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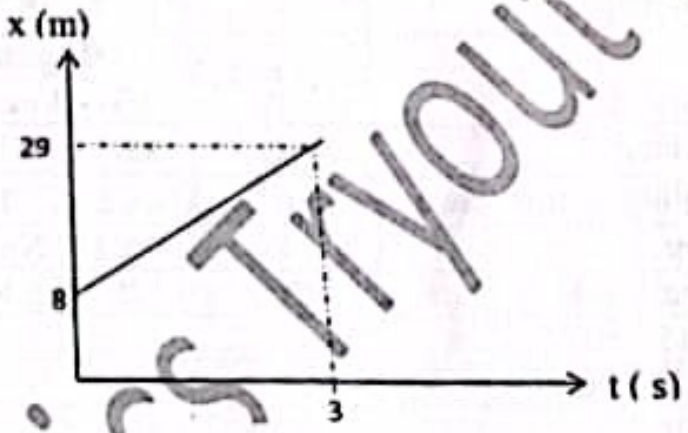
2024

BOOKLET CODE: 024 **SUBJECT CODE: 04**

1. A body acted up on by only two forces of equal magnitude is said to be in equilibrium if the forces act

   A. in opposite direction.
   B. in the same direction.
   C. perpendicular to each other.
   D. vertically upward.

2. A body performs a straight line motion starting from a position x=8m, according to the displacement versus time graph as shown in the figure below.



Which one of the following is correct about the body's motion?

A. The velocity at time t = 5 s is 12 m/s.
B. The velocity at time t = 4 s is 9.0 m/s
C. The velocity at time t = 2 s is 7.0 m/s.
D. A body is uniformly accelerating.

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3. Linear momentum is a

A. measure of how hard to support a motion.
B. measure of how hard to stop a moving object.
C. scalar physical quantity in dynamics.
D. quantity with SI unit similar to that of power.

4. A block of mass 5 kg is pulled for 12 m distance on a horizontal friction surface on a straight line. If the pulling force has a magnitude of 30 N a angle of 60^0 with the horizontal, how much work is done by the force? ($\sin 60^0 = 0.87$, $\cos 60^0 = 0.50$)

A. 1800.0N
B. 360.0N
C. 313.2N
D. 180.0N

5. Which one of the following statements is CORRECT about potential energy?

A. Elastic potential energy varies directly with height.
B. Gravitational potential energy varies directly with compression.
C. Elastic potential energy varies directly with square of compressi
D. Gravitational potential energy varies directly with square of compression.

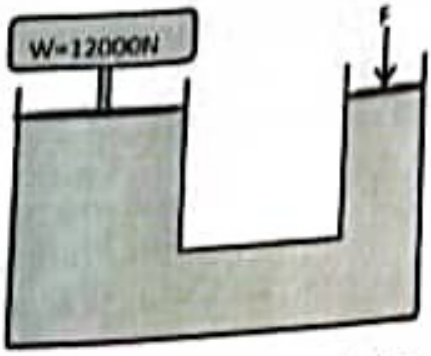
6. A block of mas 12 kg is pulled for 10 m up along a plane inclined at 3 with the horizontal. If the coefficient of friction between the block and inclined plane is 0.2, what is the actual mechanical advantage of this p ($\sin 30^0 = 0.50$, $\cos 30^0 = 0.87$)

A. 2
B. 0.5
C. 1.48
D. 0.89

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7. In a hydraulic lift (shown in the figure below), a force F acts on a small piston of circular cross section having a radius of $r = 6.00$ cm (right side)



Assuming the fluid filling the space below the pistons being incompressible and if the left side has radius of $R = 20$ cm, how much force F is required to lift a load of 12,000 N?

A. 1,080 N
B. 3,600 N
C. 12,000 N
D. 40,000 N

8. Taking the boiling point of water to be 100 °C, how much heat is required to change 20 g of water at 75 °C to steam at 120 °C? (Specific heat capacity of water = 4,200 J/kg K, Specific latent heat of vaporization of water 2,501,000 J/kg, Specific heat capacity of steam = 2,080 J/kg K)

A. 50,436 J
B. 52,952 J
C. 2,516 J
D. 3,780 J

9. The amount of heat energy required to raise the temperature of 1 gram of water by 1°C is

A. one Joule.
B. one Calorie.
C. one kilo – Joule.
D. one kilo – Calorie.

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10. Which one of the following is CORRECT about the speed of sound in gases? Sound travels:

A. slower in denser gas considering two gases at the same temperature.

B. faster in cooler gas considering two gases of the same density.

C. faster in denser gas considering two gases at the same temperature.

D. with equal velocity in all types of gases at the same temperature.

11. If the intensity of sound at a distance of 5 m from the source is measured to be 0.87 W/m^2, what is the power of the sound source?(π=3.14)

A. 136.6 W C. 314.0 W

B. 360.9 W D. 273.2 W

12. A 10 kg cat standing at the center of a circular turntable having moment of inertia 80 kgm^2, radius 2m and rotating freely with angular speed of 5.0 $^{rev}/_{s}$ suddenly starts moving radially outward. What would be the new angular speed of the turntable when the cat just reaches the edge of the table?

A. 3.33 rev/sec C. 8.51 rev/sec

B. 5.67 rev/sec D. 2.57 rev/sec

13. At what separation distance should the two celestial objects of equal mass ($M = 8.0\times10^6$ kg) be located if the they attract each other gravitationally by a force of 66.7 N? ($G = 6.67\times10^{-11} N.m^2/kg^2$)

A. 66.7 m C. 16.0 m

B. 64.0 m D. 8.0m

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14. Which one of the following is correct about the comparision between Coulomb's and gravitational forces?

A. Gravitational force between two protons is much greater than electrostatic force between them

B. Gravitation force is either attractive or repulsive, while electrical force is attractive.

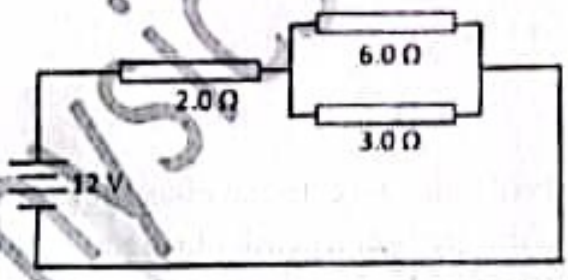
C. Forces in the two laws are inversely proportional to the square of the separation between the interacting particles.

D. Forces in both laws are perpendicular to the line joining the interacting particle.

15. If a 12 μF capacitor stores 30 μC charge, what is the potential difference across the plates of this capacitor?

A. 0.4 V
C. 42.0 V
B. 2.5 V
D. 360.0 V

16. Consider three resistors are connected as shown in the figure below.



What is the current through the 3.0 Ω resistor?

A. 2.0 A
C. 3.0 A
B. 1.0 A
D. 6.0 A

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17. A bulb labeled "220 V, 200 W" is used for 6 hours per day in a school compound. If the price rate of electricity is 0.80 Birr/kWh, what is the total cost of electricity ia a month (30 days)?

A. 72.9 Birr
C. 28.8 Birr
B. 36.4 Birr
D. 19.6 Birr

18. A student designed an experiment to demonstrate the existence of a magnetic field around a straight current carrying wire. Suppose current in the wire flows out of the page of the paper. The student places four compass needles at points P, Q, R and S, which are at equal distances from the wire and lying on a plane perpendicular to the wire as shown in the figure below.



Then the magnetic field at point

A. P is toward the bottom edge of the paper.
B. R is to the right.
C. S is parallel to the current.
D. Q is toward the bottom edge of the paper.

19. The SI unit of magnetic flux is given by:

A. Tesla
C. Tesla meter
B. Tesla . $(meter)^2$
D. Tesla/meter

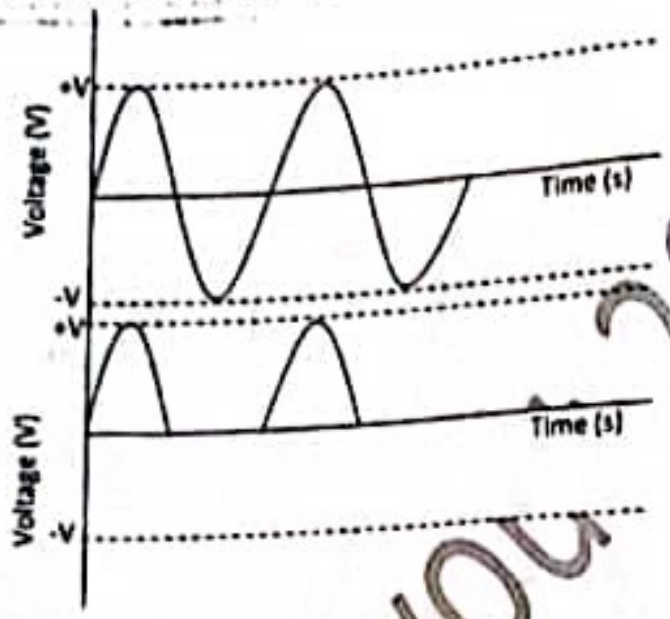
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20. The voltage versus time graph is given for the first two cycles as shown in the figure below for a rectifier circuit implemented with diode.



Which one of the following is correct?

A. The upper graph shows rectified voltage.

B. The average voltage in upper graph is zero.

C. The average voltage in lower graph is zero.

D. The lower graph shows unrectified voltage.

21. Which one of the following is correct about electromagnetic waves?

A. They are produced by stationary charges.

B. Electromagnetic waves are grouped into longitudinal waves.

C. They are produced when electric and magnetic fields oscillate at right angle to each other.

D. They carry momentum but travelling without anyenergy.

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22. The critical angle above which total internal reflection occurs at a medium-air boundary is 53°. The refractive index of the medium is

A. 1.20 C. 1.25

B. 1.67 D. 1.00

23. During scientific experiments, a source of parallax error is

A. the instrument. C. the experimenter.

B. the environment. D. The formula used.

24. Starting from the origin, an ant travelled a displacement of 5 m at an angle of 53° above the x-axis. It then travels 1m along the positive y-axis. What are the components of the ant's displacement along the x and y axis respectively? ($\sin 53^{\circ}=0.80$, $\cos 53^{\circ}=0.60$)

A. 3 m and 4 m C. 4 m and 5 m

B. 3 m and 5 m D. 5 m and 3 m

25. Which of the following pairs of vectors are orthogonal to each other?

A. 8k and -3i+4j-k C. 2i and -i-j+k

B. i+j and –i D. i+j+k and -i-j+ 2k

26. If a ball is projected with velocity v_0 from the ground at an angle θ with the horizontal. What is the expression for the horizontal range of this projectile?

A. $v_0^2 \sin\theta / g$ C. $v_0^2 \sin\theta \cos\theta / g$

B. $v_0^2 \sin 2\theta / g$ D. $v_0^2 \sin 2\theta / 2g$

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27. A body travelling in a straight line changes its speed uniformly from 5 m/s to 25 m/s in 6 seconds. What distance does it travel during this time?

A. 150 m
C. 90 m
B. 120 m
D. 60 m

28. Which one of the following statements is correct about frictional forces?

A. Coefficient of static friction is less than coefficient of kinetic friction
B. Kinetic friction varies but static friction is constant.
C. Kinetic frictional force has a value greater than the limiting static frictional force.
D. The coefficient of static and kinetic frictions are less than one.

29. An object of mass M, initially at rest, explodes and breaks up into three equal fragments. The first and the second fragments flew on x – y plane with velocities $(-8\,\hat{i}, 10\,\hat{j})$ m/s and $(12\,\hat{i}-10\,\hat{j})$ m/s respectively, what is the velocity of the third fragment?

A. $-4\,\hat{i}$ m/s
C. $(20\,\hat{i}+20\,\hat{j})$ m/s
B. $4\,\hat{i}$ m/s
D. $(-20\,\hat{i}+20\,\hat{j})$ m/s

30. An object of mass m is thrown vertically upward into air with an initial velocity v_0. At a point where its potential and kinetic energies are equal

A. maximum height is attained.
B. velocity has decreased to $1/2v_0$.
C. potential energy is negative.
D. it is at a height half of maximum height.

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. For a simple mechanical system where all the forces acting on the system being conservative, identify a correct statement!

A. Potential energy increases with equal value as a decrease in kinetic energy.

B. Decrease in potential energy is greater than increase in kinetic energy.

C. Increase in potential energy is greater than than decrease in kinetic energy.

D. Potential and kinetic energies increase at the same time.

2. A turbine blade is 1.2 m long and is rotating at 1,200 rev/min. What is the linear speed of a point on the turbine blade 0.8 m from the axis of rotation?

A. 16.0 m/s

B. 100.5 m/s

C. 125.6 m/s

D. 150.7 m/s

3. A rotating table is accelerated by a torque of 2,400 Nm starting from rest. If it has an angular acceleration of 0.6 rad/s^2, what is the moment of inertia of the table?

A. 4,000 kg m^2

B. 400 kg m^2

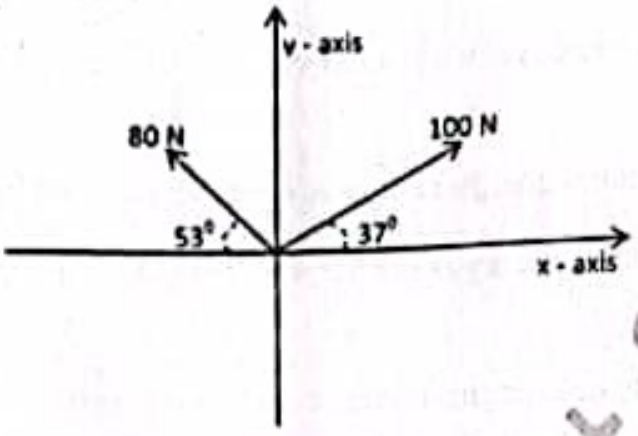
C. 1,440 kg m^2

D. 1,200 kg m^2

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34. Consider a situation where two forces are acting concurrently on a body as shown in the figure below.



What should be the x and y components, respectively, of a third force that must be applied such that the body will be in equilibrium?

A. 32 N, 124 N
B. 128 N, 124 N
C. -32 N, 124 N
D. -32 N, -124 N

35. Extension of elastic objects is directly proportional to

A. the applied force beyond the elastic limit.
B. the applied force below the elastic limit.
C. the applied force beyond the yield point.
D. the length of the object.

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38. If bodies A and B are in thermal equilibrium, and A has the same temperature as another body C, then:

A. bodies B and C can have different temperature.

B. bodies A and C are not in thermal equilibrium.

C. body A can have greater temperature than body B.

D. bodies B and C are in thermal equilibrium.

39. If gas A has four times the density of gas B ($\rho_A = 4\rho_B$), how does the rate of diffusion R_A and R_B, respectively of these gases to the same porous plug compare with each other?

A. $R_B = 4R_A$

B. $R_A = 4R_B$

C. $R_B = 2R_A$

D. $R_A = 2R_B$

40. A block 2.5 kg is suspended from a spring of spring constant 90 N/m. When the mass is pulled downwards by 40 cm and released, what is the magnitude of the velocity just when it passes the equilibrium position?

A. 2.4 m/s

B. 0.4 m/s

C. 6.0 m/s

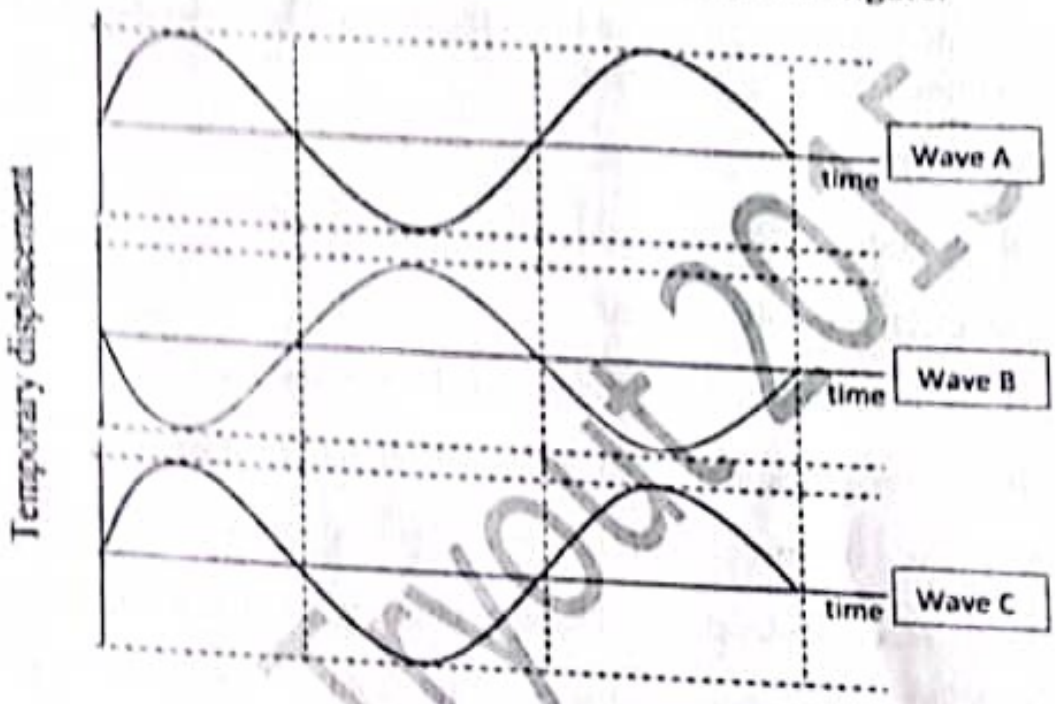
D. 1.5 m/s

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41. If three waves: wave A, wave B and wave C, travel (two at a time) along a stretched horizontal string and interfere. Temporary displacement versus time graph for each point as the wave passes is shown in the figure.



Which one is the correct statement about the waves?

A. Wave A interferes destructively with Wave C.

B. Wave B interferes destructively with Wave C.

C. Wave C interferes constructively with Wave B.

D. Wave A interferes constructively with Wave B.

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42. If light of wavelength λ passes through two slits of separation I unit and produces an interference pattern on a screen at a distance d apart, with consecutive fringes in the interference pattern at distance d apart. What would be the fringe separation if the distance between the slits is tripled without changing other factors?

A. 19 d

B. 3 d

C. 13d

D. 9d

43. An electric dipole moment

A. is defined to be a strength of electrostatic force.

B. has a magnitude that varies with sign of charges.

C. is a quantity inversely varying with charge separation.

D. is a quantity directed from negative to positive charge.

44. The magnitude of the electric potential of an isolated point charge Q at a distance of 45 cm from the charge is measured to be 100 V. What is the magnitude of the charge Q? (π=3.14, Permittivity of vacuum = 8.85×10^{-12} C^2/Nm^2)

A. 5.00×10^{-9} C

B. 2.25×10^{-10} C

C. 5.00×10^{-7} C

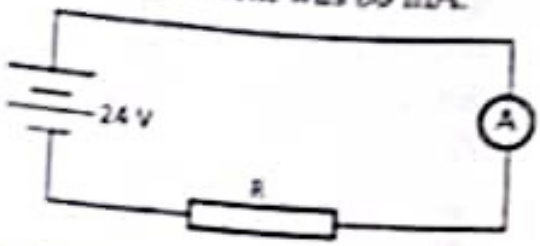
D. 7.10×10-7 C

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45. In the following circuit (Figure 9) having a resistance R, before the ammeter is added to the circuit the current was 80 mA.



If current in the circuit is reduced to 50 mA after adding an ammeter, what is the resistance of the ammeter?

A. 300 Ω

B. 480 Ω

C. 120 Ω

D. 180 Ω

46. Magnetic field of Bc=50 μT is created at the center of a coil of tangent galvanometer at a point on the earth's surface. A compass needle indicates that the earth's magnetic field is at an angle of 30° with the horizontal. What is the horizontal component (Be) of the earth's magnetic field at this point?

A. 43.5 μT

B. 87.0 μT

C. 28.7 μT

D. 100 μT

47. Magnetic flux through a given surface is zero if the magnetic field is:

A. parallel to the surface.

B. perpendicular to the surface.

C. parallel to a line perpendicular to the plane of the surface.

D. at an angle of 45°, with the surface.

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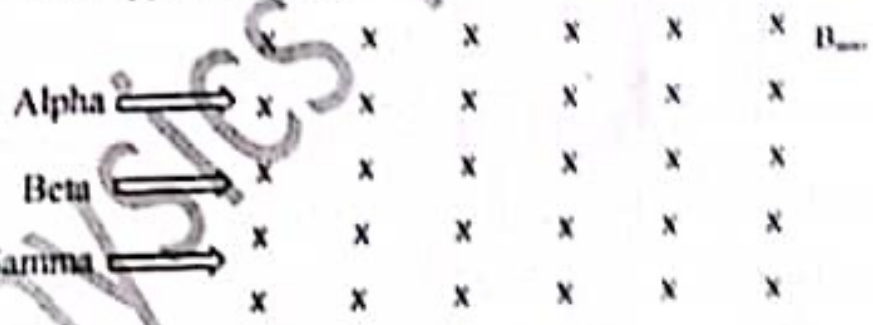
48. A resistor of resistance R=50.0 Ω, an inductor of inductance L = 500 mH and a capacitor of capacitance C = 20 μF are connected in series across an alternating voltage supply of frequency 50 Hz. What is the magnitude tangent of the phase angle between the voltage and current in this circuit?

A. 1.74
B. 0.71
C. 1.00
D. 0.57

49. We use light of a wavelength 3 μm for measuring a position of a subatomic particle having a wavelength of 1.80×10^{-11}m. If a Planck's constant is 6.34×10^{-34}J.s, the uncertainty in position of this particle is greater than or equal to

A. 3.68×10^{-23}m
B. 3.00×10^{-6} m
C. 6.00×10^{-18}m
D. 1.80×10^{-11}m

50. If Alpha, Gamma and Beta radiations enter a region of uniform magnetic field B directed into the page of the paper as shown in the figure below. What will happen to the radiations as they enter into the field?



A. Alpha radiation deflects downwards.
B. Gamma radiation deflects outwards.
C. Beta radiation deflects downwards.
D. Gamma radiation deflects upwards.

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