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Ethiopian University Entrance Examination (EUEE)
Physics
Ginbot 2010/June 2018

BOOKLET CODE: 33

SUBJECT CODE: 04

Time Allowed: 2 hours

Number of Items: 50

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.

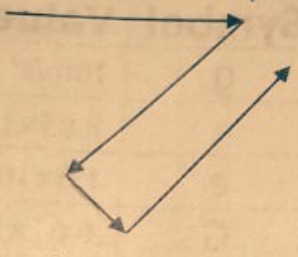
Constant	Symbol	Value
Acceleration due to gravity	g	$10 m/s^2$
Permittivity of vacuum	$\varepsilon_\circ$	8.85×10^{-12} F/m
Charge of an electron	e	1.6×10^{-19} Coulomb
Universal Gravitational Constant	G	$6.67\times10^{-11} Nm^2/Kg^2$
Density of water	ρ	$1000\ kg/m^3$
Planck's constant	h	6.63×10^{-34}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

1. Which of the following statement is correct about errors in measurement?
   (A) Experimental error is the same as a mistake.
   (B) Errors occur in every scientific investigation.
   (C) Errors make measured values same as accepted value.
   (D) Errors can be avoided by using modern measuring instruments.

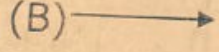
2. What can be concluded when the number of significant figures increases?
   (A) True reading increases
   (B) Uncertainty increases
   (C) Precision increases
   (D) Accuracy increases

3. Two forces $\overrightarrow{F_1} = (8\vec{i} + 3\vec{j})$ N and $\overrightarrow{F_2} = (4\vec{i} + 6\vec{j})$ N are acting on an object. What is the magnitude and direction of the resultant force?
   (A) 15 N, 37° (B) 5 N, -37° (C) 5 N, 143° (D) 225 N, 143°

4. The diagram below shows a path taken by a flying bird.



Which one of the following vector may represent a resultant displacement?

(A) 
(B) 
(C) 
(D) 

5. Four vectors are listed below

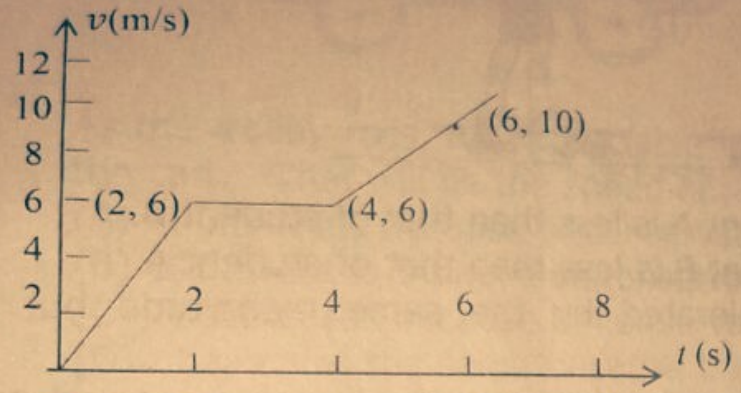
$$\vec{A} = \begin{bmatrix} 4 \\ 10 \end{bmatrix}, \quad \vec{B} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}, \quad \vec{C} = \begin{bmatrix} -6 \\ 15 \end{bmatrix}, \quad \vec{D} = \begin{bmatrix} 15 \\ -6 \end{bmatrix},$$

Which pair of the vectors is orthogonal?

(A) $\vec{A}$ and $\vec{B}$
(B) $\vec{A}$ and $\vec{D}$
(C) $\vec{C}$ and $\vec{D}$
(D) $\vec{B}$ and $\vec{C}$

6. A race car is moving at a constant speed of 35 m/s. A security car was moving at a speed of 5 m/s as the race car passes by it and was accelerating at constant rate of 5 m/s^2. What was the speed of the security car when it took over the race car?
(A) 35 m/s (B) 60 m/s (C) 65 m/s (D) 5 m/s

7. A car start moving from rest and its motion on a straight line is shown in the figure below. What is the average velocity of the car within the first 6 seconds?

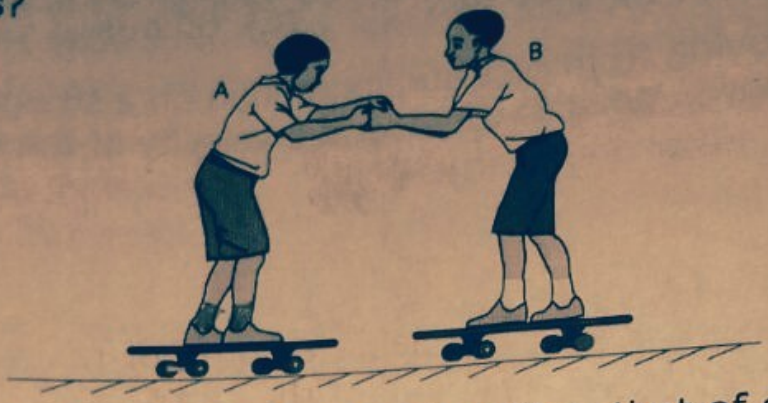


(A) 1.67 m/s (C) 5 m/s
(B) 5.67 m/s (D) 6 m/s

8. Which one of the following statements is correct regarding the motion in a plane?
(A) When a body moves in a horizontal circle, its velocity is constant.
(B) When a body moves in a vertical circle, its speed is constant.
(C) In projectile motion the horizontal component of the motion is uniformly accelerated motion.
(D) The centripetal force for a body moving in either vertical or horizontal circle is toward the center.

9. A bullet is fired at an angle of 30^0 above the horizontal. If air resistance is neglected, what should be the bullet's horizontal acceleration ($\vec{a}_x$) and vertical acceleration ($\vec{a}_y$) when it reaches its maximum height?
(A) Both $\vec{a}_x$ and $\vec{a}_y$ are zero.
(B) $\vec{a}_x$ is zero and $\vec{a}_y$ is 10 m/s^2 downward.
(C) $\vec{a}_x$ is 10 m/s^2 downward, and $\vec{a}_y$ is zero
(D) Both $\vec{a}_x$ and $\vec{a}_y$ are 10 m/s^2, downward

10. Two students A and B, with masses m_A and m_B respectively, stand on a wheeled trolleys as shown in the figure below. If student A has larger mass and pushes student B, then what can be said about their accelerations?



(A) The acceleration of student A is less than that of student B.
(B) The acceleration of student B is less than that of student A.
(C) Both boys will be accelerated by the same magnitude but in opposite directions.
(D) There would be no acceleration because the forces are equal and opposite.

11. For a constant force F, if the impulse imparted to the system is large, then what can you conclude about the collision?
(A) Linear momentum is conserved.
(B) Kinetic energy is conserved.
(C) The contact or impact time is large.
(D) The change in velocity is small.

12. An open trolley is rolling on a level surface without frictional loss through a vertical downpour of rain, as shown in the figure below



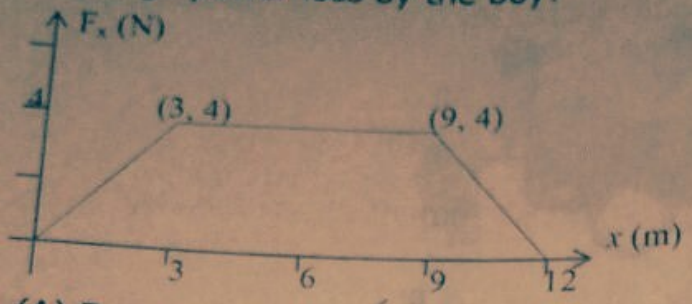
As the trolley rolls, an appreciable amount of rainwater accumulates in the cart. What will be the speed of the cart?
(A) It increases because of conservation of mechanical energy.
(B) It decreases because of conservation of momentum.
(C) It decreases because of conservation of mechanical energy.
(D) It remains the same because the raindrops are falling perpendicular to the direction of the cart's motion.

13. A satellite moves at a constant speed in a circular orbit about the center of the Earth at an altitude half the radius of the Earth above its surface. If g is the gravitational acceleration at the surface of the Earth and R its radius, then what is the speed of the satellite?
(A) $\sqrt{3gR/2}$ (B) $\sqrt{2gR}$ (C) $\sqrt{gR}$ (D) $\sqrt{2gR/3}$

14. An object of mass 1 kg moving with a speed of 2 m/s was acted on by a force that produces an acceleration of 2 m/s^2. What is the change in kinetic energy of the object if the force is exerted on the object for 2 seconds in its direction of motion?
(A) 1 J (B) 4 J (C) 8 J (D) 16 J

15. A body that is released from the top of a tall building reaches the ground after six seconds. What is the ratio of the kinetic energy acquired by it at the end of the first three seconds to the increment in the kinetic energy during the next three seconds?
(A) 1/3 (C) 3/2
(B) 1 (D) 2

16. A boy pushes a block over 12 m distance within 6 seconds. The force applied by the boy varies as shown in the diagram below. What is the average power loss by the boy?

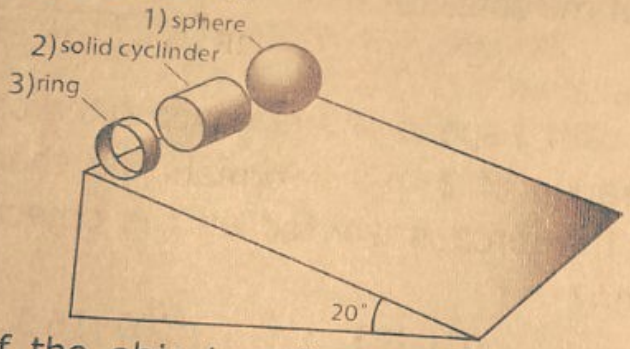


(A) 7 w (B) 8 w (C) 6 w (D) 4 w

17. A thin rod when rotated about an axis at the end of the rod has a moment of inertia $\frac{1}{3}ML^2$. The rod has a mass of 1.5 kg and length of 1.0 m. If the rod initially at rest gains a rotational kinetic energy of 1000.0 J, at what speed does it rotate?

(A) $10\sqrt{5}\ rad/s$ (B) $20\sqrt{10}\ rad/s$ (C) 10 rad/s (D) 18.8 rad/s

18. A ring, a solid cylinder and a solid sphere, all having the same mass and the same radius, are held at the top of an inclined plane as shown in the figure below.



If the objects roll without sliping and the coefficient of static friction between each object and the plane is 0.3, which one of the following shows the order in which they will get to the bottom of the inclined plane?

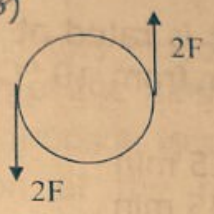
(A) All will reach the bottom at the same time
(B) Sphere, solid cylinder, ring
(C) Ring, solid cylinder, sphere
(D) Solid cylinder, sphere, ring.

19. If in a given rotational system of a body the angular momentum is increased with time, which one of the following statement is NOT correct?
(A) The radius of rotation may increase.
(B) The moment of inertia may increase.
(C) There is a torque exerted on the system.
(D) There is no torque exerted on the system.

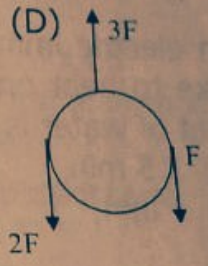
20. Which of the following is a correct statement about the first condition of equilibrium?
(A) The net force on an object must be zero.
(B) The sum of all torques must be zero.
(C) Clockwise moments should balance counter clockwise moments.
(D) The torque produced by a force should be perpendicular to the force.

21. From the figures given below, which one is in equilibrium?

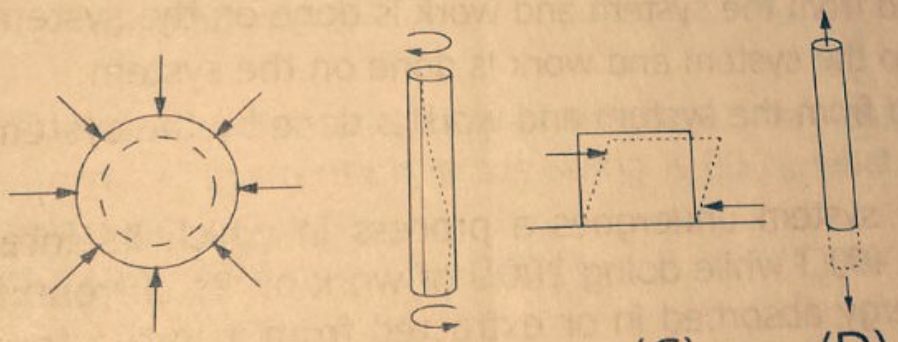
(A)


(B)


(C)


(D)


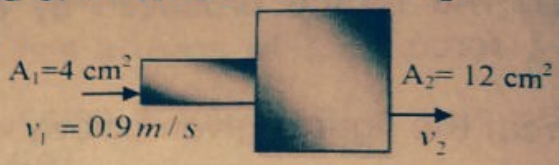
22. Which of the following figure indicates tensile deformation?



23. A beaker with water resting on a scale weighs 40 N. A block suspended on a hanging spring weighs 20 N. The spring scale reads 15 N when a block is fully submerged in the water. What is the reading of a scale on which the beaker with water rests, while the block is submerged in the water after detached from the hanging spring?
(A) 25 N (B) 45 N (C) 55 N (D) 60 N

24. An object with a mass of 150 kg and a volume of 0.75 m^3 is floating in a liquid of density 0.8 g/cm^3. What percentage of the object's volume will be submerged below the surface of the fluid?
(A) 25% (B) 50% (C) 75% (D) 100%

25. In the figure below, what is the speed of water as it leaves A_2?
(A) 0.3 m/s (C) 3.3 m/s
(B) 0.9 m/s (D) 3.6 m/s



26. An electric immersion water heater is rated at 400 W. How long will it take to heat one kilogram of water from 10 °C to 30 °C? (The specific heat of water is 4.2 J/g K.)
(A) 3.5 min (C) 15 min
(B) 1 min (D) 45 min

27. If the internal energy of the system decreases, then what can be concluded about the heat and the work done?
(A) Heat is added to the system and work is done by the system.
(B) Heat is removed from the system and work is done on the system.
(C) Heat is added to the system and work is done on the system.
(D) Heat is removed from the system and work is done by the system.

28. If a thermodynamic system undergoes a process in which its internal energy increased by 400 J while doing 200 J of work on its surrounding, then what is the energy absorbed in or extracted from it in the form of heat?
(A) -600 J (B) 600 J (C) 200 J (D) -200 J

29. Which of the following statement is **NOT** correct?
(A) A system can absorb heat from a hot reservoir and can convert it entirely into work without additional changes in the system and its surroundings.
(B) No process is possible in which there is an overall decrease in the entropy of the universe.
(C) The complete conversion of energy from hot source into work is not possible.
(D) The spontaneous transfer of energy from a cooler body to hotter body is quite possible.

30. A heat engine operating between 100 °C and 700 °C has efficiency equal to 40% of the maximum theoretical efficiency. How much energy does this engine extract from the hot reservoir in order to do 5000 J of mechanical work?
(A) 810.4 J
(B) 81.0 J
(C) 20259.32 J
(D) 20.3 J

31. What makes the oscillatory motion a simple harmonic motion?
(A) The acceleration of the motion is directly proportional in magnitude but opposite in direction to the displacement.
(B) The acceleration of the motion is directly proportional to the velocity.
(C) The velocity of the motion is directly proportional to the displacement.
(D) The velocity of the motion is inversely proportional to the displacement.

32. The two end fixed string of length 0.5 m has a mass per unit length 2 g/m. If the tension in the string is 80 N, what is the second harmonic frequency?
(A) $100\sqrt{2}$ Hz
(B) 200 Hz
(C) 400 Hz
(D) 600 Hz

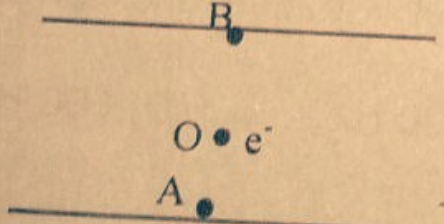
33. Which one of the followings is **NOT** the use of Doppler effect?
(A) Astronomy (C) Radar
(B) Blood flow measurement (D) Energy transmission

34. A 632.8 nm laser light produces an interference pattern on a screen of 4.0 m from a pair of slits. The slit space is equal to 0.2 mm. Calculate the fringe width.
(A) 12.7 mm (B) 25.3 mm (C) 6.33 mm (D) 15.3 cm

35. Why is an interference pattern **NOT** observed between the lights produced from a pair of car headlights?
(A) The light sources are not collimated.
(B) Interference is observed only in laboratory conditions.
(C) The spread of light as it travels out of the source.
(D) The light sources are not coherent.

36. Suppose that three point charges are placed along a straight line and the electrostatic force exerted on the middle charge is zero. What can we conclude about the charges?
(A) The signs of the three charges should be the same.
(B) The middle charge should be placed at the center between the two charges
(C) The charges at the ends must have the same sign.
(D) The charge at the middle and at the left end should have the same sign

37. Two parallel plates are kept at 3 V and 5 V as shown in the diagram below. If an electron is released at O, then which way will the electron move?



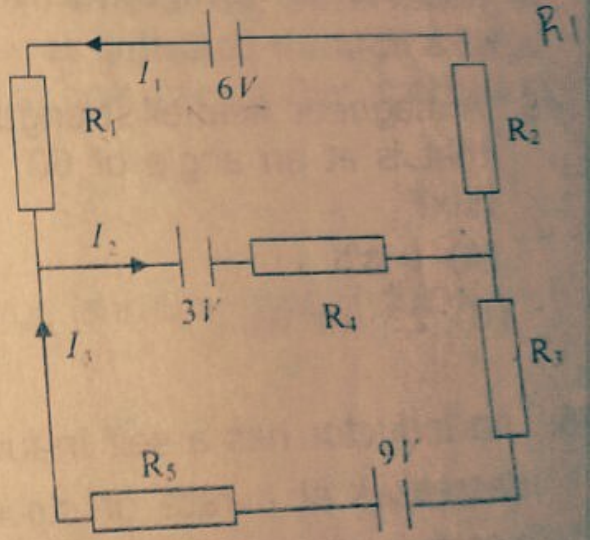
(A) towards A (C) remains at O
(B) towards B (D) parallel to the plates

38. A capacitor of 12 μF capacitance can be fully charged after it is connected between a potential difference of 9 V. How much electrical energy is used in charging the capacitor?
(A) 4.86×10^{-4} J (B) 54×10^{-4} J (C) 1.0×10^{-3} J (D) 9.72×10^{-4} J

39. A copper wire of cross-sectional area 2 mm^2 carrying a current of 1.5 A. If the drift velocity of the electron is 0.00028 m/s, what is the number of charge carriers (free electrons) per unit volume in the copper wire?
(A) $1.5 \times 10^{25} / m^3$
(B) $1.5 \times 10^{32} / m^3$
(C) $1.67 \times 10^{28} / m^3$
(D) $1.67 \times 10^{32} / m^3$

40. Which of the following statement is correct?
(A) Galvanometer can be converted to ammeter of different scale by connecting variety of low valued shunt resistance in parallel.
(B) Galvanometer can be converted to voltmeter of different scale by connecting low valued resistance in parallel.
(C) Low valued internal resistance increases accuracy of voltmeter.
(D) High valued internal resistance increases the accuracy of ammeter.

41. In the circuit shown below, each resistor has a value of 3 Ω. What is the value of the current through R_4?



(A) 0.125 A (C) 0.625 A
(B) 1.0 A (D) 0.75 A

42. Suppose you obtain a piece of iron from your laboratory shelf. How can you experimentally determine, for sure, that it is magnetized?
(A) If it attracts another magnet
(B) If it repels another magnet
(C) If it diverges a charged electroscope
(D) There is no single and sure way to determine its magnetization.

43. If a charged particle enters into a uniform magnetic field perpendicular to its direction, then what will happen?
(A) It moves in an elliptical path
(B) The radius of its path is proportional to the magnetic field strength
(C) The period of the motion is inversely related to the magnetic field strength
(D) The charged particle will not be affected by magnetic field

44. Two parallel wires each carrying 5 A current in the same direction are separated by 2.5 cm. What is the magnitude of the force per unit length acting on the wires? Is the force attractive or repulsive?
(A) 4×10^{-6} N/m, repulsive
(B) 2×10^{-4} N/m, attractive
(C) 8×10^{-5} N/m, repulsive
(D) 5×10^{-6} N/m, attractive

45. A magnetic field of strength $5\times10^{-5}\text{T}$ passes through an area of 20 cm^2 that is at an angle of 60^0 to the magnetic field. What is the magnetic flux?
(A) 0 Wb
(B) $2.5\times10^{-8}\text{Wb}$
(C) $5\times10^{-8}\text{Wb}$
(D) $8.7\times10^{-8}\text{Wb}$

46. An inductor has a self inductance of $12\ mH$. The current in the circuit decreases at a rate of $2.0\ A/s$. What is the magnitude of the induced electromotive force?
(A) 2.4π V
(B) 1.2π V
(C) $2.4\times10^{-2}\ V$
(D) $1.2\times10^{-2}\ V$

47. Which of the following is correct about the characteristic of current and voltage in a.c. circuits?
(A) If the current is in phase with the voltage, the circuit is inductive.
(B) If the current leads the voltage, its capacitive reactance is greater than inductive reactance.
(C) If the current leads the voltage, it is inductive circuit.
(D) If the current lags the voltage, the circuit is capacitive.

48. An RLC circuit is designed to have a resistance of $400\ \Omega$, capacitive reactance of $350\ \Omega$ and inductive reactance of $50\ \Omega$. The circuit is connected to an alternative voltage source of effective (rms) value 50 V, and frequency $50\ Hz$. What is the output average power?
(A) 40 W (B) 4.0 W (C) 400 W (D) 62.5 W

49. Which of the following has an electronvolt unit?
(A) charge
(B) potential difference
(C) energy
(D) electromagnetic intensity

50. In Rutherford experiment, a beam of positively charged alpha particles was projected into a thin piece of gold foil. One of the observation of this experiment is that some charged particles deflected through a large angle (10^0 to 90^0) are those concentrated in one place. What conclusion can be drawn from this observation?
(A) Most of the atom is empty space
(B) All the atom is positive charge
(C) Most of the mass and all positive charge is in tiny central nucleus
(D) All the atom's negative charge

THE END



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