة أكس

Correspondence Principle

1. The correspondence principle tells us that:

A	Modern physics and classical (تقليدي) physics contradict (يناقض) each other
B	Modern physics and classical physics agree with each other in the common areas
C	Modern physics cannot explain classical physics phenomena (ظواهر)
D	Modern physics and classical physics have no common areas

2. * As an example of the correspondence principle, applying the relativistic equation of mass to an object of rest mass (m_0) moving at a 3000-m/s speed gives relativistic mass (m) equal to:

A	zero
B	m_0
C	$2m_0$
D	∞

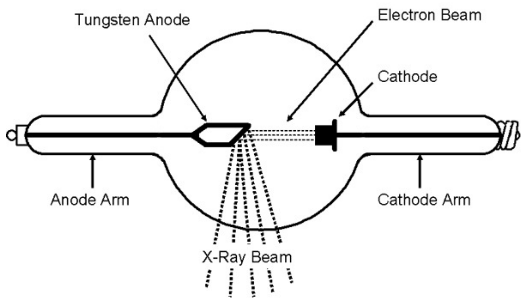
3. * As an example of the correspondence principle, applying the relativistic equation of length to an object of rest length (L_0) moving at a 3000-m/s speed gives relativistic length (L) equal to:

A	zero
B	$2L_0$
C	L_0
D	∞

X-Rays

4. In 1895, Wilhelm Roentgen discovered:

A	x-rays
B	radioactivity
C	the element radium
D	gamma-rays



5. The cathode ray tube consists of two electrodes: a negative _________ and a positive _________ :

A	cathode; anode
B	anode; cathode
C	anode; anode
D	cathode; cathode

6. The cathode ray tube contains:

A	oxygen
B	hydrogen
C	helium
D	vacuum

7. In a cathode ray tube, electrons are emitted (تقذف) from a tungsten filament (سلك دقيق) near the:

A	glass walls
B	anode
C	cathode

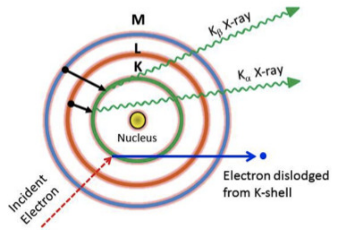
D	vacuum pump (مضخة)

8. In a cathode ray tube, electrons are accelerated between the cathode and anode by a:

A	vacuum pump (مضخة تفريغ)
B	high potential difference
C	mechanical generator (مو□د)
D	magnetic field

9. In a cathode ray tube, the high-speed electrons generate x-rays after bombarding (مصادمة):

A	gas molecules inside the tube
B	a metal target (هدف) near the cathode
C	the heated filament (سلك دقيق) near the cathode
D	a metal target near the anode



10. When a beam of high-speed electrons strikes (يصادم) a metal target (هدف), it dislodges (يقتلع) the __________ of the atoms.

A	inner protons
B	outer protons
C	inner electrons
D	outer electrons

11. Electron current in a fluorescent lamp produces ultraviolet and visible light by exciting the ________ of atoms.

A	inner protons
B	outer protons
C	inner electrons
D	outer electrons

12. When an electron is dislodged (تقتلع) from the lowest energy level of an atom, the atom emits (تُصدِر) x-rays by an:

A	outer electron falling into the lowest energy level
B	inner electron falling out of the lowest energy level
C	inner electron falling into the nucleus
D	outer electron falling into the nucleus

13. Before being absorbed (تُمتص) or scattered (تُشتَّت), x-ray photons can penetrate (تخترق) many layers of:

A	lead
B	bone
C	rock
D	atoms

14. The energy of x-ray photons is:

A	more than gamma-ray photons
B	less than microwave photons
C	more than violet-light photons
D	less than infrared photons

15. X-rays produce an image of the bones inside our body by:

A	scattering (تشتت) from soft tissues and penetrating (ترا□ق) bones
B	penetrating soft tissues and getting absorbed by bones
C	scattering from soft tissues and getting absorbed (امتصا □) by bones
D	penetrating both soft tissues and bones

Radioactivity

16. In 1896, Antoine Bacquerel discovered:

A	x-rays
B	radioactivity
C	the element radium
D	gamma-rays

17. Marie and Pierre Curie discovered:

A	x-rays
B	radioactivity
C	the element radium
D	gamma-rays

18. Radioactivity started:

A	in the 19^{th} Century
B	after 2^{nd} World War
C	after 1^{st} World War
D	before the human race

19. Radioactivity is a(n) _______ phenomenon (ظاهرة):

A	natural
B	new
C	artificial (مصطنع)
D	American

20. More than 99.9% of the atoms in our environment are:

A	unstable
B	stable
C	radioactive

D	negative

21. The nucleus of a stable atom:

A	changes frequently
B	decays in a few years
C	does not change
D	emits radiation

22. All elements with atomic number greater than 82 are:

A	gaseous (غازي)
B	artificial (مصنّع)
C	stable
D	radioactive

23. Radioactive decay results in the following types of radiation:

A	alpha, beta, gamma
B	gamma, beta, x-ray
C	alpha, gamma, x-ray
D	alpha, beta, x-ray

24. Of the radioactive radiations, those affected by a magnetic field are:

A	alpha and gamma, but not beta
B	alpha and beta, but not gamma
C	beta and gamma, but not alpha
D	alpha, beta and gamma

25. Of the radioactive radiations, those with an electric charge are:

A	alpha and gamma, but not beta
B	beta and gamma, but not alpha
C	alpha and beta, but not gamma
D	alpha, beta and gamma

26. Of the radioactive radiations, those that consist of helium nuclei are:

A	alpha and beta
B	only gamma
C	only beta
D	only alpha

27. To absorb (يمتص) and collimate (يوجه) nuclear radiation, we use a block of:

A	lead
B	aluminum
C	glass
D	brick

Environmental Radiation

28. Common rocks and minerals contain trace (قليل جداً) amounts of:

A	potassium
B	uranium
C	helium
D	sodium

29. Common rocks and minerals contain significant (مهم) quantities of:

A	magnetic poles
B	harmful microbes
C	radioactive isotopes
D	sodium

30. The leading source of naturally occurring (حاصل طبيعياً) radiation is:

A	lead-210
B	uranium-238
C	radium-226
D	radon-222

31. Radon is a:

A	heavy inert gas
B	transition metal
C	radiation detector
D	semiconductor

32. Radon arises from deposits (ترسبات) of:

A	sodium
B	uranium
C	calcium
D	potassium

33. You can check radiation level (مستوى الأشعة) with a:

A	thermometer
B	voltmeter
C	radiation detector
D	smoke detector

34. Most of our annual exposure to radiation (التعرض السنوي للأشعة) comes from:

A	food and water
B	medicine and diagnostics (وسائل التشخيص)

C	natural background (خلفية طبيعية)
D	consumer products (منتجات الاستهلاكية)

35. The combustion of coal (حرق فحم حجري) annually releases into our atmosphere (يُصْدِر سنوياً إلى جو) 13 million kg of:

A	electricity
B	heat
C	water vapor
D	radioactive elements

36. The unit "rad" stands for (تمثل):

A	radiation absorbed dose (جرعة الإشعاع ممتصة)
B	roentgen equivalent man (مكافئ رونتجين لشخص)
C	radio frequency monitor (مراقب أشعة راديو)
D	real atomic mass

37. The unit "rem" stands for (تمثل):

A	radiation absorbed dose (جرعة الإشعاع ممتصة)
B	roentgen equivalent man (مكافئ رونتجين لشخص)
C	radio frequency monitor (مراقب أشعة راديو)
D	real atomic mass

38. The unit "rad" equals:

A	0.01 J of scattered energy/ 1 kg of tissue
B	0.01 J of released energy/ 1 g of tissue
C	0.01 J of absorbed energy/ 1 kg of tissue
D	0.01 J of absorbed energy/ 1 g of tissue

39. The unit of radiation dosage based on potential damage is:

A	alpha
B	beta
C	ram
D	rem

40. Of the following, the most harmful radiation to people is:

A	5 rad alpha + 10 rad beta
B	5 rad alpha + 5 rad beta
C	5 rad alpha + 20 rad beta
D	10 rad alpha + 5 rad beta

41. Lethal doses (جرعات قاتلة) of radiation, taken over a short period of time, begin at:

A	500 rem
B	50 rem
C	5 rem
D	0.5 rem

42. Radiation-therapy patients (مرضى العلاج الإشعاعي) may receive more than 200 rems of localized doses (جرعات مركزة) each _____ for several _______.

A	day; years
B	day; weeks
C	hour; days
D	month; year

43. Radiation to which an average person in the world is exposed per day is approximately:

A	1 krem
B	1 rem
C	1 mrem
D	1 μrem

44. A chest x-ray exposes a person to a radiation dose (جرعة إشعاع) approximately equal to:

A	20 krem
B	20 rem
C	20 μrem
D	20 mrem

45. The human body contains an amount of potassium that is approximately equal to:

A	0.2 kg
B	1 kg
C	2 kg
D	zero

46. The human body contains an amount of radioactive potassium-40 (K-40) that is approximately equal to:

A	2 g
B	20 mg
C	200 mg
D	zero

47. Between every two heartbeats (نبضات قلب), potassium-40 (K-40) in an average human's body emits approximately ______ gamma rays.

A	20
B	40 million
C	60 thousand
D	zero

48. When cells in our body are damaged by radiation, they may:

A	die
B	regenerate (يتجدد)
C	become mutated (يتحول)
D	do any of these

49. Radiation is harmful to us because:

A	it increases our heart rate
B	it makes us too hot
C	it damages some of our cells
D	it burns our skin

A	
B	
C	
D	

50. The international symbol of radioactivity is: