

# Grade 12 Students

@ETHIO_ENTRANCEG12

*EDUCATIONAL ASSESSMENT AND EXAMINATIONS SERVICE (EAES)*
*ETHIOPIAN SECONDARY SCHOOL PILOT TEST (ESSPT)*
*GINBOT, 2016 E.C/ MAY, 2024G.C*

*SUBJECT CODE: 04* *BOOKLET CODE: 011*
*NUMBER OF ITEM: 60* *TIME ALLOWED: 2:30 HOURS*

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

| Name of constants | Symbol | Value |
|---|---|---|
| Acceleration due to gravity | G | $10\ m/s^2$ |
| Mass of proton | $m_p$ | $1.67 \times 10^{-27}\ kg$ |
| The charge of electron | $e^-$ | $1.6 \times 10^{-19}\ C$ |
| Mass of electron | $m_e$ | $9.11 \times 10^{-31}\ kg$ |
| Universal gravitational constant | G | $6.67 \times 10^{-11}\ Nm^2/kg^2$ |
| Mass of the Earth | $M_E$ | $6 \times 10^{24}\ kg$ |
| Radius of the Earth | $R_E$ | $6.4 \times 10^{6}\ m$ |
| Density of water | $\rho$ | $1000\ kg/m^3$ |
| Molar gas constant | R | 8.314 J/mol.K |
| permittivity of vacuum | $\varepsilon_o$ | $8.85 \times 10^{-12}\ F/m$ |
| Magnetic permeability of free space | $\mu_o$ | $4\pi \times 10^{-7}\ Tm/A$ |
| Coulomb's constant | K | $9 \times 10^{9}\ Nm^2/C^2$ |
| Planck's constant | h | $6.63 \times 10^{-34}\ Js$ |
| $\sin 30^\circ = \cos 60^\circ = 0.5$ | | |
| $\sin 60^\circ = \cos 30^\circ = 0.87$ | | |
| $\sin 37^\circ = \cos 53^\circ = 0.6$ | | |
| $\sin 53^\circ = \cos 37^\circ = 0.8$ | | |

Physics Try Out

1. A car moves 6 km North and then 8 km East .What is the resultant displacement of the car?

A. 2 km North
B. 2 km East
C. 10 km 37° North of East
D. 10 km 53° North of East

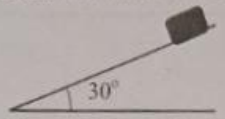
2. Which one of the following types of motion represents a uniformly accelerated motion?

A. Free falling object.
B. A mass attached on a spring oscillating on a smooth horizontal surface.
C. A car moving along a curved path at a constant speed.
D. A car moving in a straight line with constantly increasing acceleration.

3. Starting from rest, a car accelerates uniformly with 2.5 $m/s^2$. How much distance should it travels to attain a speed of 180 km/h in the direction of acceleration?

A. 5 km
B. 100 m
C. 10 km
D. 500 m

4. A teacher is teaching students about static friction by putting a box on horizontal plane as shown in the Figure below. The box remained at rest until the angle of inclination of the box is 30° to the horizontal.




What is the value of the coefficient of static friction of the inclined plane?

A. 0.50
B. 0.58
C. 0.87
D. 1.72





5. If object A exerts a force on object B, then B will also exerts a force of equal magnitude but opposite in directions on A. This is a statement of

A. Newton's first law of motion.
B. Newton's second law of motion.
C. Newton's third law of motion.
D. Newton's law of gravitation.

6. A 7 kg block placed on a smooth horizontal surface is acted up on by two forces of magnitudes 21 N and 7 N. of mass is pulled by two ropes. If the two forces act horizontally in the same direction, what is the magnitude of the acceleration of the block?

A. 1 $m/s^2$
B. 2 $m/s^2$
C. 3 $m/s^2$
D. 4 $m/s^2$

7. Two cars, A of mass 1200 kg and B of mass 3000 kg, move with a speed of 14 m/s toward West and East, respectively. If the two cars collide head on and move together after the collision, how much kinetic energy losses from the system of the two cars?

A. $8.64 \times 10^5$ J
B. $3.36 \times 10^5$ J
C. $6.94 \times 10^5$ J
D. 0

8. What is the expression for the efficiency ($\eta$) of a simple machine in terms of the actual mechanical advantage (MA) and velocity ratio (VR) of the machine?

A. $\eta$ = MA/VR
B. $\eta$ = MA x VR
C. $\eta$=VR/MA
D. $\eta = MA - VR$

9. What is the magnitude of the pressure a diver submerged 9 m below the surface of the water would feel? (Take Atmospheric Pressure to be 101 kPa and density of water is 1000 kg/m$^3$)

A. 11 kPa
B. 1001 kPa
C. 191 kPa
D. 91.01 kPa

10. A hydraulic machine with two pistons having circular shapes with radii of 4 cm and 52 cm is used to lift a mass of 2600 kg. Assuming that the mass is placed on the piston with larger cross section, what should be the magnitude of the force exerted on the smaller piston to lift the mass?

A. $153.85\pi$ N
B. $15.38\pi$ N
C. 153.85 N
D. 15.38 N

11. Two blocks of the same material A and B having masses m and 2m, respectively, are supplied with equal amount of heat. Then

A. the temperature of both blocks increases equally.
B. the change of temperature in block A is twice of that of B.
C. the change of temperature in block B is twice of that of A.
D. No temperature change occurs on both blocks.

12. A circular plate of aluminum sheet has a cross-sectional area of 400 cm$^2$ at a temperature of 0 °C? What is the area of the plate when its temperature raised to 100 °C (take the linear coefficient of expansion of aluminum $\alpha=2.3\times10^{-5}$ K$^{-1}$

A. 400.9 cm$^2$
B. 401.4 cm$^2$
C. 401.8 cm$^2$
D. 398.2 cm$^2$





13. Which one of the following feature of a wave is correctly described?

A. Wave length of a wave is a distance between successive crest and trough.
B. The amplitude of a wave is the distance between crest and trough.
C. The wave length is the maximum displacement of particles from their equilibrium position.
D. The frequency of a wave is the number of full waves that passes a given point per time taken.

14. Which one of the following statements explains the nature of longitudinal waves?

A. They are formed when electric and magnetic fields oscillate in perpendicular directions.
B. They comprise a series of crest and troughs.
C. They propagate parallel to the vibration of the medium.
D. They are waves that can travel trough vacuum.

15. Which one of the following physical quantities is constant in uniform circular motion?

A. Speed
B. Velocity.
C. Acceleration.
D. Force

16. What is the value of acceleration due to gravity at a height of 1000 km from the surface of the Earth?

A. 9.80 m/s$^2$
B. 10.00 m/s$^2$
C. 9.71 m/s$^2$
D. 7.31 m/s$^2$

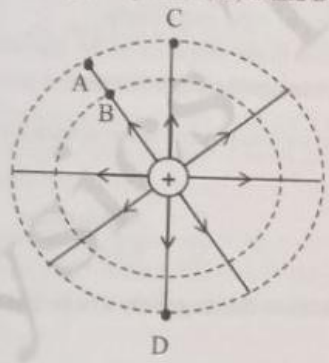
17. What is the rotational kinetic energy of a sphere, whose moment inertia is 14 $kg.m^2$, rotating at an angular velocity of 6 rad/s?

A. 36 J
B. 252 J
C. 504 J
D. 42 J

18. The region in which an electric charge experiences forces from another charge is

A. electric potential.
B. electric field.
C. electrical energy.
D. electric force.

19. The electric field lines of a positive charge are drawn as shown below in the Figure. Two circles were drawn as shown below to compare the magnitude of electric filed strength at point A, B, C and D.



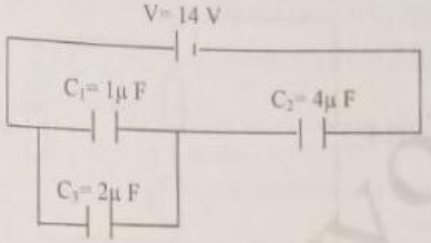

Which one of the following statement describes correctly the strength of electric field at the points given?

A. C and D have equal electric field strength.
B. A and B have equal electric field strength.
C. B and C have equal electric field strength.
D. B and D have equal electric field strength.





20. Three capacitors, $C_1 = 1\ \mu F$ $C_2 = 4\ \mu F$ and $C_3 = 2\ \mu F$, are connected to a 14 V battery as shown in the figure below.




How much total charge will be stored in the capacitors?

A. 22.12 μ C
B. 24.00 μ C
C. 1.71 μ C
D. 12.00 μ C

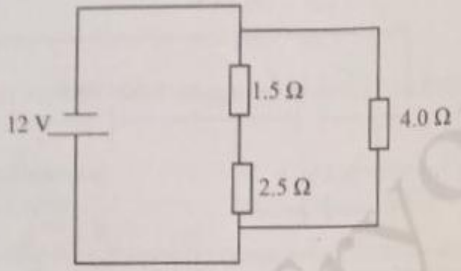
21. Consider a 10 m long rubber and a 10 m long copper wire with similar cross sectional area. Which of the following statement explains the relationship between their resistivity and conductivity?

A. Unlike copper, rubber does not have good conductivity due to its low resistivity.
B. Unlike rubber, copper is highly conducting due to its high resistivity
C. Since both copper and the rubber have the same length and cross sectional area, their resistivity is the same.
D. Even though the cross sectional area of rubber and copper is the same, their conductivity is different.



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22. Three resistors of resistances 1.5 Ω, 2.5 Ω and 4.0 Ω, are connected to a 12 V battery as shown in the figure below.




How much current will flow in 4.0 Ω resistor?

A. 2 A
B. 3 A
C. 1 A
D. 2.5 A

23. A solenoid with 100 turns of wire has a length of 2 m and it carries a current of 0.5 A. What is the magnitude of the magnetic field at the center of the solenoid?

A. $2\pi \times 10^{-5}$ T
B. $2\pi \times 10^{-7}$ T
C. $\pi \times 10^{-5}$ T
D. $4\pi \times 10^{-7}$ T

24. Consider a charge, q, moving at a speed of v perpendicular to a magnetic field of strength B. What will happen to the new magnetic force, F, if the speed of the charge is doubled?

A. half of the original
B. double of the original
C. square of the original
D. the same as the original





25. A student wants to build a simple transformer and wrapped two wires on the top half and bottom half of an iron rod. The top wire was connected to an a.c voltage supply. Which of the following can occur in the transformer?

A. Self-inductance of the wire wrapped on top will magnetize the wire in the bottom of the rod.
B. The top wire will magnetize the iron rod and an alternating current will be induced in the lower wire.
C. Magnetic field will be induced in the lower wire that will magnetize the iron rod.
D. The amount of electric current in the lower wire is zero as its biasing voltage is zero.

26. Which one of the following statements is true about the conductivity of a doped silicon semiconductor?

A. If silicon is doped with boron, the majority carriers are free electrons.
B. If silicon is doped with boron, the majority carriers are holes.
C. If silicon is doped with Arsenic, the majority carriers are holes.
D. If silicon is doped with Arsenic, the number of free electrons and holes are equal.

27. Which one of the following statements is true about a doped semiconductor?

A. In an n-type semiconductor, the majority carries are electrons while the minority carriers are holes.
B. An n-type silicon semiconductor can be produced by doping it with group III elements.
C. In n and p-type semiconductors, the concentrations of holes and electrons are the same.
D. An arsenic doped silicon semiconductor is a p-type semiconductor.

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28. Two mirrors make an angle of 90° with each other. A ray is incident on the horizontal mirror at an angle of 65° to the normal. Find the angle the ray makes with the normal to the vertical mirror after it is reflected from both mirrors.

A. 35° C. 75°
B. 25° D. 65°

29. An iron bar partially submerged in water appears to be bent, what explains the reason behind this phenomenon?

A. When the iron is submerged in water it gets rusted and starts to bend.
B. The angle of reflection of light from the iron bar is different in different medium.
C. Since water and air have different indices of refraction, the light from the air gets refracted as it passes though the water.
D. As light is scattered from the surface of the metal, it will appear that the metal in water is bent.





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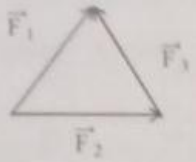
30. Five students walking around their school wanted to check their weights on a balance placed on the side of the road. The reading of the balance and the true weight of students are given in the table shown below.

| Students | Student 1 | Student 2 | Student 3 | Student 4 | Student 5 |
|---|---|---|---|---|---|
| Measured weights (kg) | 48 | 52 | 46 | 50 | 40 |
| True Weights (kg) | 46 | 50 | 44 | 48 | 38 |

What can you say about the difference between their true weights and their weights measured on the balance? The errors in their weights measured by the balance are

A. random.
B. both random and systematic.
C. systematic
D. different for the first and the last students.

31. Three vectors $\vec{F}_1$, $\vec{F}_2$, and $\vec{F}_3$ are drawn on a scale as shown in the figure below




Which one of the following equations describes the relationship between the three vectors?

A. $\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$
B. $-\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$
C. $\vec{F}_1 - \vec{F}_2 + \vec{F}_3 = 0$
D. $\vec{F}_1 + \vec{F}_2 - \vec{F}_3 = 0$

32. A rabbit was hopping on a big field toward a carrot pile which was placed at 20 m to the positive x-direction and 7 m to the negative y-direction from its starting point. Which of the following displacement vector, $\vec{S}$, represents her motion?

A. $\vec{S} = (20\,\hat{i} + 7\,\hat{j})$ m
B. $\vec{S} = (7\,\hat{i} + 20\,\hat{j})$ m
C. $\vec{S} = (-20\,\hat{i} + 7\hat{j})$ m
D. $\vec{S} = (20\,\hat{i} - 7\,\hat{j})$ m

33. Which one of the following statements defines the term reference frame?

A. A physical body on which a coordinate axis fixed to measure the motion of other body.
B. A boundary of physical body in which a body moves freely and for bodies to get out from there.
C. A coordinate which attached on a body whose motion is observed.
D. A coordinate on which all moving bodies at any velocity appear to the stationary.





34. A race car starting from rest accelerated at a constant rate of 4 m/s$^2$. What will be the velocity of the car after travelling a distance of 20 km?

A. 200 m/s.
B. 400 m/s
C. 200 m/s
D. 400 m/s

35. A ball thrown horizontally with a speed of 5 m/s from the top of a 20 m high building hit the ground after a time t. What will be the horizontal distance from the base of the building to the point it hits the ground? (Neglect air resistance)

A. 10 m
B. 50 m
C. 5 m
D. 100 m

36. What is the difference between uniform and non-uniform circular motions?

A. Direction of the acceleration is constant in uniform circular motion but not in non-uniform circular motion.
B. Speed is constant in uniform circular motion but not in non-uniform circular motion.
C. The velocity of a body in a uniform circular motion is constant but not in non-uniform motion.
D. acceleration is zero in uniform circular motion but non-zero constant in non-uniform circular motion.

37. One Newton force produces

A. a velocity on 1 m/s$^2$ on 1 kg object.
B. a velocity of 1 m/s on 1 kg object.
C. a displacement of 1 m/s on second
D. a speed of 1m/s on 1 kg object

38. Impulse (I) of an object of mass, m is defined as the product of the net force (F) exerted on an object during collision and the time of contact (Δt). Using Newton's second law, how will the change in momentum (Δp) and impulse (I) of the object relate?

A. $\Delta p = \frac{I}{\Delta t}$
B. $\Delta p = mI$
C. $\frac{\Delta p}{\Delta t} = I$
D. $\Delta p = I$

39. A car is turning in a circle of radius 25 m on a wet road with coefficient of static friction 0.20. What should be its maximum speed to turn without sliding out of control?

A. $25\sqrt{2}$ m/s
B. $5\sqrt{2}$ m/s
C. 50 m/s
D. $50\sqrt{2}$ m/s

40. A student is asked to carry a box full of 25 grade-10 physics text books each weighing 5 N up a stair of height 20 m. The amount of work done by the student is

A. equivalent to the energy transferred to the box.
B. higher than the energy transferred to the box.
C. lower than the energy transferred to the box.
D. the ratio of the force the student exerted to lift the weight to the height of the stairs.





41. A ball is dropped from a building of height, *h*. The kinetic energy of the ball (Neglect air resistance)

A. is maximum at its maximum height.
B. just before it hits the ground is equal to its potential energy when it is dropped.
C. and the potential energy of the ball are equal when it hits the ground.
D. and the potential energies of the ball cannot be equal any time during its flight.

42. An airplane propeller slows from an initial angular speed of 12.5 rev/s to a final angular speed of 5.00 rev/s at a constant angular acceleration. During this process, the propeller rotates through 21.0 revolutions. What is the angular acceleration of the propeller?

A. $-6.25\pi$ rad/s$^2$
B. $0.36\pi$ rad/s$^2$
C. $-0.36\pi$ rad/s
D. $-7.44\pi$ rad/s$^2$

43. A 10 kg disk of radius 1 m is accelerated by an applied torque of 40 Nm. What is the magnitude of its angular acceleration? (use $I = \frac{1}{2}MR^2$ for disc)

A. 4 rad/s$^2$
B. 5 rad/s$^2$
C. 8 rad/s$^2$
D. 0.25 rad/s$^2$

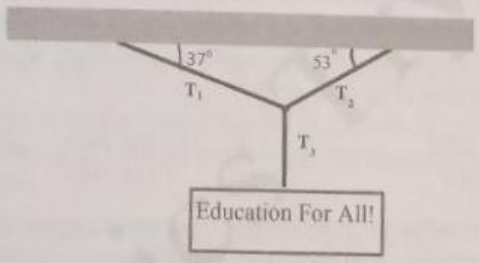
44. The law of conservation of angular momentum states that the angular momentum of a body remains constant, provided that

A. a constant non-zero resultant torque is applied on it.
B. there is no frictional loss.
C. the sum of the forces equal to zero.
D. the resultant torque applied to it is zero.

45. The first condition equilibrium states that states an object is in equilibrium provided that

A. the sum of all forces exerted on an object is zero.
B. the sum of all forces exerted on an object is non-zero.
C. the sum of all torques exert on the object is zero.
D. the net torque applied on the object is non-zero constant.

46. A big post weighing 50 N is hanging from a vertical cable tied to two other cables that are fastened to a support as shown in the Figure below. The upper cables make angles of 37° and 53° with the horizontal.




Find the tension in each of the three cables.

A. $T_1 = 40$ N, $T_2 = 50$ N $T_3 = 20$ N
B. $T_1 = 30$ N, $T_2 = 40$ N $T_3 = 50$ N
C. $T_1 = 40$ N, $T_2 = 50$ N $T_3 = 30$ N
D. $T_1 = 40$ N, $T_2 = 30$ N $T_3 = 50$ N





47. A type of fluid flow where there is disruption to layer fluid in which the velocity of the fluid at any point is continuously changing both in magnitude and direction is rate is changing is

A. laminar flow.
B. stream line.
C. turbulent flow.
D. incompressible flow.

48. A brass slab of cross-sectional area $8 \times 10^{-4}$ m$^2$ and a length of 1.5 m has a temperature difference of 70 °C across its length. If the thermal conductivity of brass is 109 W/mK. What is the rate at which heat flows?

A. 2.16 W
B. 0.406 W
C. 4.06 W
D. 21.6 W

49. Which one of the following concepts of physics is not used in mechanical engineering?

A. Aerodynamics
B. Molecular dynamics
C. Thermodynamics
D. Mechanics

50. A student is given an assignment to do a simple survey on the birds that enter a nest on a tree far from his house in a single day. Which one of the following statements is correct about his survey?

A. He can count the number of red birds entering the nest at night using infra-red camera.
B. He can use binoculars to count the number of bird entering the nest both during the day and at night.
C. He can use binoculars during the day and infra-red cameras at night to determine both the number and colors of the birds entering the nest.
D. He can use binoculars during the day and infra-red cameras at night to count the number of bird but he cannot be sure about their colors.

51. A relief airplane drops packages of wheat to the people in need. The plane was travelling horizontally at 20 m/s at a height of 80 m above the ground. What will be the horizontal and vertical components of the velocity of the package just before it hits the ground? (Neglect air resistance)

A. $V_x = 0\ m/s$ and $V_y = 4\ m/s$
B. $V_x = 20\ m/s$ and $V_y = 40\ m/s$
C. $V_x = 20\ m/s$ and $V_y = 20\ m/s$
D. $V_x = 20\ m/s$ and $V_y = 80\ m/s$

52. A bead rotating in a circle of radius, r, covers a distance of, s while sweeping out an angle of '$\theta$' in time 't'. The bead's angular velocity is

A. $\frac{s}{t}$ C $\frac{r\theta}{t}$
B. $\frac{\theta}{t}$ D. $\frac{r}{t}$

53. Three forces were acting on a particle rotating around a circle at a fixed axis. If the torque by the three forces is doubled, the angular acceleration will be

A. halved. C. remains constant.
B. doubled. D zero

54. What will be the cause of pressure in fluids?

A. The tangential force acting on the fluid layers.
B. The normal force acting on the fluid layers.
C. Both the tangential and the normal forces acting on the fluid layers.
D. Neither the tangential nor the normal forces actin on the fluid layers.





55. An athlete takes his nap on a bed of nails after a long training. How is it possible? Because

A. he has strong skin.
B. his weight is distributed over all the nails in the bed reducing the pressure on the athlete.
C. his weight is distributed over all the nails in the bed increasing the pressure on the athlete.
D. the nails are not sharp.

56. A hose is pointed straight up, with water flowing from it at a steady volume flow rate and reaching a maximum height of h. Neglecting air resistance, which of the following adjustments to the nozzle will result in the water reaching a height of 4h? Decrease the area of the opening by a factor of

A. 1/16 C. 1/4.
B. 1/8 D. 1/2.

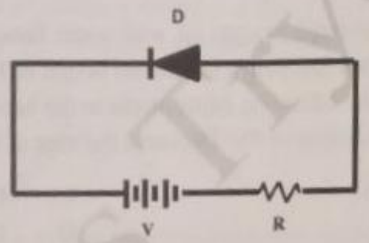
57. A student is building an electromagnet by wrapping a wire around a coil. What is true about the electromagnet?

A. There will be magnetic field in the electromagnet even though the current flowing through the wire is zero.
B. The source of the magnetic field in the electromagnet is the earth's magnetic field.
C. The electromagnet will have magnetic field when there is a current flowing thorough the wire.
D. The electromagnet will retain its magnetic property when the current is off.

58. A 100 turn coil is wrapped in a square frame of length, 10 cm, with each turn having the area of the frame. The square frame is placed in XY plane, when a magnetic-field that decreases from 0.5 T to 0 T in 0.2 s is turned on perpendicular to it. If the resistance of the coil is 2.5 Ω, how much electromotive force will be generated?

A. 0.025 V
B. 2.500 V
C. 5.000 V
D. 0.500 V

59. A student biased a pn-junction diode with a battery as shown in the Figure below.




What will happen when he reverses the terminals of the battery?

A. The width of depletion layer of the diode increases.
B. The amount of current that flows through the diode is almost zero.
C. There will be low resistance to the flow of current.
D. The width of the depletion layer remains the same.





60. A video stored in a CD can be played using a computer. How is the stored?

A. The pictures are changed into a continuous signal that corres each color.
B. The pictures are changed into a series of 0s and 1s when they stored.
C. The pictures are represented as analog signal to represent eac
D. The pictures are stored as varying sinusoidal signals.

The End



Physics Tryout

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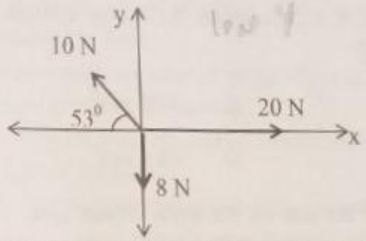
| Name of constants | Symbol | Value |
|---|---|---|
| Acceleration due to gravity | G | 10 $m/s^2$ |
| Mass of proton | $m_p$ | $1.67 \times 10^{-27}$ kg |
| The charge of electron | e | $1.6 \times 10^{-19}$ C |
| Mass of electron | $m_e$ | $9.11 \times 10^{-31}$ kg |
| Universal gravitational constant | G | $6.67 \times 10^{-11}$ $Nm^2/kg^2$ |
| Mass of the Earth | $M_E$ | $6 \times 10^{24}$ kg |
| Radius of the Earth | $R_E$ | $6.4 \times 10^{6}$ m |
| Density of water | $\rho$ | 1000 $kg/m^3$ |
| Molar gas constant | R | 8.314 J/mol.K |
| permittivity of vacuum | $\varepsilon_o$ | $8.85 \times 10^{-12}$ F/m |
| Magnetic permeability of free space | $\mu_o$ | $4\pi \times 10^{-7}$ Tm/A |
| Coulomb's constant | K | $9 \times 10^{9}$ $Nm^2/C^2$ |
| Planck's constant | h | $6.63 \times 10^{-34}$ Js |
| $\sin 30^\circ = \cos 60^\circ = 0.5$ | | |
| $\sin 60^\circ = \cos 30^\circ = 0.87$ | | |
| $\sin 37^\circ = \cos 53^\circ = 0.6$ | | |
| $\sin 53^\circ = \cos 37^\circ = 0.8$ | | |





SUBJECT CODE: 04 BOOKLET CODE: 015

1. The figure below shows three forces that act on an object.




The magnitude and direction of the resultant of these forces are respectively_____.

A. 27.2 N and $31.6^0$ from the positive x-axis
B. 14 N and positive x-axis
C. 21.3 N and $31.6^0$ from the positive x-axis
D. 16 N and positive y-axis

2. An object is thrown upward from a 5.95 m high tower with a speed of 5 m/s. What is the magnitude of the object's velocity when it hits the ground?

A. 5 m/s C. 10.9 m/s
B. 9.7 m/s D. 12 m/s

3. Suppose an object placed on horizontal rough surface is pulled horizontally. Static friction force is
   A. equal to the maximum value of frictional force between the object and the surface.
   B. occurs when an object starts sliding over the surface.
   C. occurs when the object is trying to move on the surface, but not yet moving.
   D. drops in magnitude when the pulling force that acts on the object increases.

4. A rocket of mass 20,000 kg is fired vertically upward. The engine of the rocket provides 230,000 N to accelerate the rocket upward. What is the acceleration of the rocket?

A. $1.5\ m/s^2$
C. $11.5\ m/s^2$
B. $10\ m/s^2$
D. $21.5\ m/s^2$

5. Uneven heating effect of the sun on the earth creates areas of higher and lower pressure on the earth's surface. This is used to get

A. wind energy.
C. solar energy.
B. geothermal energy.
D. hydro electrical energy.

6. An object of weight $W_1$ is placed on the surface of inclined plane whose weight is $W_2$, base length b and height h. There is a friction force $F_f$ that exerts between the surface of the inclined plane and the object. Which one of the following expressions correctly represents the actual mechanical advantage of the inclined plane?

A. $\frac{W_1}{W_1+F_f}$
C. $\frac{W_2}{W_1\left(\frac{h}{\sqrt{b^2+h^2}}\right)+F_f}$
B. $\frac{W_1}{W_2\left(\frac{b}{h}\right)+F_f}$
D. $\frac{W_1}{W_1\left(\frac{h}{\sqrt{b^2+h^2}}\right)+F_f}$







7. Archimedes principle states that

A. the apparent weight of a body is less than its weight when the body is immersed in fluid.
B. the buoyant force exerted on a body immersed in a fluid is equal to the weight of the fluid displaced.
C. the buoyant force exerted on a body immersed in a fluid is equal to the weight of the body.
D. when a body is immersed fully or partially in a fluid, its apparent weight is equal to the buoyant force.

8. Which one of the following statements is best to explain the abnormal expansion of water?

A. As water cools from 10 °C to 0 °C, the intermolecular distance deceases, the force between the water molecules increases and its density increases.
B. At 4 °C, water has maximum density because of the intermolecular force between hydrogen and oxygen atom is very weak.
C. As water cools down from 4 °C to 0 °C, the space between water molecules gets larger and larger that gives smaller water density.
D. As the water cools down from higher temperature to 4 °C, water particles loss energy and become closer to each other that gives the increase in its density.

9. An 80 gm metal is heated to a temperature of 98 °C and immediately immersed in 150 gm of water at 15 °C. The temperature of the water rose to 23.5 °C after the metal is immersed. What is the specific heat capacity of the metal?

A. 2495.4 J/kg k
B. 898.5 J/kg k
C. 683.04 J/kg k
D. 1888.4 J/kg k

10. A sound wave that travels at speed of 340 m/s has a wavelength of 17 m. What is the period of the wave?

A. 20 s
B. 50 s
C. 0.5 s
D. 0.05 s

11. Which one of the following statements is **NOT** an application of the reflection or refraction of sound waves?

A. Refraction of sound wave is used to measure the depth of the sea.
B. A SONAR working principle is based on the reflection of sound waves.
C. Refraction of sound wave is the main source for hearing differences during day and night.
D. Ultrasound machine works on the principle of reflection of sound.

12. Which of the following statements is correct about distance and displacement?

A. Distance is a vector physical quantity, while displacement is a scalar quantity.
B. Both distance and displacement are scalar physical quantities.
C. Both distance and displacement are vector physical quantities.
D. Distance is a scalar physical quantity, while displacement is a vector quantity.





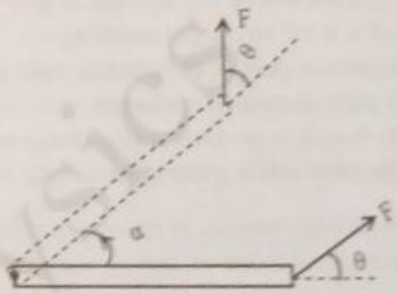
13. An object is released from a 5.0 m high building. With what speed it strike the bottom floor of the building?

A. 5.0 m/s
B. 2.5 m/s
C. 10 m/s
D. 20 m/s

14 The wave equation is state that the speed of a wave is

A. equal to the product of the frequency and wave length of the wave.
B. equal to the product of the period and wave length of the wave.
C. equal to the ratio of the wavelength to the frequency of the wave.
D. equal to the ratio of the frequency to the wavelength of the wave.

15. A beam of length L laying on a horizontal frictionless surface is pivoted at its one end. At its free end, a force of magnitude F acts horizontally at an angle θ with the beam.




If the beam rotates about the fixed end by an angle α, the work done on the beam is

A. FLα sin θ
B. FLα.
C. FLθ sin α
D. FLθ.

16. A 100 kg satellite is launched to a height of 200 km above the surface of the Earth. The mean radius of the earth is $6.4 \times 10^8$ m and its mass is $6.0 \times 10^{24}$ kg. What is the period of the satellite as it rotates around the Earth at the stated height?

A. $8.64 \times 10^5$ s
B. $5.10 \times 10^6$ s
C. $3.94 \times 10^{12}$ s
D. $2.25 \times 10^6$ s

17. Suppose a positively charged glass rod is brought near to a neutral metal sphere held on an insulating support. The same glass rod then brought to a piece of paper. Which one of the following phenomenon's will **NOT** happen?

A. If the metal sphere is grounded, it will be charged negatively after the rod removed.
B. The piece of paper will be first attracted by the rod and then detached from the rod as it will be charged positively.
C. The metal sphere is charged by induction when it is grounded, while the piece of paper charged by conduction
D. Charging by induction produces similar charge to the charging body and hence the metal sphere is charged positively, when it is grounded.

18. A capacitor with a dielectric between its plates is charged by a DC source. If the DC source is now disconnected and then the dielectric is removed,

A. the charge stored on the plates and the electric fields between the plates decrease.
B. the potential difference and electric field between the plates increase.
C. the capacitance and charge stored on the plates decrease.
D. the potential difference between the plates and energy stored on the capacitor decrease.





19. Suppose that you are given two conducting wires A and B. The resistivity of wire A is 0.75 times the resistivity of wire B. The two wires have the same length, but the diameter of wire B is 0.75 time diameter of wire A. The ratio of the resistance of wire A to the resistance of wire B is

A. 0.42.
B. 0.75.
C. 1.33.
D. 2.38.

20. Your teacher provided you the following materials and equipment: unknown resistance of resistance R, variable resistance $R_L$, ammeter, voltmeter, power source, and connecting wires of negligible resistance. Now, you are requested to determine the resistance R experimentally at constant temperature. Which one of the following procedure is **NOT** helpful to determine R in your experiment?

A. Connecting the power supply, the ammeter, the unknown resistor and the voltmeter all in series
B. Connecting the power supply, the ammeter, the unknown resistor and the variable resistor all in series and the voltmeter parallel to the unknown resistor R
C. By varying the value of $R_L$, measure the potential drop across R and the current through the circuit
D. Determining the resistance R from the inverse slope of the current against potential drop

SUBJECT CODE: 04 BOOKLET CODE: 015

21. A diode is

A. an electronic device with three terminals that allows current when it is in forward bias.
B. an electronic component with three terminals that allows current when light shone on it.
C. a semiconductor device with high resistance and its resistance depends on temperature.
D. an electronic component with two terminals that allows current in one direction.

22. A generator produces 150 A current at 2000 V. The voltage is stepped up to $4 \times 10^4$ V by a transformer before sent to a higher voltage transmission line. What is ratio of the number of turns of the coil in the output to the number of turns of the coil in the input?

A. 13
B. 20
C. 0.05
D. 267

23. A charged particle of charge q and mass m enters into a uniform magnetic field intensity B. The particle has a speed v and set into a circular path of radius R by a magnetic force of magnitude F. The magnetic field intensity B is given by

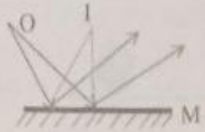
A. $\frac{F}{qvR}$.
B. $\frac{mv^2}{qR}$.
C. $\frac{mv}{qR}$.
D. $\frac{F}{mv^2}$.

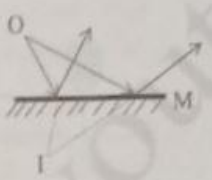


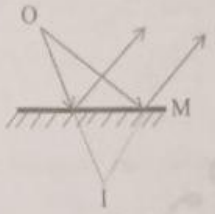


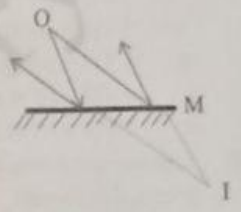
SUBJECT CODE: 04 BOOKLET CODE: 015

24. Among the following diagrams, which one correctly describes the construction of image by a plane mirror? (O for object, I for image and M for mirror)

A. 


C. 


B. 


D. 

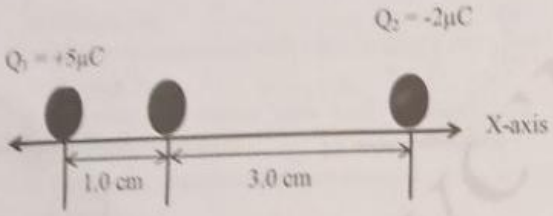

25. An object of 20 cm in height is placed at a distance of 20 cm in front of a concave mirror of focal length 10 cm. What is the magnification of the image formed?

A. 2
B. 1
C. 0.5
D. 20

26. A grind stone increases its angular speed from 2.0 rad/sec. to 10 rad/sec. in 4 sec. Through what angle does it turn during that time if the angular acceleration is constant?

A. 32 rad.
B. 16 rad.
C. 24 rad.
D. 8 rad.

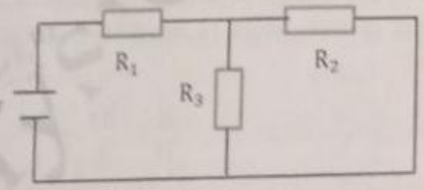
27. Two charges separated by 4.0 cm are placed on the x-axis, as shown. (Use $K = 9 \times 10^9\ Nm^2C^{-2}$)




What is the net force on the charge, $Q_3$ placed at 1.0 cm from $Q_1$?

A. $1.410 \times 10^3$ N to the +x axis
B. $1.575 \times 10^8$ N to the + x axis
C. $1.410 \times 10^2$ N to the - x axis
D. $1.575 \times 10^8$ N to the – x axis

28. Consider the following circuit. The resistors are connected to the source of potential difference, V.




Neglecting the internal resistance of the source, which of the following describe the equivalent resistance $R_{eq}$ of the circuit?

A. $R_{eq} = \frac{R_1R_2 + R_1R_3 + R_2R_3}{R_2 + R_3}$
B. $R_{eq} = \frac{R_1R_2 + R_1R_3}{R_2 + R_3}$
C. $R_{eq} = \frac{R_2 + R_3}{R_1R_2 + R_1R_3 + R_2R_3}$
D. $R_{eq} = \frac{R_1R_2 + R_2R_3}{R_1 + R_2}$







29. Semiconductors differ from metal conductors in that

A. their resistance increases greatly as their temperature goes up.
B. their resistance falls greatly as their temperature goes up.
C. few electrons (charge carriers) have more energy to break free when the temperature raises.
D. more electrons (charge carriers) have more energy to break free when the temperature falls.

30. Almaz and Fatuma are grade 11 students. Their physics teacher provided them two meter rule to measure the length of physics book in which the true value of the length of the book is 29 cm. Both students take the reading five times as tabulated in the table below.

| Student | Reading in cm | | | | |
|---|---|---|---|---|---|
| | First | Second | Third | Fourth | Fifth |
| Almaz | 29.3 | 29 | 28.9 | 29.1 | 28.8 |
| Fatuma | 29.3 | 29.2 | 29.1 | 29.3 | 29.3 |

What can be concluded from the measurements performed by the students?

A. Fatuma's measurement shows a systematic error.
B. The meter used by Almaz has calibration problem.
C. Fatuma's measurement shows a random error.
D. Almaz's measurement shows a systematic error

31. A displacement vector $\vec{r}$ is given by $\vec{r} = 4\hat{i}+2\hat{j}+\sqrt{5}\hat{k}$. Which one of the following represents a unit vector in the direction of $\vec{r}$?

A. $\vec{r} = \hat{i}+\hat{j}+\hat{k}$

B. $\vec{r} = \frac{1}{5}(4\hat{i}+2\hat{j}+\sqrt{5}\hat{k})$

C. $\vec{r} = 5(\hat{i}+\hat{j}+\hat{k})$

D. $\vec{r} = 4\hat{i}+2\hat{j}+\sqrt{5}\hat{k}$

32. Which one of the following pair of vectors is collinear?

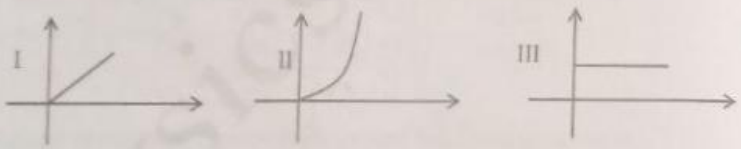
A. $\vec{r}_1 = 4\hat{i}+2\hat{j}, \vec{r}_2 = 2\hat{i}+4\hat{j}$

B. $\vec{r}_1 = 3\hat{i}+3\hat{j}, \vec{r}_2 = 2\hat{i}-2\hat{j}$

C. $\vec{r}_1 = 3\hat{i}+6\hat{j}, \vec{r}_2 = 2\hat{i}+1\hat{j}$

D. $\vec{r}_1 = 6\hat{i}+3\hat{j}, \vec{r}_2 = 4\hat{i}+2\hat{j}$

33. Suppose three graphs shown below are representations of quantities of an object that is uniformly accelerated in a straight line.




Which one of the following statements is **NOT** correct about the graphs?

A. Graph I represents acceleration versus time graph.

B. Graph II represents displacement time graph.

C. Graph III represents acceleration time graph.

D. The slop of graph I give acceleration.





34. Suppose two satellites of different masses are launched from the surface of the earth and revolve around the earth at different orbital radiuses. Which one of the following statements is correct about the motions of the two satellites?

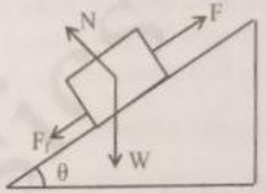
A. A satellite with heavier mass takes longer time to make one revolution around its orbit.

B. A satellite with heavier mass is launched with larger speed.

C. A satellite with smaller orbital radius revolves with larger orbital velocity.

D. A satellite with larger orbital radius is launched with larger speed.

35. The frictional force ($F_f$), the applied force ( F) and the normal force that act on a block of weight (W), which is placed on inclined plane, are shown in the figure below.




The block moves upward when the applied force F is greater than or equal to

A. $F_f$

B. $F_f+W\cos\theta$.

C. $F_f+W\sin\theta$.

D. $F_f+N\sin\theta$.

36. An object of mass m moves with a velocity $v_1$ towards a positive x axis. Constant force acting for t time interval on the object changes the object's velocity to $v_2$ in the positive y axis. The magnitude of the force acting on the object is given by_____.

A. $\frac{m}{t}(v_2-v_1)$

B. $\frac{m}{t}(v_2+v_1)$

C. $\frac{m}{t}\sqrt{v_2^2+v_1^2}$

D. $\frac{m}{t}\sqrt{v_2^2-v_1^2}$

37. Two forces $F_1$ and $F_2$ exerting on different blocks of masses $m_1$ and $m_2$, respectively do equal amount of work. $F_1$ moves $m_1$ through a horizontal distance $S_1$ and $F_2$ moves $m_2$ through a horizontal distance $S_2$. Both blocks are initially at rest and have speeds of $v_1$ and $v_2$ at the end of their motion. Which one of the following statement is correct about the blocks?

A. If $F_1$ is greater than $F_2$, then $v_1$ is greater than $v_2$.
B. If $S_1$ is greater than $S_2$, then $F_1$ is greater than $F_2$.
C. The ratio of $m_1$ to $m_2$ is equals to $v_2^2/v_1^2$.
D. The ratio of $F_1$ to $F_2$ is equals to $s_1/s_2$.

38. Mechanical energy is conserved during

A. oscillation of mass-spring system on smooth horizontal surface.
B. a trolley moves around a curved path from point P to again back to the same point.
C. a swimming in 100 m wide swimming pool.
D. jumping from a height of 20 m bridge under resistive force.





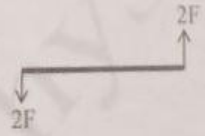
39. A grindstone rotates at a constant angular acceleration of 0.5 rad/s$^2$. Then a constant force is applied to the grindstone and after 20 s it has angular speed of 15 rad/s. What was its angular speed at time t = 0 s?

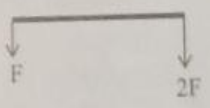
A. Zero
B. 0.5 rad/s
C. 10 rad/s
D. 5 rad/s

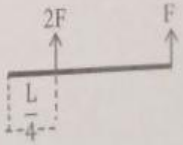
40. Parallel-axis theorem states that Rotational Inertia I of a body about any axis that is parallel to the axis about the center of mass is

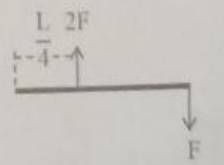
A. the sum of the moment of inertia about the center of mass plus the product of the mass and the square of the distance between the axes.
B. the sum of the moment of inertia about the center of mass and half of the product of the mass and the square of the distance between the axes.
C. the sum of the moment of inertia about the center of mass and the product of the mass and half of the distance between the axes.
D. equal to the moment of inertia about the center of mass.

41. Suppose a uniform bar of length L and weight W lies in a horizontal position. Which one of the following diagrams shows that the body is in a rotational equilibrium?

A.



C.



B.



D.


SUBJECT CODE: 04 BOOKLET CODE: 015

49. Electromagnetism is related to electrical and electronics engineering. However, one of the following does **NOT** acknowledge this view.

A. Electrical engineering involves designing electrical circuits including motors.
B. Electronic appliances, optical fibers networks, computers, and communication links are designed by electrical engineers.
C. Electrical engineers often need to convert electrical energy to other forms of energy.
D. Electrical engineers need no knowledge of magnetism and thermodynamics for their entire discoveries.

50 A football player kicked a ball from a level ground at an angel θ to the horizontal with speed $v_0$. If the acceleration due to gravity at the place is g, then the horizontal range of the projectile would be

A. $\frac{v_0^2 \cos 2\theta}{g}$ C. $\frac{v_0^2 \sin 2\theta}{g}$

B. $\frac{v_0 \cos 2\theta}{g}$ D. $\frac{v_0^2 \sin^2 \theta}{2g}$

51. Nowadays, electronics is getting wide-reaching applications in various sectors. Which one of the following is **NOT** a correctly identified pairing between the so-far state of application of electronic device and the sector where it is used?

A. MRI Machines in medical sectors
B. Satellite power supplies in Aerospace industry
C. Air conditioner or dryer in Residential areas
D. Rainfall preventers in Meteorology sector





SUBJECT CODE: 04 BOOKLET CODE: 015

52 Gravitational force exerted by an unknown mass M on a 4 kg mass is measured to be $6.4\times10^{-9}$ N. If the two masses are 50 cm apart, how large is mass M?

A. 12 kg C. 4 kg
B. 6 kg D. 2 kg

53 Which one of the following statements is correct about the three states of matter?

A. Constituent molecules of gases are the closest of all.
B. Intermolecular force in liquids is the strongest of all.
C. Constituent molecules of solids interact with strongest force.
D. Liquids can easily change their volume on compression.

54 To be safe from the risk of high pressure gas cylinders, which one of the following is **NOT** recommended?

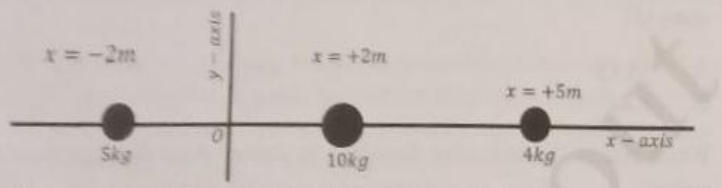
A. Keeping a gas cylinder in horizontal position to avoid the gas to raise up.
B. Educate people around you on gas cylinder safety.
C. Make sure that there are no inflammable materials near the gas cylinder.
D. Store gas cylinders where they are protected from damage.

55 If the magnetic field lines are denser in a certain region than in other region, then,

A. the intensity of the magnetic field in the region is smaller than in the other regions.
B. it can exert a larger force on a charge at rest in the region than in the other regions.
C. the source of magnetic field could be an isolated magnetic pole.
D. it can exert a larger force on a charge moving in the region than in the other regions

SUBJECT CODE: 04 BOOKLET CODE: 015

56. Three particles are connected by rigid rods of negligible mass along the x-axis as shown in figure.



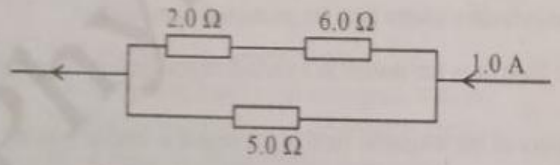

If the system rotates about the y-axis, what would be the moment of inertia about the y-axis?

A. 50 kgm$^2$
B. 100 kgm$^2$
C. 140 kgm$^2$
D. 160 kgm$^2$

57. A positively charged particle carries a charge of 12.0 μC. What is the electrostatic potential at a distance of 8 cm from this charged particle?

A. $1.50 \times 10^5$ V
B. $1.35 \times 10^6$ V
C. $1.69 \times 10^7$ V
D. $1.85 \times 10^{10}$ V

58. A current of 1A flows in the network of resistors shown in the figure given below.




The potential drop across a 6.0 Ω resistor is

A. 0.77 V.
B. 0.38 V.
C. 2.31 V.
D. 3.14 V.





SUBJECT CODE: 04 BOOKLET CODE: 015

59. Suppose a long straight wire of length L is coiled N times to form a solenoid of length l. If the solenoid set its axis to be lied parallel to the x-axis and a current I flow through its coil, the magnetic field produced by it

A. is proportional to N/L.
B. is uniform outside the coils and negligible inside the coils.
C. is uniform inside and outside the coils and directs to the y-axis.
D. is negligible outside the coils and uniform inside the coils.

60. Faraday's law of electromagnetic induction states that

A. the direction of the induced electromotive force is such that to oppose the change creating it.
B. the magnitude of the induced electromotive force equals the rate change of the magnetic field.
C. the magnitude of the induced electromotive force is proportional to the rate change of magnetic flux.
D. the direction of the induced electromotive force is such that to enhance the change creating it.

## The End