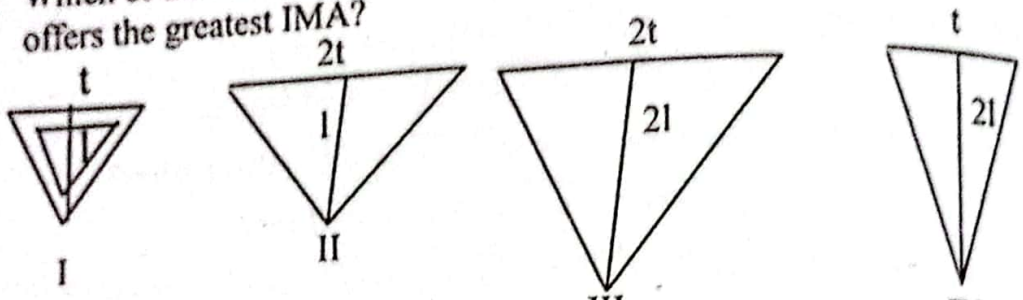
1. Which of the following are contact forces?
   A. Friction, gravity, electrostatics, and kicks
   B. Friction, tension, thrust, and air resistance
   C. Electrostatic, magnetic, weight, and viscous
   D. Gravity, magnetic, electrostatic, and buoyant
2. Which of the following double wedges with different length l and thickness t offers the greatest IMA?

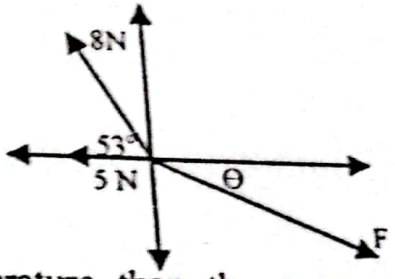


   A. I B. IV C. III D. II
3. Iff the direction of a moving airplane changes and its speed remains constant, which quantity must remain the same?
   A. Displacement B.Vlocity C. Momentum D. Kinetic energy
4. The diagram below shows a pair of gear wheels. The nuber of teeth on gear A is 32 and pn B is 16. Which of the following statements is correct when B is the driving gear?
   A. The load is less than the effort and A rotates slower than B.
   B. The load is less than the effort and A rotates faster than B.
   C. The load is greater than the effort and A rotates slower than B.
   D. The load is greater than the effort and A rotates faster than B.
5. A gas in a cylinder expanded and does 150 J of work in pushing up the piston while 500 J of heat is supplied ti it. What is the change in the internal energy of the gas in the process?
   A. 150 J B. 650 J C. 500 J D. 350 J
6. A 2kg circular magnet is attached to a vertical metallic board by magnetic force F_m = 16 N as shown in the diagram below.The magnet is then observed to slide along the surface at a constant acceleration of 4 m/s^2. What is the coefficient of friction between the magnet and the board? (Use g = 10 m/s^2)
   A. 0.70 B. 2.66 C. 0.75 D. 1.25
7. An object of mass m at rest explodes into two unequal masses $\frac{1}{3}m$ and $\frac{2}{3}m$. If the $\frac{1}{3}m$ mass moves to the right with a speed of 20 m/s, what is the velocity acquired by the $\frac{2}{3}m$ *mass*?

A. 10 m/s to the right
B. 40 m/s to the left
C. 40 m/s to the right
D. 10 m/s to the left

8. In the diagram below, three forces act concurently on an object. If the object is in equilibrium, what must be the magnitudes of components of F ? (Use $\sin 53° = 0.8$ and $\cos 53° = 0.6$)

A. 9.8 N and 6.4 N
B. 5 N and 8 N
C. 5 N and 6.4 N
D. 11.4 N and 6.4 N



9. Cities have higher average evening temperature than the surrounding countryside. This is because concrete (common building material for roads, buildings, etc in cities) has a higher specific heat capacity than soil, This implies that, in the evening
   A. concrete releases the large amount of energy stored in t during the day and cools faster than soil.
   B. soil releases the large amount of energy stored in it during the day and cools slower than concrete.
   C. concrete releases the large amount of energy stored in it during the day and cools slower than soil.
   D. soil absorbs large amount of energy and cools slower than concrete.

10. Why is an ice at 0°C more effective than the same mass of water at 0°C in cooling a drink?
   A. The ice has more average kinetic energy than the water.
   B. The ice absorbs heat from the drink in order to melt to water.
   C. The water transfers heat to the drink in order to freeze to ice.
   D. The water particles on the average move faster than the ice.

11. What initial minimum velocity must a projectile have to reach a target at a distance of 50 km away? (Use $g = 10\ m/s^2$)
   A. 700 m/s B.140m/s C. 70 m/s D.1400m/s

12. The small spheres in the diagram below are connected to a mass less axle with mass less rods. A force of 6 N is exerted to the farthest sphere and the system rotates about the vertical axis. What is the maximum angular acceleration of the system?
   A. 0.003 rad/s^2 B. 400 rad/s^2 C.200rad/s^2 D. 0.12rad/s^2

13. Two equal forces were exerted on identical heavy disks and resultd in different final angular velocities of the disks. Which one of the following quantity can be used as a possible explanation for the observed difference?
   A. Torque of the forces
   B. Rotational inertia of the disks
   C. Mass of the disks
   D. Magnitude of the forces

14. If a point on a spinning wheel changes its angular speed by a factor of 3 and its angular acceleration by a factor of 9, the magnitude of the total acceleration changes by a factor of

A. $\frac{1}{9}$ B. 9 C. 3 D. $\frac{1}{3}$

15. The escape speed at the surface of a certain planet is twice that of Earth. If the planet has radius twice that of Earth, what is its mass in units of Earth's mass?

A. 8 B. 4 C. 2 D. 0.5

16. In an electric circuit at home, a student wanted to use a fuse to safeguard her radio set that has a 5 V transformer supply. If the fuse operates at a maximum of 6 W, how should it be connected?

A. In series with the radio next to the transformer
B. In series with the radio before the mains input
C. In parallel with the radio next to the transformer
D. In arallel with the radio before the mains

17. The diagra shows a cicuit with four lamps. If the switch S is opened, the current through lamp L

A. increases to 5.8 A and brightness of the lamp increases.
B. becomes 3 A and brightnessof the lamp increases.
C. becomes 2.6 A and brightness of the lamp decreases.
D. decreases to 4.3 A and brightnessof the lamp increases.

18. A simple circuit consisted of a resistor of 10 Ω connected to a battery of emf 18 V. If the current through the circuit is 1.6 A, what is the internal resistance of the battery?

A. 10.0 Ω B. 8.75 Ω C. 1.25 Ω D. 11.2 Ω

19. Which of the following is true about semiconductors?

A. Number of charge carriers in semiconductors decreases with temperature.
B. At a certain temperature semiconductors have both positive and negative charge carriers.
C. Coduction in semiconductors is due to free electrons.
D. Semiconductors have positive charge carriers.

20. The diagram below shows an input of alternating current to a "black box" and the resulting output current. The "black box" most likely is

A. transitor
B. capacitor
C . brdge rectifier with capacitor filter
D. diode with capacitor filter

21. The figure below shows Silcon pnp transistor circuit. The depletion voltage is 0.6 V and the base resistance is 280 kΩ. What is the value of the base current I_B?

A. 3.4×10^{-5} A
B. $3,2 \times 10^{-2}$ A
C. 3.0×10^{-5}
D. 3.0×10^{-3} A

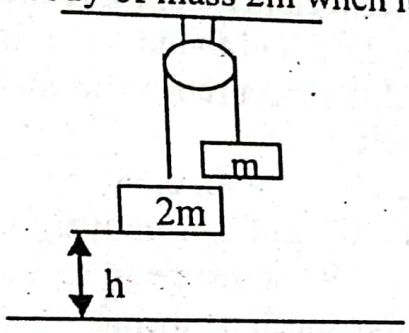
22. An automobile driver spotted a track 50 m ahead of him moving at a speed of 10 m/s. At that instant, the speed of the automobile was 20 m/s. How far should he drive before he overtakes the track?
A. 100 m B. 50 m C. 5 m D. 150 m

23. The velocity-time graph of an object moving along a straight line is shown below. Which of the following statements is a correct sequence about the motion from t = 0 to t = 4 s?
A. Accelerate, stop, accelerate, reverse direction of motion, decelerate, stop
B. Decelerate, stop, reverse direction of motion, accelerate, decelerate, stop
C. Decelerate, stop, accelerate, reverse direction of motion.Decelerate, stop
D. Accelerate, decelerate, accelerate, reverse directon of motion, stop

24. A body with an initial speed of 1 m/s accelerates uniformly along a straight line a 2 m/s^2. What distance does it cover in the thirdsecond?
A. 4 m B. 12 m C. 8 m D. 6 m

25. Which of the following energy/ies change/s by work of friction, when a block slides across a rough horizontal table top?
A. Kinetic and internal energies C. Kinetic energy only
B. Kinetic and potential energies D. Internal energy only

26. The system shown in the diagram below is released from rest. What is the kinetic energy of the body of mass 2m when it reaches the floor?
A. mgh
B. $\frac{2}{3}mgh$
C. $\frac{1}{3}mgh$
D. 2mgh



27. Ethiopian Electric Power Corporation calculates the first 50 kWh consumption at the minimum rate. In this quantity the unit kWh refers to
A. power B. current C. charge D. energy

28. One piston in a hydraulic lift has an area that is twice the area of the other. When the pressure at the smaller piston is increased by ΔP the pressure at the larger piston increases by
A. ΔP B. $\frac{\Delta P}{2}$ C. 2ΔP D. 4ΔP

29. An air pressure of 101 kPa supports a 76 cm of mercury in a barometer column. What would be the height of the column of another liquid of density 10 g/cm^3 were used? ($\rho_{mercury}$=13.6 g/cm^3)
A. 55.88 cm B. 103.36cm C. 79.6 cm D.76.0cm

30. An object hangs from a spring balance. The balance indicates 30 N in air and 20 N when the object is totally submerged in water with density 1000 kg/m^3. What is the volume of the object? (Use g = 10 m/s^2)
A. 10^3 m^3 B. 10^{-1} m^3 C. $10^{-6}m^3$ D.$10^{-3}m^3$

31. The diagram below shows displacement-time graph of a wave generated by a certain source. The time intrval between the crests P and Q is one second. What is the frequency of the source?

A. 0.25 HZ B. 5.0 HZ C. 4.0 HZ D. 0.20 HZ

32. What happens on a duck floating on the surface of water, as a pulse of water wave passes past the duck?

A. It remains at rest at the same initial point.

B. It moves back and forth about the initial point in the direction of the wave motion.

C. It moves together with the wave pulse in the direction of the wave motion.

D. It moves up and down about the initial point in the transverse direction.

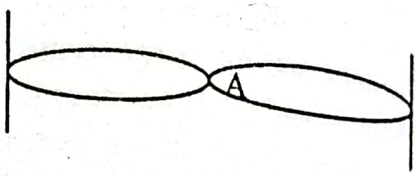
33. The diagram below shows a standing wave on a string fixed at two ends. Which phenomenon occurs at point A?

A. Refraction

B. Diffraction

C. Destructive interference

D. Constructive interference



34. A girl measured the time between her claps and the echoes in a relatively warmer day of temperature 25°C and found that it is 0.68 s. What would be the time interval if she did the masurement in a cold day of temperature 15°C? (V_{sound}= 331 m/s at 0°C)

A. 0.346 s B. 0.692 s C. 0.580 s D. 0.480 s

35. A positively charged glass rod and a negatively charged rubber rod are placed far from each other. What happens to the dry pieces of paper brought nearby the rods before touching them?

A. Repelled by glass and attracted by rubber

B. Attracted by glass and repelled by rubber

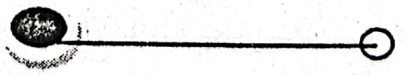
C. Attracted by both glass and rubber

D. Repelled by both glass and rubber

36. Two particles, with charges q_1 and q_2, are on the x-axis, with q1 at x=a and q_2 at x=-2a. For the net force on a third charged particle, at x=0, to be zero, q_1 and q_2 must be related by

A. $q_2 = 2q_1$ B. $q_2 = -4q_1$ C. $q_2 = -2q_1$ D. $q_2 = 4q_1$

37. In the figure below Q is a negative source charge and q is a positive test charge.



If q is replaced by a charge of the same magnitude but negative, the potential at this position due to Q

A. remains the same. B. increases C. decreases. D. changes its sign

38. A 2 μF and a 1μF capacitors are connected in parallel and a potential difference is applied across the combination. The 2 μF capacitor has

A. half the charge of the 1 μF capacitor.
B. twice the potential difference of the 1 μF capacitor.
C. half the stored energy of the 1 μF capacitor.
D. twice the stored energy of the 1 μF capacitor.

39. All of the following are application of microwaves EXCEPT
A. transmission of television signal
B. FM radio broadcasting
C. wireless telephone transmission
D. SONAR communication of submarines

40. If a person is diagnosed to have short sightedness, which of the solutions are appropraite to correct the defect?
A. A converging lens t refocus the nearby object at a short distance.
B. A diverging lens to refocus the distant object at a closer distance.
C. A diverging lens to refocus the nearby object at a large distance.
D. A converging lens to refocus the distant object at a closer distance.

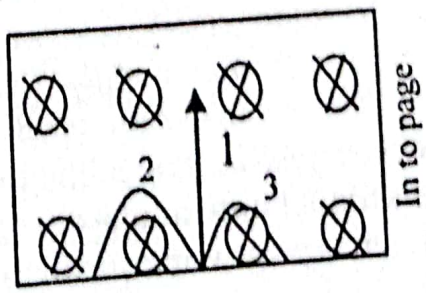
41. A pin stands erect 10 cm from a onverging mirror of focal length 20 cm. How far apart are the pin and its image?
A. 7 cm B. 30 cm C. 20 cm D. 10 cm

42. Your teacher tells you to check an unknown sample with a bar magnet. If the sample is attracted by both poles of the bar magnet, it must be
A. a magnet
B. an insulator
C. a magnetic matrial
D. a nonmagnetic material

43. A long solenoid has 1000 turns uniformly distributed over a length of 0.40 m. What current is required in the windings to produce a magnetic field of magnitude $\pi x10^{-4}$T at the center of the solenoid? ($\mu_o=4\pi x10^{-7}$Tm/A)
A. 0.01 A B. 10 A C. 1.0 A D. 0.1 A

44. Which one of the following statements is **NOT** true about magnetic lines force?
A. They have the same pattern for current-carrying wire and solenoid.
B. They point away from a north pole and back into a south pole.
C. However large they are, they close up on themselves.
D. They are close to each other in a strong magnetic field region.

45. Three types of particles with unkown charges enter into a region of uniform magnetic field perpendicular to their velocities as shown in the figure below. The charges of the particles travelling along the paths 1, 2, and 3, are respectively
A. negative, neutral, and positive.
B. neutral, negative, and positive.
C. neutral, positive, and negative.
D. positive, neutral, and negative.



CERTIFICATE PHYSICS EXAMINATION ANSWER
GINBOT 2005/MAY 2012

BOOKLET CODE 70

1. *Solution:* Friction, tension. Thrust and air resistance are all examples of contact forces because they involve body contact. *Answer: B*

2. *Solution:* In choice D the effort distance to load distance is the greatest and it yeilds the greatest IMA. *Answer; D*

3. *Solution:* The hysical quantity that remains unchanged is the kinetic energy because it is a scalar quantity. *Answer; D*

4. *Solution:* The gear system multiplies speed. so the load is less than the effort and A rotates slower than B *Answer; B*

5. *Solution:* Given $\Delta W = -150$ J, $\Delta Q = 500$ J required; ΔU=?
$\Delta U = \Delta Q + \Delta W = 500\text{ J} + (-150\text{ J}) = 350\text{ J}$ *Answer; D*

6. *Solution:* The size of the frictin force equals the magnetic force.
$Ff = Fm = 16$ N and the normal force has a magnitude of
$N = mg = 20$ N
The coefficient of friction is then
$\mu = Ff/N = 16\text{ N}/20\text{ N} = 0.75$

7. *Solution:* Applying the conservation of momentum principle to the problem gives *Answer; C*
Ptot bef = P tot aft
$0 = m_1v_1 + m_2v_2$
$0 = m/3(20\text{ m/s}) + 2m/3(v2)$
$v_2 = -10$ m/s
The negative sign tells us that it is moving to the left.

8. *Solution:* Let $F_1 = 8$ N, and $F_2 = 5$ N *Answer; D*
$F_{1x} = F_1 \cos 53° = 8\text{N} \times 0.6 = 4.8$ N, $F_{1y} = F1 \sin 53° = 8\text{N} \times 0.8 = 6.4\text{N}$
$F_{2x} = F_2 = 5$ N and $F_{2y} = 0$
The x-component of $F = F_x = F_{1x} + F_{2x} = 4.8\text{N} + 5\text{ N} = 9.8$ N
The y-component of $F = F_y = F_{1y} = 6.4$ N

9. *Solution:* The concrete with high specific heat capacity takes longer time tobecome hot and cools quickly when it releases its stored heat. *Answer; A*

10. *Solution:* Because the the same mass of water at 0°C has more heat content than the same mass of ice at 0°C. *Answer; A*

11. *Solution:* *Answer; B*

12. *Solution:* *Answer; A*

13. *Solution:* The possible reason for this to occur is that the difference in torque these forces produce. *Answer; C*

14. *Solution:* The total acceleration of the spinning wheel is *Answer; A*

$a_1 = \sqrt{a^2_{c1} + a^2_{t1}}$

But $a_{c2} = r(3\dot{\omega})^2 = 9(a_{c1})$, and $a_{t2} = r(9\alpha) = 9a_{t2}$

$$a = \sqrt{a^2_c 2 + a^2_t 2} = \sqrt{(9a_{c1})^2 + (9a_{t1})^2} = 9\sqrt{a^2_{c1} + a^2_{t1}} = 9a_1$$

15. *Solution:* Given $v_p = 2v_e = \sqrt{\frac{GM_P}{R_P}}, v_e = \sqrt{\frac{GM_E}{R_e}}$ *Answer, B*

$$\frac{v_p}{v_e} = \sqrt{\frac{M_P R_e}{M_e R_P}} = 2 \Rightarrow 4 = \frac{M_P}{2M_e} \Rightarrow M_P = 8M_e$$ *Answer, A*

16. *Solution:* To protect the radio from damage the fuse must be connected in series before the mains input. *Answer, B*

17. The diagra shows a cicuit with four lamps. If the switch S is opened, the current through lamp L
    A. increases to 5.8 A and brightness of the lamp increases.
    B. becomes 3 A and brightnessof the lamp increases.
    C. becomes 2.6 A and brightness of the lamp decreases.
    D. decreases to 4.3 A and brightnessof the lamp increases.
    Solution: *Answer, C*

18. *Solution:* **The internal resistance of the source is calculated from**

$$r = \frac{\varepsilon}{I} - R = \frac{18V}{1.6A} - 10\Omega = 11.25\Omega - 10\Omega = 1.25\Omega$$

Answer, C

19. *Solution:* At a certain temperature semiconductors have both positive and negative charge carriers. *Answer, B*

20. *Solution:* For the purose of rectifying voltage we use a diode with a capacitor filter. *Answer, D*

21. *Solution:* *Answer, C*

22. *Solution:* Let the distance traveled by the automobile ans the truck be S_1 anS_2 respectively.
    $S_1 - S_2 = 50\ m = (V_1 - V_2)\ t = (2m\ m/s - 10\ m/s)\ t$
    $50\ m = (10\ m/s)\ t$
    Solving for t gives t = 5 s
    Therefore the distance traveled by the automobile becomes
    $S_1 = V_1 \times t = 20\ m/s \times 5\ s = 100\ m$ *Answer, A*

23. *Solution:* Based on the v-t graph choice A best describes the motion of the object. *Answer, A*

24. *Solution:* The distance covered during the third second is obtained from *Answer, D*
    $S(3^{rd}\ s) = u + \frac{1}{2}\ a(2n - 1) = 1m + 1(5m) = 6\ m$

25. *Solution:* The work of friction for a sliding block is changed to KE and internal energy. *Answer; A*

26. *Solution:* The acceleration of the system In the figure is calculated as follows *Answer; A*

$2mg - T = 2m(a)\ldots 1$

$T - mg = ma\ldots.2.$

Solving (1) and (2) simultaneously gives

$mg = 3\ ma$ and $a = g/3$

The speed of the mass $m1 = 2m$ when it reaches the floor is

$v_2 = 2(g/3)h$. therefore, the kimetic energy of the mass becomes

$EK1 = \frac{1}{2}(2m)(2gh/3) = 2/3(mgh)$

27. *Solution:* The unit Kwh is used to estimate the cost of electrical energy consumed by an appliance. *Answer; B*

28. *Solution:* According to Pascal's principle any change in the pressure of a confined fluid is transmitted equally to all parts of the fluid. *Answer; D*

29. *Solution:* The height of column of liquid supported by 101 kPa is calculated as follows. *Answer; A*

$$P = \rho gh \Rightarrow h = \frac{P}{\rho g} = \frac{101000Pa}{10000kg/m^3 x 9.8m/s^2} = 103.36cm$$

30. *Solution:* According to Archimedes principle the apparent loss of weight supplies the buoyant force. Thus, *Answer; B*

$Wloss = 30\ N - 20\ N = 10\ N = \rho g V_{ld}$

$$V_{ld} = \frac{10N}{1000kg/m^3 x 10m/s^2} = 10^{-3}m^3$$ *Answer; D*

31. *Solution:* *Answer; C*

32. *Solution:* As the wave passes the floating duck the motion of the duck is up and down retaining its equilibrium position. *Answer; D*

33. *Solution:* At point A motion of particles of the string is zero and destructive interference results. *Answer; C*

34. *Solution:* The speed of sound at 25°C is

$V_1 = 331\ m/s + 0.6\ m/s(25) = 346\ m/s$

The distance between the source of sound and the reflecting surface is

$$S = \frac{v_1 t}{2} = \frac{346m/s \times 0.68s}{2} = 173 \times 0.68m$$

The speed of sound in air at a temperature of 15°C is
$V_2 = 331$ m/s + 0.6 m/s(15)= 340 m/s
The time interval taken by sound in cold air is

$$t = \frac{2S}{v} = \frac{346 \times 0.68s}{340} = 0.692s$$

Answer, B

35. *Solution:* piece of sheets of paper are attracted by the rubber rod and repelled by glass rod.

Answer, A

36. *Solution:*

Answer, D

37. *Solution:* the electric potential at a distance r from a point charge Q is given by V=KQ/r and the sign of the charge placed at a distance has no effect on the electric potential.

Answer, A

38. *Solution:* When the 2μF and 1μF capacitors are connected in parallel the voltage maintained is the same for both but, the charge stored in the 2 μF capacitor twice as much as across the 1μF capacitor.

Answer, D

39. *Solution:*

Answer, D

40. *Solution:*

Answer, C

41. *Solution:*

Answer, B

42. *Solution:* If a substance is attracted by a bar magnet then, the substance is a magnetic substance.

Answer, C

43. *Solution:* The magnetic field strength of a solenoid is given by

$$B = \frac{\mu_o NI}{l} \Rightarrow I = \frac{Bl}{\mu_o N} = \frac{\pi \times 10^{-4} T \times 0.4m}{4\pi \times 10^{-7} Tm/A \times 10^3} = 0.1A$$

Answer, B

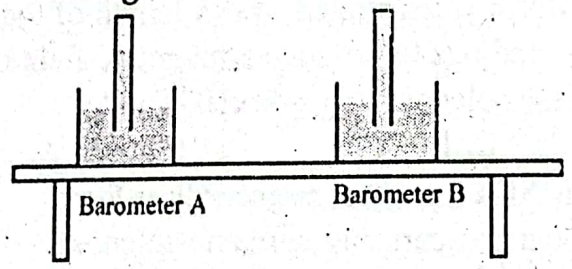
44. *Solution:*

Answer, B

45. *Solution:*

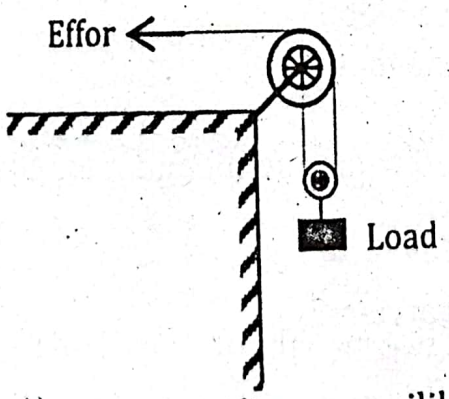
Answer, C

1. What is the measure of the distribution of the mass of a body in relation to its axis of rotation?
   A. Torque
   B. Angular momentum
   C. Moment of inertia
   D. Angular displacement
2. A rock and a ball are initially at the same height from the ground. The rock is dropped at the same instant the ball is thrown horizontally. If air resistance is ignored.
   A. the rock and the ball strike the ground at equal speeds.
   B. the rock and the ball strike the ground simultaneously.
   C. the ball strikes the ground earlier than the rock.
   D. the rock strikes the ground earlier than the ball.
3. Which one of the following systems can absorb some amount of heat without any change in its temperature?
   A. Ice at 0^0C B. Water 10^0C C. Water ^0C D. Ice at -10^0C.
4. What is the ratio of the coefficient of linear expansion to coefficient of volume expansion?
   A. 1:2 B. 1:4 C. 1:3 D. 1:6
5. The Height of the liquid in the inverted tube of barometer A is less than the height of the liquid in the inverted tube of barometer B as shown in the figure below.



   If the liquids are at the same temperature, what does this height difference indicate?
   A. The density of the liquid in barometer A is less than the one in barometer B.
   B. The density of the liquid in barometer A is greater than the one in barometer B.
   C. The atmospheric pressure on barometer A is greater than that on barometer B.
   D. The diameter of the inverted tube in barometer A is greater than the one in barometer B.
6. Which one of the following statement is true about the change in gravitational potential energy?
   A. It is positive because mass and gravity are positive.
   B. It depends on the height where the body is.
   C. It depends only on the initial and final height.
   D. It depends on path of motion of the body.

7. Which one of the following is a vector quantity?
   A. Distance between two places.
   B. Instantaneous acceleration.
   C. The work done by the constant force.
   D. The magnitude of the acceleration due to gravity.
8. Which one of the following is true about Kepler's laws of planetary motion?
   A. The line that joins the sun to the orbiting planet sweeps out different area in equal times.
   B. The path of each planet about the sun is an ellipse with the sun at one focus.
   C. The square of the time it takes the planet to go round the sun is proportional to its average distance from the sun.
   D. The period of revolution of the planet around the sun is proportional to its average distance from the sun.
9. If the period of a transverse wave is 0.1s and its wavelength is 40cm, which one of the following interpretations is correct?
   A. The distance between two successive crests is 20 cm.
   B. In one second the wave travels a distance of 40 cm.
   C. In one second 20 crests pass a given point.
   D. In 0.1 s the wave travels a distance of 40cm.
10. A block of lead has a greater density than a block of iron, and both are denser than water. Compared to buoyant force on a block of iron, the buoyant force on a block of lead is
   A. the same if they have equal masses.
   B. greater if they have equal masses.
   C. the same if they have equal volumes.
   D. greater if they have equal volumes.
11. The figure below represents a pulley system.



If the pulley masses & frictional losses are ignored, the machine is
   A. neither speed nor force multiplier
   B. both speed and force multiplier
   C. force multiplier
   D. speed multiplier

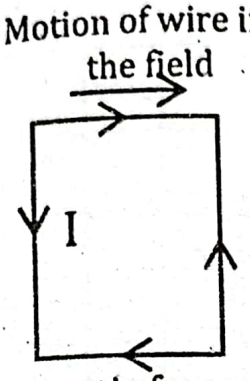
12. A system is in linear equilibrium if and only if the sum of all
   A. forces acting on the system is zero.
   B. forces acting on the Y-axis is zero.
   C. torques acting on the system is zero.
   D. forces acting on the X-axis is zero.

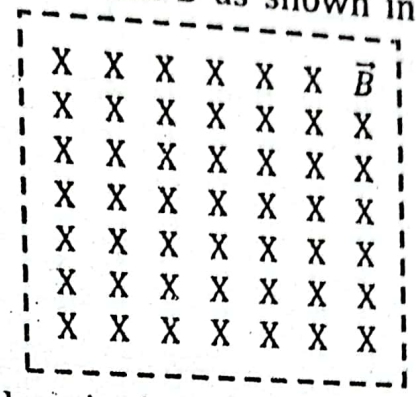
13. A package is dropped from an airplane flying parallel to the ground with constant velocity. How would two observers, one in the airplane and the other standing on the ground, describe the motion of the package?
    A. To the observer on the ground the package moves vertically down.
    B. To the observer on the airplane the package moves vertically down.
    C. To the observer on the airplane the package moves horizontally with airplane.
    D. To the observer on the airplane the package moves along a curved path.
14. When a wave travels through a medium, the particles of the medium
    A. move in the same direction as the wave.
    B. move in opposite direction to the wave.
    C. move to the center of the medium.
    D. oscillate about their equilibrium positions.
15. Which of the following statement is true about a lightening protection provided to building?
    A. An overhead grid of wire conductors extended to the ground.
    B. A system of lightning rods and conductors extended to the building.
    C. An overhead grid of insulators extended to the ground.
    D. A system of lightning rods connected to a building's steel frame.
16. The terminal potential difference of a battery is the maximum when
    A. the e.m.f of the battery is the minimum.
    B. the battery is being discharged through a wire.
    C. there is a steady current flowing through the battery.
    D. there is no current flowing through the battery.
17. A metal bar magnet has a magnetic field in the region of space around it. The magnetic field is due to
    A. an electric current that runs along the length of the magnet.
    B. the motion of charged particles in the metal.
    C. magnetic monopoles embedded in the metal.
    D. a hidden voltage source in the metal.
18. The objective of adding impurity atoms to a pure semiconductor crystal is
    A. to make the crystal impure.
    B. to increase the number of minority carriers.
    C. to decrease the resistance of the crystal.
    D. to decrease the number of majority carriers.
19. The emission of conduction electrons from the hot metal in a diode valve is known as
    A. vacuum emission
    B. thermionic emission
    C. electron emission
    D. charge emission

20. A voltmeter should be connected in parallel across a resistor in a circuit because
A. its resistance is very small.
B. it requires high current.
C. its resistance is very high.
D. it measures current.

21. What is the unit for magnetic flux density?
A. T/m^2
B. T/m
C. T.m
D. T

22. A rectangular current carrying wire moves to the right with its plane perpendicular to a uniform magnetic field B as shown in the figure below.

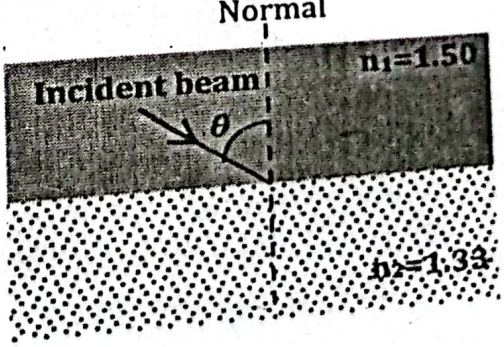




The net magnetic force acting on the wire is to the right,
A. when the right side of the wire is within the magnetic field but not the left side.
B. when the rectangular wire is completely within the magnetic field.
C. when the rectangular wire is completely outside the magnetic field.
D. when the left side of the wire is within the magnetic field but not the right side.

23. Which one of the following is true about absolute potential and potential difference?
A. Bothe quantities have arbitrary value that can be set equal to zero convenience.
B. Potential difference is a location dependent quantity.
C. Absolute potential is energy while potential difference is the work done per unit time.
D. Both quantities are measured in the same unit even if they are different.

24. A beam of light travelling through a medium of refractive index 1.50 encounters a boundary leading to another medium of refractive index 1.33 as shown in the figure below.

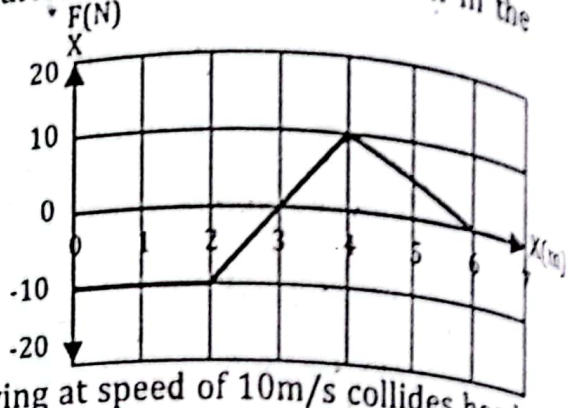


The critical angle in this case is 62.7^0. Which one of the following values of θ would result in a refracted ray in the second medium?
A. 62.7^0
B. 40^0
C. 80^0
D. 90^0

25. The angular velocity of a fly wheel is 8 rad/s. What will be the angular displacement of the fly wheel in πs?
A. 4 rev B. 8 rad C. 8 π rev D. 4 rad

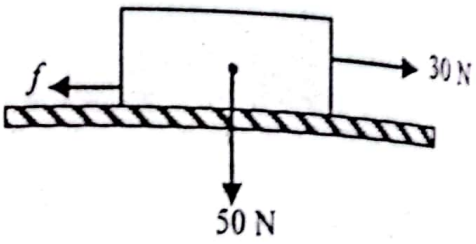
26. A sound wave traveling through a solid material has a frequency of 600 Hz. The wave length of the sound is 3m. What is the speed of sound in the material?
A. 1,800 m/s B. 600 m/s C. 331.5 m/s D. 200 m/s

27. The force acting on a particle varies with position as shown in the figure below.
What is the work done as the particle moves from x=0 to x=6m?
A. 10J
B. 40J
C. -10J
D. -15J



28. Car A, with mass 2×10^3 kg moving at speed of 10m/s collides head-on and sticks with Car B of mass 3×10^3 kg initially at rest. How much kinetic energy is lost during the collision?
A. $4 \times 10^3 J$ B. $6 \times 10^3 J$ C. $1 \times 10^5 J$ D. $6 \times 10^4 J$

29. A 30 N force is applied to a 50 N block that is at rest on a horizontal surface as shown in the diagram below.
The coefficient of kinetic friction between the block and the horizontal surface is 0.5 while that of static friction is 0.7. What friction force is blocking the body from sliding due to the force of 30 N exerted on it?



A. 25 N kinetic friction C. 30N static friction
B. 30N kinetic friction D. 35N static friction.

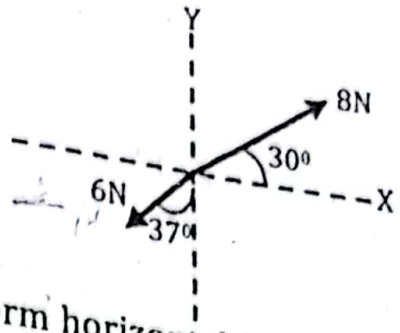
30. In the laboratory to determine the force constant a spring a student obtained the following data.

Applied force in N	0	2	4
Stretch in m	0	0.015	0.028

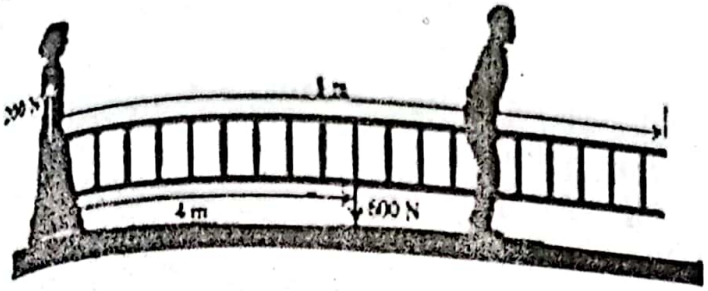
What is the average value of the spring constant K?
A. 92.0 N/m B. 133.3N/m C. 142.8 N/m D. 138.0 N/m

31. Consider the two vectors of magnitude 6N and 8N as shown in the figure below.
By considering the components of each vector, what is the magnitude of the Y- component of the resultant of these two vectors in Newton's?

A. $8 \sin 30^0 - 6\cos 37^0$
B. $8\sin 30^0 - 6\sin 37^0$
C. $8 \cos 30^0 - 6\sin 37^0$
D. $8 \cos 30^0 - 6\cos 37^0$



32. Chaltu and Abebe are carrying a uniform horizontal ladder that is 8m long and weights 600N as shown in the figure belolw.

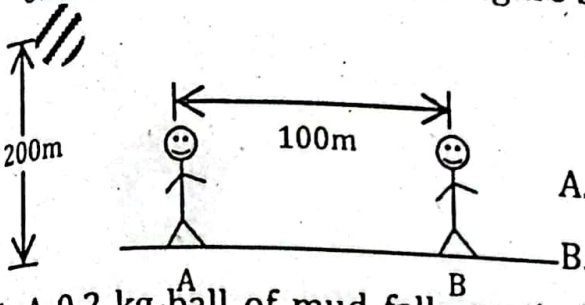


If Chaltu applies an upward force equal to 200N at one end point of the ladder, how far is Abebe from Chaltu?

A. 2m B. 7m C. 6m D. 8m

33. A physics student shot a ball straight upward from a spring cannon. The ball's maximum height was found to be 80 cm. What was the ball's initial velocity as it left the muzzle of the cannon? (use $g=10m/s^2$)
A. 8m/s B. 4m/s C. 16m/s D. 32m/s

34. A bomb explodes 200m above the ground. Observer A is directly under the point of explosion while observer B is 100 m away from observer A as shown in the figure below.



What is the ratio of the second intensities heard by observers A and B?

A. $\frac{I_A}{I_B} = 1.25$ C. $\frac{I_A}{I_B} = 2$
B. $\frac{I_A}{I_B} = 5$ D. $\frac{I_A}{I_B} = 0.5$

35. A 0.2 kg ball of mud falls vertically onto a 2.8 kg cart that is rolling freely at 3 m/s on a horizontal surface. What is the final speed of the cart?
A. 2.8 m/s B. 5.6 m/s C. 0.4 m/s D. 3 m/s

36. If a lens produces a real image that is four times as large as the object and is located 24cm from the lens, what is the focal length of the lens?
A. 4 cm B. 6 cm C. 4.8 cm D. 8cm

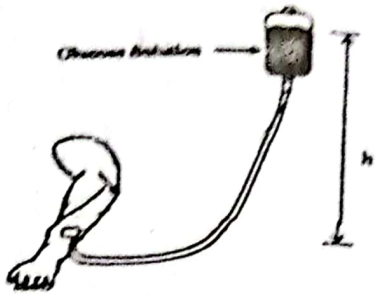
37. Glucose solution of density $1025kg/m^3$ is given to a patient from collapsible plastic bag as shown in the figure below.
If the average gauge pressure in artery is 12300 Pa, what must be the minimum height h of the bag in order to infuse glucose into the artery? (Use $g=10m/s^2$)

A. 1.6m

B. 11.05m

C. 8.6m

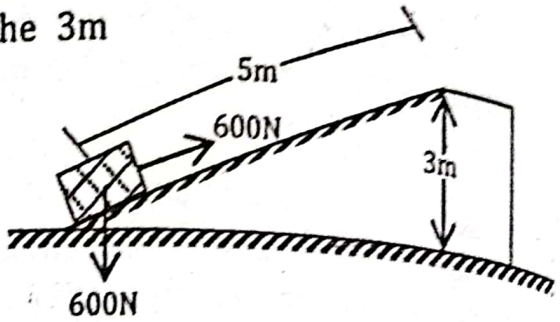
D. 1.2m



38. A transformer on a pole near to a factory steps the voltage down from 3600 V to 220V. What is the current in the primary coil when the transformer delivers 900kW to the factory?

A. 4.1 A B. 250 A C. 0.25 A D. 220 A

39. Due to the presence of friction, the effort needed to slide a 600N load along the inclined plane is 600 N as shown in the diagram below. What is the efficiency of the inclined plane in lifting the load to the 3m height?



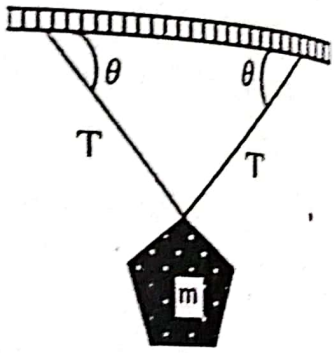
A. 50%

B. 60%

C. 75%

D. 100%

40. A concrete block of mass m hangs from two wires. The wires make the same angle with the horizontal and the tension in them is the same as shown in the figure below.
If the system is in equilibrium, what will be the tension in each wire?



A. $T = \frac{mg}{\cos\theta}$ C. $T = \frac{mg}{2\cos\theta}$

B. $T = \frac{mg}{\sin\theta}$ D. $T = \frac{mg}{2\sin\theta}$

41. A point charge Q_1 is at x=0 and Q_2 is at x=8cm. What is the relationship between these charges if the resultant electric field strength is zero at x=16 cm?

A. $Q_1=2Q_2$ B. $Q_1=-0.25Q_2$ C. $Q_2=0.25Q_1$ D. $Q_1=-4Q_2$

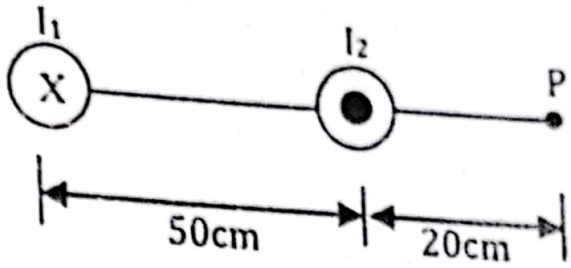
42. A stove that draws 10 A current from 220V line is used for 5 hours. If the electrical company demands 20 cents per kilowatt-hour, what is the cost of the electrical energy consumed?

A. 2 Birr and 20 cents C. 1 Birr

B. 1 Birr and 10 cents D. 55 cents

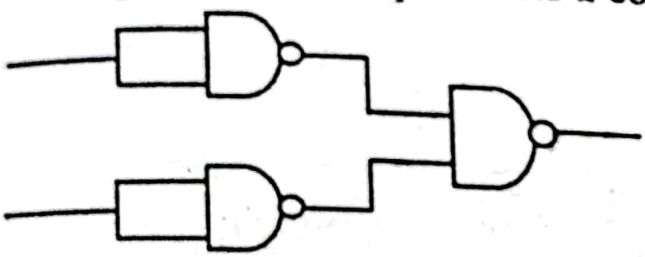
43. Two long, parallel conductors that are 50 cm apart carry currents $I_1=7A$ and $I_2=10A$ in opposite directions as shown in the figure below.

What is the resultant magnetic field at point P? (Permeability constant $\mu = 4\pi \times 10^{-7}\, T\frac{m}{A}$)



A. $1.2 \times 10^{-5}\, T, down$
B. $1.2 \times 10^{-5}\, T, up$
C. $8 \times 10^{-6}\, T, down$
D. $8 \times 10^{-6}\, T, up$

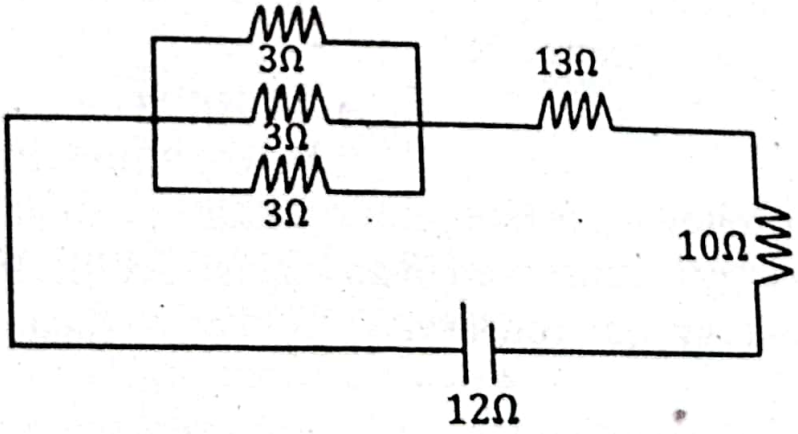
44. The diagram below represents a combination of logic gates.



Which one of the following gates is equivalent to the above combination?

A. AND
B. OR
C. NOR
D. NOT

45. A 12 V battery is connected to a resistors network as shown in the figure below.



What is the potential drop across the 10 Ω resistor?

A. 5V
B. 1V
C. 10V
D. 12V

1. *Solution:-* In rotational motion the rotational inertia of a body is measured by moment of inertia. Moment of inertia also measures the distribution of the mass of the body in relation to the axis of rotation.
   - Moment of inertia is also the counter part of mass in translational motion.

   Answer:- C

2. *Solution:-* The rock falls freely while the ball is thrown horizontally from the same height at the same instant implies that they reach the ground at the same time but they fall at different points.

   Answer:- B

3. *Solution:-* When ice at 0^0C is heated it absorbs heat and changes to water at 0^0C without any rise in the temperature of ice. In general during change of state there is no rise or fall in temperature even if heat is added or liberated from a body.

   Answer:- B

4. *Solution:-* The coefficient of volume expansion of a solid is three times that of the coefficient of linear expansion. Thus, $\sigma = 3\alpha \ or \ \alpha : \sigma = 1:3$

   Answer:- C

5. *Solution:-* *Given* $h_A < h_B$ and the pressure acting on the surface layer of the mercury kept in the bowls is the same which is the external atmospheric pressure.
   $P_A = P_B$ means
   $\rho_A g h_A = \rho_B g h_B \Rightarrow \rho_A h_A = \rho_B h_B$
   $\frac{\rho_A}{\rho_B} = \frac{h_B}{h_A} > 1$ which means $\rho_A \, h_A = \rho_B \, h_B$

   Note:- The density of the liquid in barometer A is greater than the one in barometer B.

6. *Solution:-* The change in the gravitational potential energy of a body depends only on the initial and final height! Thus
   $\Delta E_P = mgh_2 - mgh_1 > 0 \ if \ h_2 > h_1$ Otherwise it is negative.

   Answer:- B

   Answer:-C

7. *Solution:-* Among the given alternatives the instantaneous acceleration is a vector quantity.

   Answer:- B

8. *Solution:-* Johannes Kepler stated his three laws of planetary motion as follows.

   1st law:- All planets and their satellites revolve around the sun in an elliptical orbit with the sun at one focus.

2nd law:- The line that joins the sun and the planet sweeps out equal area in equal time.



$A_1 = A_2$ and $t_1 = t_2$

3rd law:- The square of the period of revolution of any planet is proportional to the cube of the mean distance between the center of planet and the sun.

$T^2 \alpha a^3$

9. *Solution:-* *Given* T=0.1sec, $\lambda = 40cm$ *Answer.B*

The wave length of a wave is the distance between any two consecutive crest points or troughs.

From the period and wave length given two crest points pass a point in 0.1 second and in 1 second 20 crest points will pass a point. *Answer.-C*

10. *Solution:-* *Given* $\rho_L > \rho_I > \rho_{water}$

Both solids sink in water when they are submerged in water.

The buoyant force on each solids is given by

$F_{bL} = \rho_L g V_{ld(leod)}$, $F_{biron} = \rho_{ir}\, g V_{iron\ dis}$

$$\frac{F_{b\ iron}}{F_{b\ lead}} = \frac{\rho_{ir} V_{iron\ dis}}{\rho_{lead}\, V_{lead}}$$

$If\ M_{lead} = M_{iron}$, $then\ F_{b\ iron} = F_{b\ lead}$

$If\ V_{lead} = V_{iron}$, $then\ F_{b\ iron} < F_{b\ lead}$ *Answer.-A*

11. *Solution:-* From the pulley system shown in the figure the effort needed to move the load is half the size of the load. Thus,

$$E = \frac{L}{2} \quad and\ MA = 2$$

Therefore, the pulley system multiplies force. *Answer.-C*

12. *Solution:-* A body under the action of a number of forces is said to be in translational or linear equilibrium if the vector sum of all the forces acting on it is zero. *Answer.-A*

13. *Solution:-* For a package dropped from an airplane that moves horizontally at a constant speed for an observer on the airplane the package moves vertically down and for an observer on the ground the motion of the packages is horizontal. *Answer.-B*

14. *Solution:-* When a wave travels through a medium, the particles of the medium oscillate about their equilibrium position as the wave passes them because in a wave motion there is no actual displacement of particles of the medium. *Answer.-D*

15. *Solution:-* The main aim of a lightning protector provided to a building is to ground the current for this purpose a system of lightning rods and conductors must be extended to the building.

Answer:- B

16. *Solution:-* The terminal potential difference of a battery has a maximum value (equal to the emf battery) for a short circuit or when there is no current flowing through the battery.

Answer:- D

17. *Solution:-* A bar magnet has a magnetic field in the region of space around the magnet due to magnetic monopoles embedded in the metal.

Answer:- C

18. *Solution:-* The main objective of adding impurity atoms to a pure semi conductor crystal is to make the crystal impure or to make it extrinsic semiconductor.

Answer :- A

19. *Solution:-* the emission of conduction electrons from the surface of a hot metal (cathode) in a diode is known as thermionic emission.

Answer:- B

20. *Solution:-* A voltmeter should be connected in parallel across a resistor in an electric circuit because its resistance is very high.

Answer:- C

21. *Solution:-* The unit of magnetic flux density is Wb/m^3 or T/m.

Answer:- B

22. *Solution:-* The net magnetic force acting on the wire is to the right when the left side of the wire is within the magnetic field but not the right side according to the right hand rule.

Answer:- D

23. *Solution:-* The absolute potential is defined as the amount of work done in moving a test charge from infinity to a point per unit charge.

- The potential difference is the amount of work done per unit charge in moving the charge from one point to another point in a region of an electric field. Even if both quantities are measured in the same unit they are different.

Answer:- D

24. *Solution:-* A ray of light incident from a denser medium with $n_1=1.50$ gets refracted and enters a second medium with $n_2=1.33$ if the angle of incidence is less than the critical angle of the medium. Thus, $\theta < 62.7$.

Answer:- B

25. *Solution:-* *Given* W=8rad/s, t=πsec

Required:- θ =?

To calculate the angular displacement we use

$$\theta = wt = 8\frac{rad}{s} \times s = 8\pi rad$$

$$\theta = \frac{8\pi rad}{2\pi rad\ /rev} = 4rev$$

26. *Solution:-* Given:- $f = 600Hz,\ \lambda = 3m$ Answer:- J

Required:- V=?

The speed of the sound is calculated from

$$V = \lambda f = 3m \times 600Hz = 1{,}800\frac{m}{s}$$

27. *Solution:-* The amount of work done as the particle moves from $x = 0\ to\ x = 6m$ is the area under force against distance graph. Thus, Answer:- J

$$W_1 = A_1 = \frac{1}{2}(b_1 + b_2)h, taking\ b_1 = 2m, b_2 = 3m. h$$

$$= -10N$$

$$W_1 = \frac{1}{2}(2m + 3m)(-10N) = -25Nm = -25J$$

$$W_2 = A_2 = \frac{1}{2}b_2h_2\ \ Taking\ b_2 = 3m\ and\ h_2 = 10N$$

$$W_2 = \frac{1}{2}(3m)(10N) = 15Nm = 15J$$

The total work done in moving the particle is

$$W = W_1 + W_2 = -25J + 15J = -10J$$

28. *Solution:-* $M_A = 2 \times 10^3 kg,\ U_A = 10\frac{m}{s}, M_B = 3 \times 10^3 kg,\ U_B = 0$ Answer:- C for inelastic collision the speed of the cars after impact is $M_AU_A + M_BU_B = (M_A + M_B)V.$

$$V = \frac{M_AU_A}{M_A + U_B} = \frac{2 \times 10^3 kg}{5 \times 10^3 kg} \times 10\frac{m}{s} = 4\frac{m}{s}$$

The Kinetic energy of the system before collision is

$$E_{k\ bef} = \frac{1}{2}M_A{U_A}^2 = \frac{1}{2}(2 \times 10^3 kg)(10\frac{m}{s})^2 = 10^5\ Joules$$

The Kinetic energy of the system after collision is

$$E_{k\ after} = \frac{1}{2}(M_A + M_B) = V^2$$

$$= \frac{1}{2}(5 \times 10^3 kg)\left(4\frac{m}{s}\right)^2 = 4 \times 10^4\ Joules$$

The amount of KE lost during collision is

$$E_{k\ lost} = E_{k\ bef} - E_{k\ after}$$

$$= 100{,}000J - 40{,}000J = 60{,}000 = 6 \times 10^4\ J$$

29. *Solution:-* The size of the static friction force that is needed in blocking the body from sliding is calculated from. Answer:- D

$f_{static} = \mu_{static} \times N = \mu_{st} \times mg$
$= 0.7 \times 50N = 35N$ static friction

30. *Solution:-* The average value of the spring constant K is obtained as follows. *Answer:- D*

$$K_1 = \frac{F_1}{\Delta x_1} = \frac{2N}{15 \times 10^{-3}m} = \frac{2{,}000N}{15m} = 133.3\frac{N}{m}$$

$$K_2 = \frac{F_2}{\Delta x_2} = \frac{2N}{13 \times 10^{-3}m} = \frac{2{,}000N}{13m} = 143.57\frac{N}{m}$$

The average value of K is given by

$$K = \frac{K_1 + K_2}{2} = \frac{133.3\frac{N}{m} + 143.57\frac{N}{m}}{2}$$

$$K = 142.8\ N/m$$

31. *Solution:-* The component of the forces along the y-axis are obtained as follows. *Answer:- C*

Let $F_1 = 6N$ *and* $F_2 = 8N$

$F_{1y} = F_1 cos37^0 = -6N(0.8) = -4.8N$

$F_{2y} = F_2 sin30^0 = 8N(0.5) = 4N$

$$\sum F_y = F_{1y} + F_{2y} = -6Ncos37^0 + 8Nsin30^0$$
$$= (8sin30^0 - 6cos37^0)$$

32. *Solution:-* Applying 1st condition of equilibrium to the problem gives *Answer:- A*

$F_C + F_A = 600N$

$200N + F_A = 600N \Longrightarrow F = 400N$

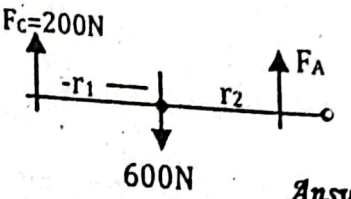
Applying the second condition of equilibrium gives

$\sum T_{clock} = \sum T_{antl}$

$F_C \times r_1 = F_A \times r_2$

$200N \times 4m = 400N(r_2)$

$r_2 = 2m$



33. *Solution:-* The potential energy possessed by the ball at the highest point equals to its kinetic energy as the ball left the spring cannon. *Answer:- A*

$E_{K\ ball} = E_{P\ max}$, $h_{max} = 80cm$

$$\frac{1}{2}mV^2 = mgh_{max}$$

$$V^2 = 2gh_{max} = 2 \times 10 \times 0.8m = 16\frac{m^2}{s^2}$$

$$V = \sqrt{16\frac{m}{s^2}} = 4\frac{m}{s}$$

Answer:- B

34. *Solution:-* The intensity of sound observed by observer A and observer B are obtained as follows.

$I_A = \frac{P}{S^2}$ *where* $S_A = 200m$

$I_B = \frac{P}{S_B^2}$ *where* $S_B^2 = S_A^2 + S^2 = (200m)^2 + (100m)^2$

$S_B^2 = 40{,}000\mu^2 + 10{,}000\mu^2 = 50{,}000\mu^2$

The ratio of the sound intensities heard by observers A and B is

$$\frac{I_A}{I_B} = \frac{\frac{P}{S_A^2}}{\frac{P}{S_B^2}} = \frac{S_B^2}{S_A^2} = \frac{50{,}000\mu^2}{40{,}000\mu^2} = \frac{5}{4} = 1.25$$

Answer:-A

35. *Solution:-* *Given* $m_1 = 0.2kg, \mu_1 = 0, m_2 = 2.8kg, \mu_2 = 3\frac{m}{s}$

Required:- V=?

Taking the collision between the mud and the cart as inelastic collision gives.

$$V = \frac{m_1\mu_1 + m_2\mu_2}{m_1 m_2} = \frac{0.2kg \times 0 + 2.8kg \times 3\frac{m}{s}}{0.2kg + 0.3kg}$$

$$= \frac{8.4kg\frac{m}{s}}{3kg} = 2.8\frac{m}{s}$$

Answer:-A

36. *Solution:-* *Given:-* $m = 4, v =$ distance of image=24cm

Required:- f =?

The linear magnification of the lens is given by

$$m = \frac{h_I}{h_O} = \frac{v}{u} = 4$$

$$V = 4u \text{ or } U = \frac{1}{4}v$$

From the equation of a mirror we have

$$f = \frac{v \times u}{v + u} = \frac{4v \times u}{4v + u} = \frac{4}{5}u = \frac{4}{5}\left(\frac{1}{4v}\right)$$

$$f = \frac{1}{5}v = \frac{1}{5}(24cm) = 4.8cm$$

Answer:-C

37. *Solution:-* *Given;-* $P = 12{,}300pa,\ \rho = 1025\frac{kg}{m^3}, g = 10\frac{m}{s^2}$

Required:- h=?

The average gauge pressure in the artery is given by $P = \rho gh$ and from this the height is

$$h = \frac{p}{\rho g} = \frac{12{,}300pa}{1025\frac{kg}{m^3} \times 10\, m/s^2} = \frac{12{,}300pa}{10{,}250\frac{N}{m^3}} = 1.2m$$

Answer:-D

38. *Solution:-* *Given* $V_p = 900v,\ V_s = 220v$

$I_p = ?$ $P_s = I_s V_s = 900kw$

$I_s = \frac{P_s}{V_s} = \frac{900{,}000w}{220v} = \frac{45{,}000A}{11}$

Using the transformer equation we have

$\frac{V_p}{V_s} = \frac{I_s}{I_p} \Rightarrow I_p = \frac{V_s}{V_p} \times I_s$

$I_p = \frac{220v}{3600v} \times \frac{45{,}000}{11} A = \frac{90{,}000}{360} A = 250A$

39. *Solution:-* *Given :-* $E = 600N, S_E = 5m$ *Answer:- B*

$L = 600N, S_L = 3m$

Required:- $Efficiency = \eta = ?$

The input and the output work are calculated as follows.

$W_0 = L \times S_L = 600N \times 3m = 1{,}800Nm$

$W_I = E \times S_E = 600N \times 5m = 3{,}000Nm$

The efficiency of the inclined plane is obtained from

$\eta = \frac{W_0}{W_I} \times 100\% = \frac{1{,}800Nm}{3{,}000Nm} \times 100\% = 60\%$

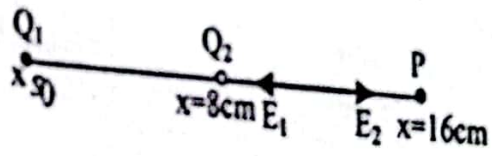
40. *Solution:-* *Given :-* $T_1 = T_2 = T$ *and* $\theta_1 = \theta_2 = \theta$, $W = mg$ The tension on each string is calculated from the following equations. *Answer:- B*

$T_1 = \frac{mgcos\theta_2}{\sin(\theta_1 + \theta_2)} = \frac{mgcos\theta}{\sin 2\theta} = \frac{mgcos\theta}{2\sin\theta cos\theta} = \frac{mg}{2sin\theta}$

But $T_1 = T_1 = \frac{mg}{2sin\theta}$

41. *Solution:-* *Given :-* The net (resultant) electric field strength at x=16cm is zero. *Answer:- D*

Let the electric field strength at p due to Q_1 is to the left and is given by $E_1 = \frac{kQ_1}{(16cm)^2}$



If $E_P = 0$, *then* $E_1 = -E_2$, *Thus*

$\frac{kQ_1}{(16cm)^2} = \frac{-kQ_2}{(8cm)^2}$

$\frac{Q_1}{Q_2} = -\left(\frac{16}{8}\right)^2 = -4 \Rightarrow Q_1 = -4Q_2$

Or $Q_2 = -0.25Q_1$

42. *Solution:-* *Given :-* I=10A, v=220v, t=5hrs cost of electrical energy per kilowatt-hour=0.20 Birr. The amount of electrical energy consumed by the stove is obtained from *Answer:- D*

$W = VIt = 220v \times 10A \times 5 \times 3{,}600s = 39{,}600{,}000\,J$

If $1KWh = 3.6 \times 10^6 J$ *then*

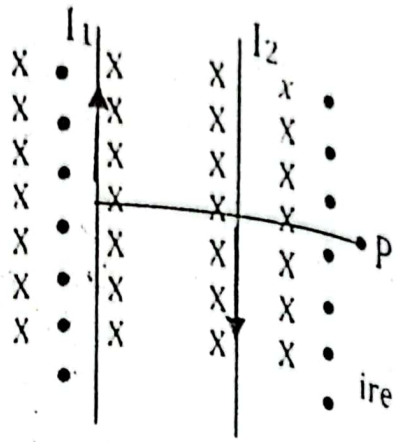
$W = \frac{39{,}600{,}000J}{3.6 \times 10^6 \frac{J}{KWh}} = 11KWhr$

Total cost of electrical energy=11KWh ×0.2birr/KWhr

=220 cents=2 birr and 20 cents *Answer:-*

43. *Solution:-* *Given* :- $l_1 = 7A$, $l_2 = 10A$, $\mu = 4\pi \times 10^{-7} T\frac{m}{A}$

The direction of the magnetic field vector between and outside the wires is as shown in the figure.



The magnetic field is very strong between the wires and weak outside the wires.

the magnetic field strength at po carrying a current of 7A is given b

$$\vec{B}_1 = \frac{\mu_0 I_1}{2\pi r_1} \text{ down} = \frac{4\pi\times10^{-7}\frac{Tm}{A}\times7A}{2\pi\times0.7m} = 2\times10^{-6}T \text{ down}$$

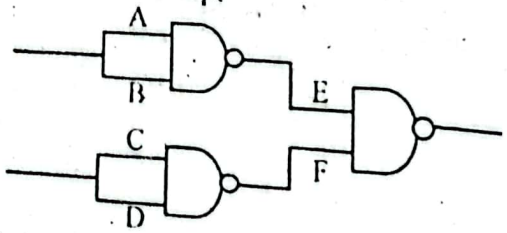
The magnetic field strength at point P due to the second wire at point P is given by

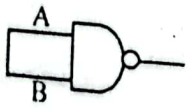
$$\vec{B}_2 = \frac{\mu_0 I_2}{2\pi r_2} \text{ up} = \frac{4\pi\times10^{-7}\frac{Tm}{A}\times10A}{2\pi\times0.2m} = 10^{-5}T \text{ up}$$

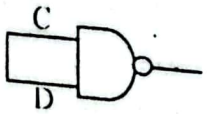
The resultant or net magnetic field strength at P is the vector sum of the magnetic field strength due to each wire .Thus

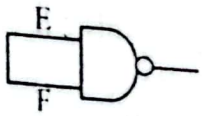
$$\vec{B}_P = 2\times10^{-6}T \text{ down} + 10^{-5}T \text{ up}$$
$$= -0.2\times10^{-5}T \text{ up} + 1\times10^{-5}T \text{ up}$$
$$= (1-0.2)\times10^{-5}T \text{ up} = 0.8\times10^{-5}T \text{ up}$$
$$= 8\times10^{-6}T \text{ up}.$$

44. *Solution* *Answer:- D*









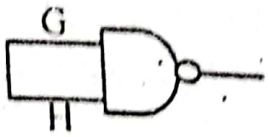
A	B	AND	NAND
1	1	1	0
1	0	0	1
0	1	0	1
0	0	0	1

C	D	AND	NAND
1	1	1	0
1	0	0	1
0	1	0	1

E	F	AND	NAND
0	0	0	1
1	1	1	0
1	1	1	0
1	1	1	0

The truth table of AND get is equivalent to the above logic gates.

G	H	AND
1	1	1
1	0	0
1	0	0
0	1	0
0	0	0



Answer:- A

45.Solution:- Let $R_1 = R_2 = R_3 = 3\Omega, R_4 = 13\Omega, R_5 = 10\Omega$

V=12V

The equivalent resistance of the three resistors connected in parallel is

$$R_{123} = \frac{R_1}{3} = \frac{3\Omega}{3} = 1\Omega$$

R_{123}, R_4 and R_5 are all in series and their combined resistance is

$$R_T = R_{123} + R_4 + R_5$$
$$= 1 + 13\Omega + 10\Omega = 24\Omega$$

Using Ohm's law the current across the circuit is

$$I = \frac{V}{R_T} = \frac{12V}{24\Omega} = 0.5A$$

When a current of 0.5A flows across the 10 Ω resistor the potential drop becomes

$V_s = I\,R_5 = 0.5A \times 10\,\Omega = 5v$ *Answer:-A*