Ethiopian University Entrance Examination (EUEE)
Physics
GINBOT 2011/JUNE 2019

BOOKLET CODE: 23 **SUBJECT CODE: 04**
Number of Items: 50 **Time Allowed: 2 hours**

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Read each question and carefully **blacken** the letter of your best choice on the separate answer sheet provided.

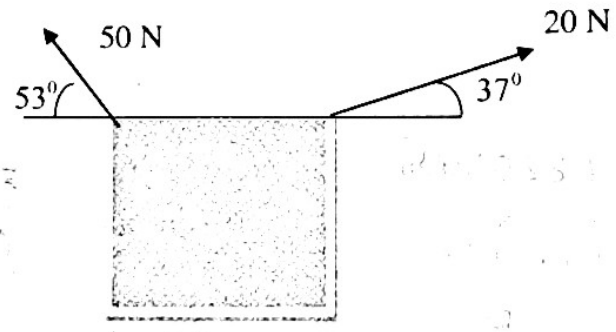
You may refer to the information given below when you work on some of the questions.

Constant	Symbol	Value
Acceleration due to gravity	g	$10 m/s^2$
Permittivity of vacuum	ε_o	8.85×10^{-12} F/m
Charge of an electron	e	1.6×10^{-19} Coulomb
Universal Gravitational Constant	G	$6.67\times10^{-11} Nm^2/Kg^2$
Density of water	ρ	$1000 kg/m^3$
Planck's constant	h	6.63×10^{-34} J.s
Electron mass	me	9.11×10^{-31} kg
Elementary (unit) charge	e	1.602×10^{-19} C
Latent heat of fusion of water		
Latent heat of vapouraization		
$\sin 30^\circ = \cos 60^\circ = 0.5$		
$\sin 37^\circ = \cos 53^\circ = 0.6$		
$\sin 45^0 = \cos 45^0 = 0.707$		
$\sin 53^\circ = \cos 37^\circ = 0.8$		
$\sin 60^\circ = \cos 30^\circ = 0.866$		
$k = 9 \times 10^9 Nm^2/C^2$		
$\mu_o = 4\pi \times 10^{-7} Tm/A$		

1. A grade 11 physics teacher ordered four of his students to measure the length of a class room. He provided them the following length measuring instruments. The instruments are meter rule with millimeter division, vernier calipers, micrometer screw gauge and meter tape with centimeter scale, but its zero reading is not visible. Which one of these instruments is appropriate for the task?
   (A) Meter rule
   (B) Meter tape
   (C) Vernier calipers
   (D) Micrometer screw gauge

2. Which part of a scientific report discusses the accuracy of measurements taken?
   (A) Aim (B) Theory (C) Methods (D) Results

3. Two forces exerted on a block as shown in the figure below. What is the horizontal component of the net force?
   (A) 70 N, East
   (B) 30 N, West
   (C) 14 N, West
   (D) 28 N, West

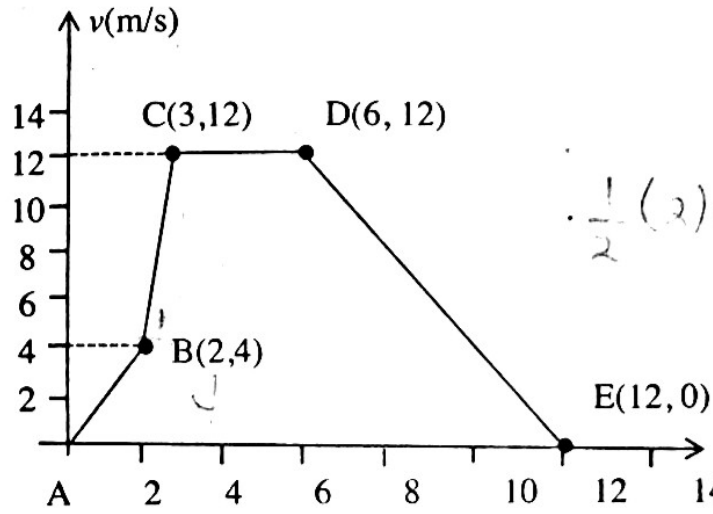


4. What is the magnitude of the resultant velocity for a bird flying first at a speed of 10 m/s North East and then flying to South at a speed of 8 m/s?
   (A) 7.13 m/s
   (B) 16.6 m/s
   (C) 12.8 m/s
   (D) 7.07 m/s

5. Let $\vec{C}=\vec{A}X\vec{B}$ and $\theta \neq 90^0$, where θ is the smaller angle between $\vec{A}$ and $\vec{B}$ when they are drawn with their tails at the same point. Which of the following is **NOT** true?
   (A) $\vec{A}.\vec{B} = 0$
   (B) $\vec{A}.\vec{C} = 0$
   (C) $/\vec{C}/=/\vec{A}//\vec{B}/\sin\theta$
   (D) $-\vec{C}=\vec{B}X\vec{A}$

6. A driver of an automobile travelling at a constant speed of 20 m/s suddenly applies a brake and the automobile comes to rest in 2.0 seconds after skidding for a certain distance. What is the length of the skid distance?
(A) 400 m (B) 10 m (C) 40 m (D) 20 m

7. Which of the following is correct about the motion shown in the velocity – time graph below?



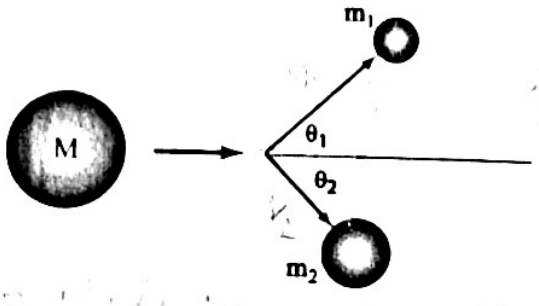
(A) Between C and D, the motion is with constant acceleration.
(B) Between B and C, the acceleration is $4m/s^2$
(C) Between D and E, the motion is with constant positive acceleration.
(D) Total displacement is 84m.

8. An object of mass M is set in a vertical circular motion. The tension T from the rope keeps the object in a circular path with speed v. Where does the rope experience a maximum tension?
(A) At the top of the circle
(B) At the bottom of the circle
(C) When the object is at half of the circle
(D) When it is at 45^0 to the vertical line

9. A shell is fired from a gun, whose barrel is inclined at an angle to the horizontal. During the flight, the shell explodes in air into fragments. The center of mass of different fragments will follow
(A) a horizontal straight line
(B) a vertical straight line
(C) a parabola
(D) an unpredictable path

10. A 5 kg mass pushed upward along an inclined plane of inclination 30^0 with constant force F. If the acceleration of the block for this motion is 1.0 m/s^2 and the plane is assumed to be friction less, what is the magnitude of the constant force F?
(A) 5.0 N (B) 25.0 N (C) 20.0 N (D). 30.0 N

11. A ball of mass M moves with speed V in the + x-direction. It explodes into two pieces that go off at angles θ_1 and θ_2, as shown below.



What are the magnitude of the momenta of the two pieces?.

(A) $p_1 = \dfrac{MV\cos\theta_2}{\sin(\theta_1+\theta_2)}$, and $p_2 = \dfrac{MV\cos\theta_1}{\sin(\theta_1+\theta_2)}$

(B) $p_1 = \dfrac{MV\sin\theta_2}{\sin(\theta_1+\theta_2)}$, and $p_2 = \dfrac{MV\sin\theta_1}{\sin(\theta_1+\theta_2)}$

(C) $p_1 = MV\tan\theta_2$, and $p_2 = MV\tan\theta_1$

(D) $p_1 = \dfrac{MV\cos\theta_2}{\cos(\theta_1+\theta_2)}$, and $p_2 = \dfrac{MV\cos\theta_1}{\cos(\theta_1+\theta_2)}$

12. The rate of change of momentum of the raindrop can be given by $F = ma + u\frac{\Delta m}{\Delta t}$.

In this expression what does u represent?

(A) The velocity of the extra mass added to the raindrop
(B) The velocity of the raindrop
(C) The velocity of the loss in mass of raindrop
(D) The rate of change of the velocity for combined system

13. A trolley is set to move on a smooth track that is banked at an angle of 30°. For a trolley moving with a speed 5m/s to round the curve, what is the radius of the banked surface?

(A) 5.0m (B) 2.5m (C) 10m (D) 3.5m

14. Which of the following is equal to the amount of work required to stop a moving object ?

(A) the mass of the object times its acceleration
(B) the kinetic energy of the object
(C) the square of the velocity of the object
(D) the mass of the object times its velocity

15. A 1kg roller coaster is acted on by a 4N force over a displacement of 2m in the direction of force and then set free. The roller is moving on a smooth and horizontal surface towards a free end of a spring of constant k, whose other end is fixed on the wall. If the spring is compressed by 20cm to bring the roller coaster to rest, then what is the value of the spring constant?

(A) 100 N/m (C) 400 N/m
(B) 200 N/m (D) 800 N/m

16. In which of the following case is no work done by a dissipative force?

(A) When a parachute jump from a plane
(B) For a freely falling object
(C) On a racing car that moves in a desert
(D) When someone slides a box on a horizontal rough surface.

17. Five beads of equal mass are fixed on a rigid light rod that is free to rotate about a frictionless vertical bearing. The arrangement is such that, four of them are placed at 0.25 m and the fifth one is at 0.5m from the axis of rotation. The rotational kinetic energy is 144J when the beads were rotating with angular speed of 48rad/s. What is the mass of each bead?

(A) 0.25Kg (B) 0.5Kg (C) 0.75 Kg (D) 1Kg

18. A thin circular ring of mass M and radius r and moment of inertia Mr^2 is rotating about its axis with a constant angular velocity ω. Two objects each of mass m, are attached gently to the opposite ends of a diameter of the ring. What would be the angular velocity of the wheel ?

(A) $\frac{\omega M}{(M+m)}$ (C) $\frac{\omega M}{(M+2m)}$

(B) $\frac{\omega(M+2m)}{(M+2m)}$ (D) $\frac{\omega(M+2m)}{M}$

19. In a playing room a turn table of radius 2m has moment of inertia 250Kgm^2 and is rotating about a frictionless vertical axel. When a boy of mass 50Kg stands near the rim, the system rotates with angular speed 3rad/s. The boy walks towards the center and stands at 1m from the axel. What is the final angular speed of the system?

(A)3rad/s (B) 2.5rad/s (C) 5.4rad/s (D) 4.5rad/s

20. Two forces $\overrightarrow{F_1}=3\hat{i}$ N and $\overrightarrow{F_2}=4\hat{j}$ N are acting on a particle of mass m. What is the magnitude and direction of a force that balances the two?

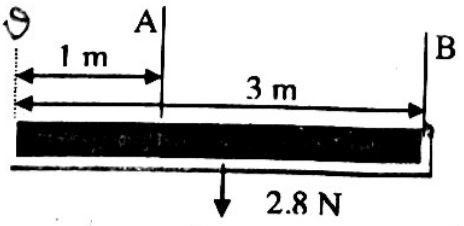
(A) $\overrightarrow{F_{eq}}$= 7N at 127^0 counterclockwise from $\overrightarrow{F_1}$

(B) $\overrightarrow{F_{eq}}$= 5N at 143^0 counterclockwise from $\overrightarrow{F_2}$

(C) $\overrightarrow{F_{eq}}$= 7N at 127^0 counterclockwise from $\overrightarrow{F_2}$

(D) $\overrightarrow{F_{eq}}$= 5N at 143^0 counterclockwise from $\overrightarrow{F_1}$

21. The rod shown in the figure below is uniform and its weight is 2.8 N. The length of the rod is 3.0 m. Two ropes A and B keep the rod in horizontal position. Rope A is 1.0 m from one end and rope B is at the other end of the rope. What is the calculated value of the tension in rope A?



(A) 2.1 N (B) 0.7 N (C) 2.8 N (D) 1.4 N

22. Which of the following statement is correct about elastic behavior of materials?
(A) For sufficiently small stress, stress is proportional to strain.
(B) In tensile stress the force is parallel to the cross-sectional area, where as in shear stress, the force is perpendicular to the area.
(C) All materials do not necessarily have elastic limit.
(D) With plastic materials, the body goes to original dimensions after removal of the force that caused deformation.

23. A fluid of unknown density filled in a beaker of 250.0 cm^3. The pressure due to the fluid at the base of the beaker is 2.30 Pa. The base area of the beaker is 102 cm^2. What is the density of the fluid?
(A) 9.2 x 10^3 kg/m^3
(B) 9.2 x 10^1 kg/m^3
(C) 9.2 x 10^6 kg/m^3
(D) 7.9 x 10^3 kg/m^3

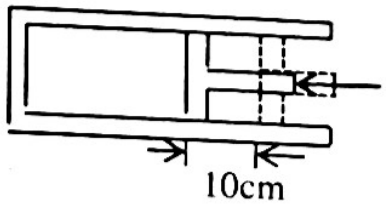
24. Which of the following statement is correct?
(A) Surface tension is proportional to the length along with the surface tension force acts.
(B) In a given tube, the capillary action is large for a liquid of larger density.
(C) The angle between the wall of a container and the liquid surface has no role on the capillary action
(D) Surface tension pulls the liquid column up until there is sufficient mass of liquid for weight to overcome the intermolecular forces.

25. Water flows at a rate of 0.4 litter per second through garden hose of inside diameter 4.0 cm. The nozzle of the hose is a circular opening of diameter 2.0 cm. What is the speed of the water when it emerges? **(π = 3.14)**
(A) 0.32 m/s (B) 1.27 m/s (C) 3.2 m/s (D) 12.7 m/s

26. How much heat would be absorbed by 2g of ice at 0°c dropped into water at 0°c, to melt it totally to water at 0°c? (Latent heat of melting, L = 340,000J/Kg)
(A) 680J (B) 840J (C) 340J (D) 420J

27. The direction of heat flow is from:
(A) high pressure to low pressure
(B) high temperature to low temperature
(C) high density to low density
(D)a point of higher emissivity to lower one

28. External force of 220N applied on a piston of a cylinder containing 1.25g of ammonia gas move 10cm as shown in the diagram below. Assuming adiabatic process, what is the rise in temperature of the gas? (Specific heat capacity of ammonia, c = 2200J/Kg °K)



(A) 4 °K (B) 8 °K (C) 0.004 °K (D) 0.008 °K

29. Which of the following statement is correct?
(Here ρ is the density of an ideal gas, m is the mass of the gas and c is speed of particles)
(A) P(pressure of an ideal gas) = $\frac{1}{2}\rho\langle c^2\rangle$
(B) For a mixture of two gases in equilibrium in a container, $\frac{\rho_2}{\rho_1} = \sqrt{\frac{\langle c_1^2\rangle}{\langle c_2^2\rangle}}$.
(C) For a mixture of two gases in equilibrium in a container, $\frac{p_2}{p_1} = \sqrt{\frac{\langle c_2^2\rangle}{\langle c_1^2\rangle}}$
(D) For a mixture of two different gases with equal partial pressure and equal number of molecules in a container, $\frac{m_2}{m_1} = \frac{\langle c_1^2\rangle}{\langle c_2^2\rangle}$.

30. Which of the following statement is NOT correct?
(A) No process is possible in which there is an overall decrease in the entropy of the universe.
(B) The spontaneous transfer of energy from cooler body to a hotter body is not possible.
(C) Spreading out of random kinetic energy through heating does not represent an overall increase in entropy.
(D) The complete conversion of energy from a hot source into work is not possible.

31. Which one of the following is not an example of simple harmonic motion?
(A) A mass attached to a spring system oscillating in horizontal direction to the surface of the Earth
(B) Oscillation of simple pendulum
(C) Rotation of second pointer in hand watch
(D) A mass attached to a spring system oscillating in vertical direction to the surface of the Earth

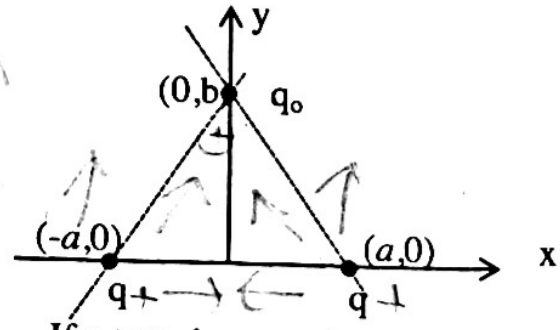
32. Travelling wave is given by the equation $Y = A\cos(kx - \omega t)$, where k is the wave number and ω is the angular frequency. What is the distance that the wave travels in the time $t = T/2$?
(A) full wavelength
(B) half the wavelength
(C) a quarter of the wavelength
(D) at the origin

33. A 50 cm pipe is open at one end and closed at the other end. When air is blow at 150 Hz. What is the velocity of the sound along the pipe?
(A)150 m/s (B) 100 m/s (C) 330 m/s (D) 300 m/s

34. In Young's double slit experiment, if the slit separation is 1.2mm and the average spacing of the bright fringes observed on a screen placed 4m away from the source is 2mm. What is the wavelength of the light source?
(A) 550nm (B) 600nm (C) 630nm (D) 750nm

35. The colors seen from soap bubbles and oil slicks are a manifestation of thin film interference. What is the cause of this interference?
(A) Interference from refraction of light
(B) Interference from reflection of light from the two surfaces of the film
(C) Interference from diffraction of light
(D) Interference from superposition of lights that are incident and reflected

36. Two like charges of value q are fixed at x= a and x= -a as shown in the diagram below.



If a test charge q_o is released at y = b, which path will it follow?

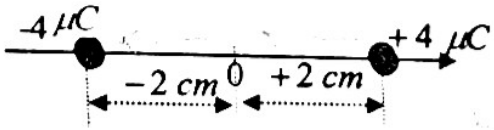
(A) It stays at y = b

(B) along a line $y = -\frac{b}{a}x + b$

(C) along a line $y = \frac{b}{a}x + b$

(D) a long y- axis

37. Two equal and opposite charges are located along x-axis at $-2.0\,cm$ and $+2.0\,cm$ as shown in the figure below. How much would be the electric potential at the origin?



(A) Zero (B) 1.8 MV (C) 3.6 MV (D) 4.5 MV

38. A sheet of polythene (ε_r = 2.3) and 0.25 mm thick is to be used in a capacitor by sandwiching it between two sheets of aluminum foil. What area must the sheets have if the capacitor is to have a capacitance of 0.5 μF?

(A) 12 m^2 (B) 6.14 m^2 (C) 0.6 m^2 (D) 0.12 m^2

39. A metal rod is measured to have a resistance R. If the same metal rod is stretched to reduce its radius by half without affecting its density, what is its new resistance?

(A) 2R (B) 4R (C) 8R (D) 16R

40. The statement of Kirchoff's point rule follows from:

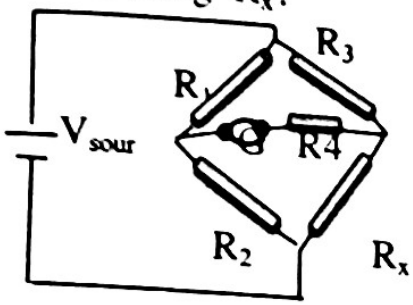
(A) conservation of charge

(B) conservation of energy

(C) Ohm's law

(D) dependence of resistance on temperature

41. You are given the bridge circuit as shown in the diagram below. The resistance R is used to limit the current in the galvanometer. Which of the following is correct in measuring R_x?



$R_1 R_x = R_2 R_3$

$\frac{R_1}{R_2} = \frac{R_3}{R_x}$

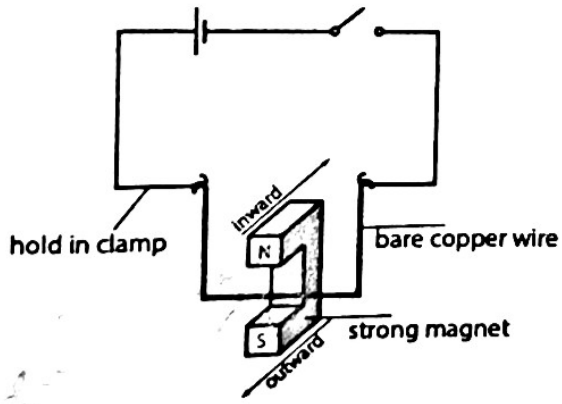
(A) The bridge is balanced when $\frac{R_1}{R_2} = \frac{R_3}{R_4}$

(B) The bridge balance condition is given by $\frac{R_x}{R_3} = \frac{R_2}{R_1}$.

(C) $\frac{R_x}{R_3} = \frac{R_1}{R_4}$

(D) $\frac{R_x}{R_3} = \frac{R_2}{R_4}$

42. A current of 5A flows through the circuit when the switch in the figure below is closed.



What would be the copper wire suspended on the clamp ?

(A) be deflected inward
(B) be deflected outward
(C) be lifted upward
(D) experience no force.

43. What is the expression of the centripetal acceleration of a particle of charge q and mass m moving in a uniform magnetic field B on a circle of radius r if $\vec{B}$ is perpendicular to the particle's direction of motion?

(A) $\frac{qB}{m}$ (B) $\frac{2qB}{mr}$ $V = \frac{Bqr}{m}$ (C) $\frac{q^2B^2}{m}r$ $a = \frac{B^2q^2r}{m^2r}$ (D) $\frac{q^2B^2}{m^2}r$

44. Two long wires of 10 m in length carries a current of 2.0 A and 0.5A in the same direction. The wires are separated by 4.0 cm. What is the magnetic force that the wires exerted on each other?

(A) $5 \times 10^{-5}\ N$ (C) $5\times10^{-7}\ N$

(B) $5\times10^{-6}\ N$ (D) $4\times10^{-6}\ N$

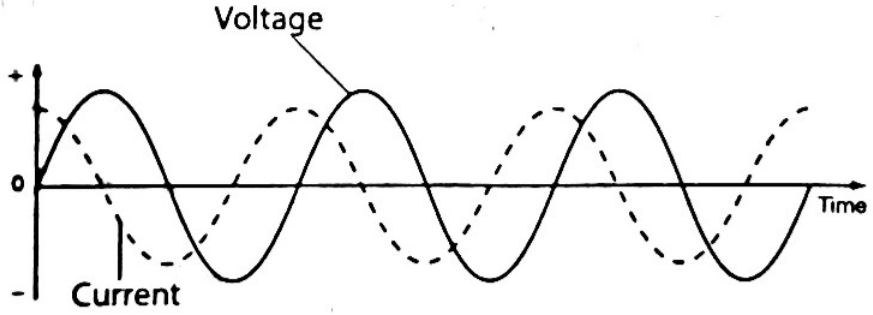
45. Lenz's law in electromagnetic induction follows from which law of conservation ?

(A) charge (B) energy (C) momentum (D) mass

46. A rectangular loop of area $0.4m^2$ is placed in a magnetic field that is changing at a rate of 100T/s. If the normal of the loop makes angle 60° with the magnetic field, what is the magnitude of induced emf?

(A) 80V (B) 40V (C) 20V (D)34.64V

47. The applied ac voltage and the resulting current, in a circuit element, is shown below



What is the circuit element ?

(A)inductor (B)capacitor (C) resistor (D) diode

48. A series circuit consisting of 50 Ω resistor and capacitor of capacitive reactance 50 Ω are connected to alternating source of voltage(rms) 100V. What is the average power output and power factor of the circuit?

(A)141.4W, 0.8 (C) 70.7W, 0.707

(B) 200W, 0.8 (D) 100W, 0.707

49. When ultraviolet light is shone on a clean metal surface the surface will emit electrons. What is the necessary precondition for electrons to be ejected from the metal surface is ?
(A) The intensity of light must be high enough
(B) The minimum energy required to release the electron is the same as the work function of the metal
(C) The wave length of the light has to be greater than that of ultraviolet light.
(D) The frequency of the metal has to be less than that of ultraviolet light.

50. Complete the following equation which represents a nuclear fission reaction. What is the particle represented by X?
$^{235}U + {}^{1}_{0}n \rightarrow {}^{95}Rb + {}^{139}Cs + 2X + \text{energy}$?

(A)electron (B) proton (C)neutron (D) alpha particle

THE END