SECTION A; Answer all the questions

1. For an object moving with uniform acceleration, the velocity v is given by the equation $v^2 = p + qx$, where p and q are constants and x is a variable.What are the dimensions of the term qx?

A L B LT^{-1} C LT^{-2} D L^2T^{-2}

2. A ball is thrown vertically upwards. The upward direction is considered the positive direction. Assuming that air resistance is negligible, which of the following statements is correct?
A When the ball is at the highest point, its acceleration is zero
B Its velocity is negative during the upward and downward motions.
C Its acceleration is negative during the upward and downward motions.
D Its displacement from the point of projection is negative during the upward and downward motions

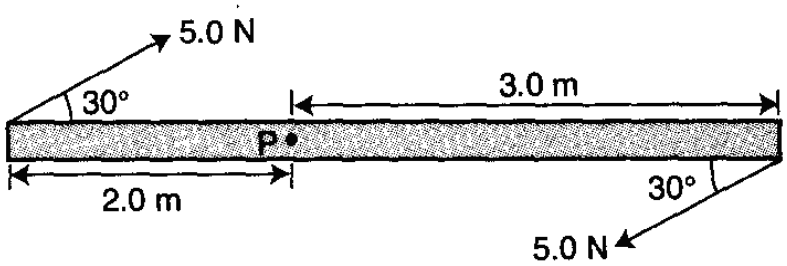
3. A car of mass 1250 kg accelerates from 0 to 100 km h^{-1} in 4.0 s. The average power of the car is
A 121 kW
B 341 kW
C 484 kW
D 681 kW

4. A particle moves with constant speed in a horizontal circle. Which of the following quantities is zero?
A Angular velocity
B Angular acceleration
C Centripetal acceleration
D Resultant force

5. A bicycle wheel of radius 0.2 m can rotate freely about a fixed axis. A constant force of 3 N is applied tangentially to the wheel for 0.4 s. The wheel starts to rotate from rest and its moment of inertia about the axis of rotation is 0.5 kg m^2. What is its angular velocity after 0.4 s?

A 0.12 rad s^{-1}
B 0.48 rad s^{-1}
C 0.20 rad s^{-1}
D 0.60 rad s^{-1}

6. The figure shows a rod pivoted at point P on a smooth horizontal surface.



Two forces, each of magnitude 5.0 N acting in opposite directions, are applied at the two ends of the rod. The resultant torque on the rod is

A 2.5 N m B 12.5 N m C 21.7 N m D 25.0 N m

7. If the gravitational field strength at a certain area is uniform. which of the following statements is true?

A No work is done when a mass is displaced in that area..
B The gravitational field strength is the same at all points in that area..
C The gravitational potential is the same at all points in that area.
D The gradient of the gravitational field strength is of the same magnitude as the gravitational potential.
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8. The graph shows the variation of the acceleration a with displacement x of a particle performing simple harmonic motion.
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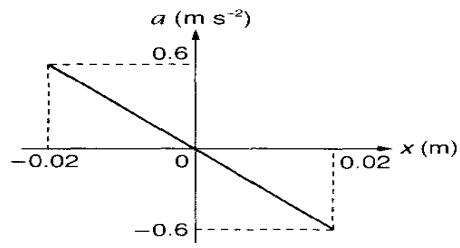

The frequency of oscillation of the simple harmonic motion is

A 0.87 Hz
B 1.15 Hz
C 4.77 Hz
D 34.41 Hz

9. Which of the following statements about critical damping is true?

A No energy is lost from the system
B Only a few oscillations are possible.
C The system takes an infinite time to return to equilibrium.
D The system does not oscillate but returns easily to its equilibrium position.

10.Which of the following physical quantities has the same dimensions as impulse?

A Weight
B Momentum
C Work done
D Kinetic energy

11. A fluid flows through a pipe of diameter d and length *l*. The volume flow rate R is given by $R = \frac{cd^4 \Delta p}{\eta l}$,where c is a dimensionless constant, Δp the pressure difference between the two ends of the pipe and η the viscosity of the fluid. The unit of η in terms of base units is

A kgm
B kg s^{-2}
C kg $m^{-1}s^{-1}$
D kg m^{-3} s^{-1}

12. For an object moving with uniform acceleration, the velocity v is given by the equation $v^2 = p + qx$, where p and q are constants and x is a variable.What are the dimensions of the term qx?

A L
B LT^{-1}
C LT^{-2}
D L^2T^{-2}

13. The velocity-time (v-t) graph for a car is as shown in the graph.

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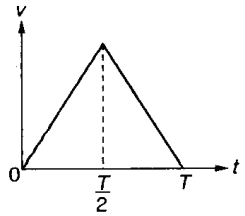
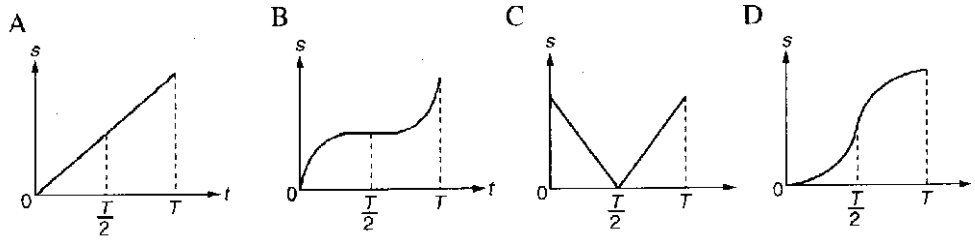


Which of the following is the displacement-time (s-t) graph for the car?



14. Which one of the following is not a valid example of action and reaction to which Newton's Third Law of Motion applies?

A The forces of attraction between an electron and a proton in a hydrogen atom
B The forces of repulsion between two parallel wires carrying currents in opposite directions.
C The forces of attraction between two gas molecules passing near each other
D The weight of a satellite and the centripetal force keeping the satellite in orbit

15. When a force of 8 N acts on an object of mass 4 kg for 2 s, what is the rate of change of momentum of the object?

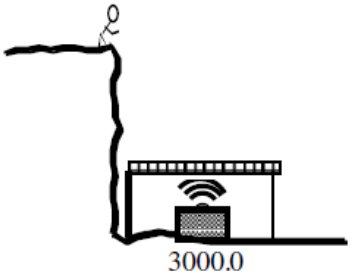
A 2 $kgms^{-2}$ B 4 $kgms^{-2}$ C 8 $kgms^{-2}$ D 16 kg ms^{-2}

16 A transverse periodic wave described by the expression (where *y* and *x* are in meters and *t* is in seconds) is established on a string. Which one of the following statements concerning this wave is false?

$$y = \sin\left[2\pi\left(\frac{x}{2} + \frac{t}{10}\right)\right]$$

A The wave is traveling in the negative *x* direction.
B The amplitude is 1.0 m
C The wavelength of this wave is 2.0 m.
D The wave travels with speed 5.0 m/s.

17 A loudspeaker at the base of a cliff emits a pure tone of frequency 3000.0 Hz. A man jumps from rest from the top of the cliff and safely falls into a net below. How far has the man fallen at the instant he hears the frequency of the tone as 3218.0 Hz? The speed of sound is 343 m/s.



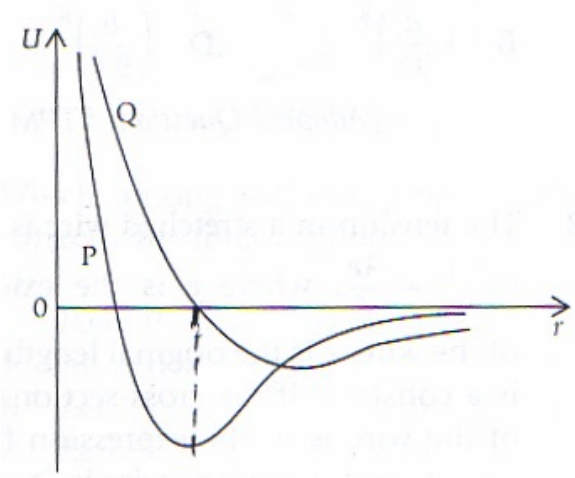
A 12.2 m B 15.3 C 31.7 D 46.8

18

The physical process not observable for sound waves is

A Reflection
B Refraction
C Interference
D Polarization

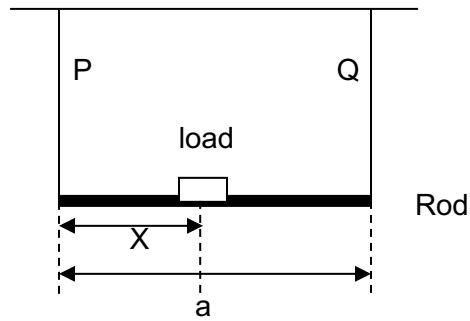
19 The graph shows the potential energy curves of two kinds of solid P and Q.



Which among the following statements is **not** true of P and Q

A Solid P has a higher specific latent heat than that of solid Q
B Solid P has a higher force constant than that of solid Q
C The molecular bond in solid P is stronger than or solid Q
D The molecules of solid P reaches the minimum potential energy at a temperature lower than that of solid Q

20 The diagram below shows a light rod, of length a, hung from the lower ends of the wires P and Q so that both the wires are vertical. P and Q possess the same natural length and the same natural radius but each possess different Young modulus of E_1 and E_2 respectively. A load is placed on the rod at a distance x from wire P so that the rod will remain horizontal



What is the value of x in terms of a, E_1 and E_2

A $\frac{E_1 a}{E_2}$ B $\frac{E_1 a}{E_1 + E_2}$ C $\frac{E_2 a}{E_1 + E_2}$ D $\frac{(E_1 + E_2)a}{E_1}$

21

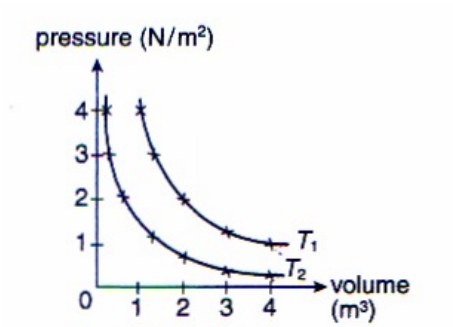


Figure 14.9 shows two isothermals for an ideal gas of fixed mass at temperatures T_1 and T_2. The ratio $\frac{T_1}{T_2}$ is

A $\frac{1}{4}$ B $\frac{1}{2}$ C 1 D 4

22 Which of the following shows correctly the relation between the mean speed $\bar{v}$, the ms speed v_{rms}, and the most probable speed v_o of the molecules of a gas?

A $\bar{v} \rangle v_{rms}$

B $v_{rms} \rangle v_o$

C $v_o \rangle \bar{v}$

D $v_{rms} \langle v_o$

23 According to the kinetic theory of gases, the internal energy of an ideal gas is best defined as

A The average kinetic energy of the molecules of gas.
B The total kinetic energy of the molecules of gas
C The mast probable kinetic energy of the gas molecules
D The total potential energy and the kinetic energy of the molecules of the gas

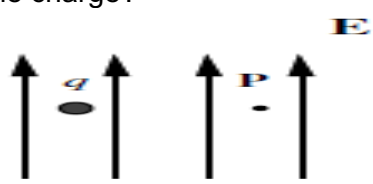
24 An ideal monoatomic gas with an initial volume of V at the initial pressure of p expands adiabatically to a pressure of $\frac{p}{32}$. The new volume of gas is

A 4 V B 8 V C 8 V D 32 V

25 Which one of the following statements provides the most convincing evidence that *visible light* is
a form of electromagnetic radiation?

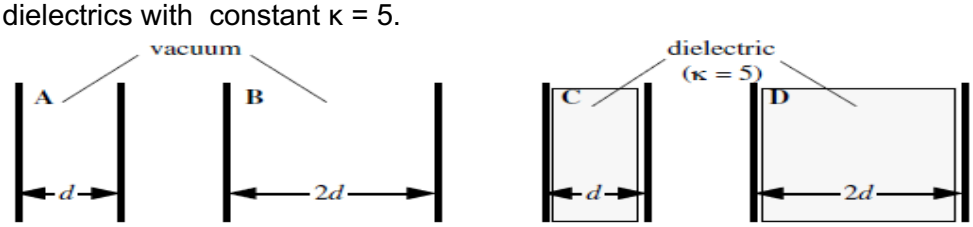
A Two light sources can be coherent.
B Light can be reflected from a surface.
C Light can be diffracted through an aperture.
D Light can form a double-slit interference pattern.

26 A charge q = −4.0 μC is moved 0.25 m horizontally to point **P** in a region where an electric field is 150 V/m and directed vertically as shown. What is the change in the electric potential energy of the charge?



A -2.4×10^{-3}
B -1.5×10^{-4}
C $+1.5 \times 10^{-4}$
D Zero Joules

27 The figure below shows four parallel plate capacitors: **A**, **B**, **C**, and **D**. Each capacitor carries the same charge q and has the same plate area A. As suggested by the figure, the plates of capacitors **A** and **C** are separated by a distance d while those of **B** and **D** are separated by a distance $2d$.
Capacitors **A** and **B** are maintained in vacuum while capacitors **C** and **D** contain dielectrics with constant κ = 5.

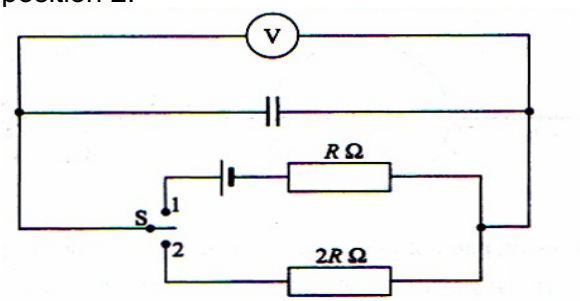


A A B C D
B A B D C
C BADC
D BACD

28 If the work required to move a +0.35 C charge from point **A** to point **B** is +125 J, what is the potential difference between the two points?

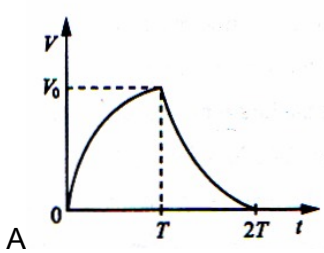
A Zero
B 44 V
C 88 V
D 360 V

29 In the circuit below, switch S is connected to position 1 at time t = 0. At the instant t =T, when the voltmeter reading reaches V_o, the switch S is connected to the position 2.

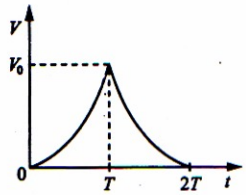


Which of the following graphs shows the variation of the voltmeter reading V with time t?

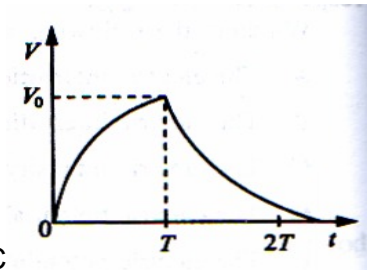
A



A



B



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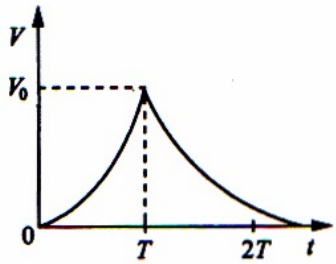


D

30 Which one of the following statements is true concerning the *spacing* of the electric field lines in the
vicinity of two point charges of equal magnitude and opposite sign?

A It indicates the direction of the electric field.
B It does not depend on the magnitude of the charges.
C It is large when the magnitude of the charges is large.
D It indicates the relative magnitude of the electric field.

31 Which one of the following statements concerning the magnetic force on a charged particle in a
magnetic field is true?

A It is zero if the particle moves perpendicular to the field.
B It is a maximum if the particle moves parallel to the field.
C It acts in the direction of motion for a positively charged particle.
D It depends on the component of the particle's velocity that is perpendicular to the field.

32 Two electrons are located in a region of space where the magnetic field is zero. Electron **A** is at
rest; and electron **B** is moving westward with a constant velocity. A non-zero magnetic field
directed eastward is then applied to the region. In what direction, if any, will each electron be
moving after the field is applied?

A	Upward	away from earth westward
B	at rest	westward
C	northward	eastward
D	at rest	eastward

33 A proton is traveling south as it enters a region that contains a magnetic field. The proton is
deflected downward toward the earth. What is the direction of the magnetic field?

A downward B west C north D east

34 A long, straight wire carries a current *I*. If the magnetic field at a distance *d* from the wire has
magnitude *B*, what is the magnitude of the magnetic field at a distance 2*d* from the wire?

A *B*/2 B 2*B* *C* *B/4* *D* *4B*

35 The current in a certain ac circuit is independent of the frequency at a given voltage. Which
combination of elements is most likely to comprise the circuit?
A F/s
B F • s
C Ώ
D W b

36 A battery is used to drive a circuit. After a certain amount of time, the current is zero amperes. When
the same circuit is driven by an ac generator, the current is non-zero and alternates. Which
combination of elements is most likely to comprise the circuit?

A resistors only
B inductors only
C capacitors only
D a combination of inductors and resistors

37 A variable inductor is connected to an ac source. What effect does *increasing* the inductance have on
the reactance and current in this circuit?

	Reactance	Curren t
A	no change	no change
B	decreases	no change
C	decreases	increases
D	increases	decreases

38 When the frequency of an ac circuit is increased at constant voltage, the current increases and then
decreases. Which combination of elements is most likely to comprise this circuit?

A resistors only
B capacitors only
C a combination of inductors and resistors
D a combination of inductors and capacitors

39 Which one of the following types of wave is intrinsically different from the other four?
(a) (c) (e) visible light
(b) (d)

A radio waves
B sound waves
C gamma rays
D ultraviolet radiation

40 What is the correct order, beginning with shortest wavelength and extending to the longest
wavelength, of the following colors in the visible light spectrum: blue, green, red, violet, and
yellow?

A red, yellow, blue, green, violet
B violet, blue, yellow, red, green
C red, yellow, green, blue, violet
D violet, blue, green, yellow, red

41 Which one of the following statements concerning the energy carried by an electromagnetic wave
is true?

A The energy is carried only by the electric field.
B More energy is carried by the electric field than by the magnetic field.
C The energy is carried equally by the electric and magnetic fields.
D More energy is carried by the magnetic field than by the electric field.

42 The most convincing evidence that electromagnetic waves are *transverse* waves is that

A they can be polarized.
B they carry energy through space.
C they can travel through a material substance.
D they do not require a physical medium for propagation.

43 Linearly polarized light is incident of a sheet of polarizing material. The angle between the
transmission axis and the incident electric field is 52°. What percentage of the incident intensity
is transmitted?

A 38 % B 43 % C 52 % D 62 %

44 Which one of the following statements provides the most convincing evidence that *visible light* is a form of electromagnetic radiation?

A Two light sources can be coherent.
B Light can be reflected from a surface.
C Light can be diffracted through an aperture.
D Light can form a double-slit interference pattern.

45 Which one of the following quantities is not necessarily conserved in nuclear reactions?

A electric charge
B number of protons
C linear momentum
D angular momentum

46 The nucleus of a certain isotope of tin contains 68 neutrons and 50 protons. Which symbol
correctly represents this isotope?

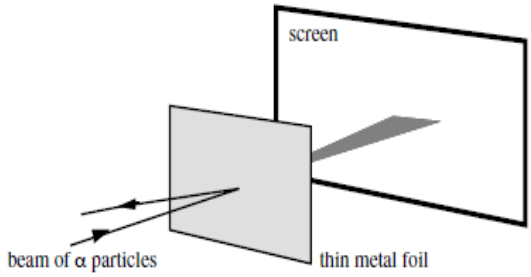
A $^{68}_{50}Sn$

B $^{50}_{68}Sn$

C $^{118}_{50}Sn$

D $^{118}_{68}Sn$

47 Which model of atomic structure was developed to explain the results of the



experiment shown?

A Bohr model
B nuclear atom
C billiard ball atom
D plum-pudding model

48 Which one of the following pairs of characteristics of light is best explained by assuming that
light can be described in terms of photons?

A photoelectric effect and the effect observed in Young's experiment
B diffraction and the formation of atomic spectra
C polarization and the photoelectric effect
D existence of line spectra and the photoelectric effect

49 Determine the wavelength of incident electromagnetic radiation required to cause an electron transition from the n = 6 to the n = 8 level in a hydrogen atom.

A 1.2 x□□10^3 nm
B 2.2x □10^3 nm
C 3.4 x 10^3 nm
D 7.5 x □10^3 nm

50 Which one of the following statements concerning the cutoff wavelength typically exhibited in X-ray spectra is true?

A The cutoff wavelength depends on the target material.
B The cutoff wavelength depends on the potential difference across the X-ray tube.
C The cutoff wavelength is independent of the energy of the incident electrons.
D The cutoff wavelength occurs because of the mutual shielding effects of K-shell electrons

OBJECTIVE ANSWER SCHEME

N0	Answer	No	Answer
1	D	26	D
2	C	27	C
3	A	28	D
4	A	29	C
5	B	30	D
6	B	31	D
7	B	32	B
8	A	33	B
9	D	34	A
10	B	35	C
11	C	36	C
12	D	37	D
13	D	38	D
14	B	39	B
15	D	40	D
16	D	41	C
17	C	42	A
18	D	43	A
19	D	44	D
20	C	45	B
21	D	46	D
22	B	47	B
23	D	48	D
24	C	49	D
25	D	50	B