ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU
ADDIS ABEBA
GRADE 12 PHYSICS MODEL EXAMINATIONS
GINBOT 2013/MAY 2021

BOOKLET CODE: **SUBJECT CODE:**
NUMBER OF ITEMS: 50 **TIME ALLOWED: 2 HOURS**

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **PHYSICS** EXAMINATION. THE SUBJECT CODE FOR THIS EXAMINATION IS **( )** AND THE CODE FOR THIS PARTICULAR BOOKLET IS **( )**. PLEASE COPY THESE CODES ON YOUR ANSWER SHEET WHERE IT READS BOOKLET CODE AND SUBJECT CODE. THEN, BLAKEN THE CORRESPONDING BOXES IN THE COLUMNS BELOW EACH NUMBER.

IN THIS EXAMINATION, THERE ARE A TOTAL OF **50 MULTIPLE CHOICE ITEMS**. ATTEMPT ALL THE ITEMS. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER CAREFULLY. USE ONLY **PENCIL** TO MARK YOUR ANSWERS.

THERE IS ONLY **ONE BEST** ANSWER FOR EACH ITEM. CHOOSE THE BEST ANSWER FROM THE SUGGESTED OPTIONS AND BLAKEN THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET. YOUR ANSWER MARK SHOULD BE **HEAVY** AND **DARK**, COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY FROM YOUR ANSWER SHEETS.

YOU WILL BE ALLOWED TO MARK FOR **2 HOURS**. IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY GO BACK AND REVIEW. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, LAY YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION HALL WILL RESULT INAUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE(S).

DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

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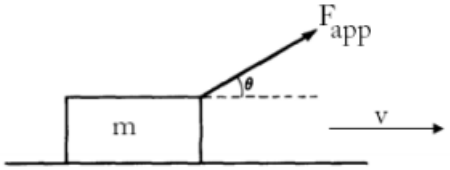
You may refer to the information given below when you need to work on some to work on some of the questions.

Name of constants	**Symbol**	**Value**
Acceleration due to gravity	g	10 m/s^2
Mass of proton	m_p	1.67×10^{-27} kg
The charge of electron	e-	1.6×10^{-19} C
Universal gravitational constant	G	6.67×10^{-11} Nm^2/kg^2
Density of water	ρ	1000 kg/m^3
Permittivity of vacuum	ε_0	8.85×10^{-12} F/M
Magnetic permeability of free space	μ_0	$4\pi \times 10^{-7}$ Tm/A
Coulomb's constant	K	9 x 109 Nm^2/C^2
Sin 26° = 0.44 and Cos 26° = 0.9		
Sin 30° = 0.5 = cos 60°		
Sin 60° = 0.87 = cos 30°		
Sin 37° = cos 53° = 0.6		
Cos 79° = 0.19, sin 79° = 0.98		
Cos 104° = -0.24, sin 104° = 0.97		

I. Each of the following questions is followed by four possible alternatives. Read each question carefully and write your answer on the space provide.

1. Random error can be eliminated by
   A. careful observation.
   B. eliminating the cause.
   C. taking large number of observations and then their mean.
   D. measuring the quantity with more than one instrument.
2. Which of the following statements regarding the scientific methods is true?
   A. Hypothesis is must be agreed upon by more than one scientist.
   B. A theory is a hypothesis that has understood with many scientific tests.
   C. A theory is proven to be true, and therefore may not be discarded.
   D. A hypothesis cannot predict the outcome of scientific experiment.
3. With respect to a rectangular Cartesian coordinate system, three vectors are expressed as $\vec{a} = 4\hat{i} - \hat{j}, \vec{b} = -3\hat{i}$ and $\vec{c} = -\hat{k}$ where, $\hat{i}, \hat{j}, \hat{k}$ are unit vectors of axis X, Y and Z then $\hat{r}$ along the direction of sum of these vector is:
   A. $\hat{r} = \frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$
   C. $\hat{r} = \frac{1}{\sqrt{2}}(\hat{i} + \hat{j} - \hat{k})$
   B. $\hat{r} = \frac{1}{3}(\hat{i} - \hat{j} + \hat{k})$
   D. $\hat{r} = \frac{1}{\sqrt{2}}(\hat{i} + \hat{j} + \hat{k})$
4. A ball is thrown vertically downward with a velocity of 20m/s from the top of a tower. It hits the ground after sometime with a velocity of 80m/s. Neglecting air resistance, which of the following is the height of a tower?
   A. 300m. B. 360m. C. 320m. D. 340m.
5. An Astronaut on the Moon simultaneously drops a bird feather and a screw driver. The fact that two objects reach the surface at the same time can be explained by which of the following?
   A. The Moon has no gravity
   B. The Moon's gravity is much weaker than the Earth's gravity
   C. The same gravitational force is applied on both objects on the Moon
   D. At the given location all objects fall with the same acceleration in the absence of air resistance.
6. A stone tied to the end of a string of 1m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magnitude and direction of acceleration of the stone?
   A. π^2 m/s^2 and direction along the tangent to the circle..
   B. π^2 m/s^2 and direction along the radius away from the Centre.
   C. π^2 m/s^2 and direction along the radius towards the Centre.
   D. $\frac{\pi}{4}$ m/s^2 and direction along the radius towards the Centre.
7. An object flying in air with velocity (20i + 25j – 12k) m/s suddenly breaks in two pieces whose masses are in the ratio 1:5. The smaller mass flies off with a velocity (100i + 35j + 8k) m/s. What will be the velocity of the larger piece?
   A. (-20i – 15j – 80k) m/s
   C. (-100i – 35j – 8k) m/s
   B. (20i + 15j – 80k) m/s
   D. (4i + 23j – 16k) m/s

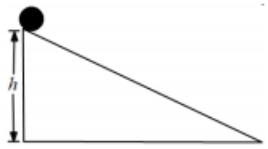
8. A block of mass **m** is pulled along a horizontal surface at constant speed **v** by a force **Fapp**, which acts at an angle of $\boldsymbol{\theta}$ with the horizontal. The coefficient of kinetic friction between the block and the surface is $\boldsymbol{\mu_k}$. The normal force exerted on the block by the surface is:



A. mg – Fapp cos(θ)
B. mg - Fapp sin(θ)
C. mg- Fapp sin(θ)
D. mg + Fapp cos(θ)

9. We can most directly derive the impulse-momentum equation from the law that states;
   A. when a net external force **(F)** acts on a mass **(m)** the acceleration **(a)** that results is directly proportional to the net force and has a magnitude that is inversely proportional to the mass.
   B. whenever one body exerts a force on a second body, the second body exerts an oppositely directed force of equal magnitude on the first body.
   C. the force of gravitation between two masses is directly proportional to the product of the two masses and inversely proportional to the separation between them squared.
   D. an object continues in a state of rest or in a state of motion at a constant speed along a straight line, unless compelled to change that state by a net force.
10. Which of the following is a wrong statement about a particle moves in a uniform circular motion?
    A. The particle moves with constant speed
    B. The acceleration is always normal to the velocity
    C. The particle moves with uniform acceleration
    D. The particle moves with variable velocity.
11. Two cyclists (Abel and Dawit) who weigh the same and have identical bicycles ride up the same mountain, both starting at the same time. Abel rides straight up the mountain, and Dawit rides up the longer road that has a lower grade. Abel gets to the top before Dawit. Ignoring friction and wind resistance, which one of the following statements is true?
    A. The amount of work done by Abel is greater than the amount of work done by Dawit, and the average power exerted by Abel is greater than that of Dawit.
    B. The amount of work done by Abel is equal to the amount of work done by Dawit, but the average power exerted by Abel is greater than that of Dawit.
    C. Abel and Dawit exerted the same amount of work, and the average power of each cyclist was also the same.
    D. The average power exerted by Dawit and Abel was the same, but Abel exerted more work in getting there.
12. Which one of the following is **NOT** a conservative force?
    A. Magnetic force
    B. Electrostatic force
    C. Gravitational force
    D. Force of friction
13. A ball falls from a height *h* from a tower. Which of the following statements is true?
    A. The potential energy of the ball is conserved as it falls.
    B. The kinetic energy of the ball is conserved as it falls.
    C. The difference between the potential energy and kinetic energy is a constant as the ball falls.
    D. The sum of the kinetic and potential energies of the ball is a constant.
14. A crane can lift a 500 kg mass to height of 30 m in 2 minutes. The power at which the crane is operating is_____ .
    A. 125 Watts
    B. 1250 Watts
    C. 7500 Watts
    D. 250,000 Watts

15. If the angular momentum of a system of particles is constant, which of the following statements must be true?
    A. The net torque is zero for the whole system.
    B. The net external torque on the system is constant.
    C. A constant torque acts on every part of the system.
    D. The net torque is zero on each part of the system.
16. A flat disk of mass M, radius R, and rotational inertia I = $\frac{1}{2}MR^2$ is released from rest at the top of an inclined plane of height h as shown in figure below.



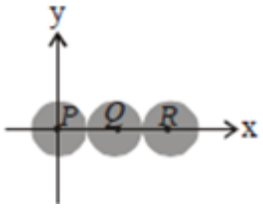
    If the plane is frictionless, what is the speed of the center of mass of the disk at the bottom of the incline?

    A. $\sqrt{gh}$ B. $\sqrt{\frac{4gh}{3}}$ C. $\sqrt{2gh}$ D. $\sqrt{3gh}$

17. The angular velocity of a rotating disk with a radius of 2 m decreases from 6 $^{rad}/_{sec.}$ to 3 $^{rad}/_{sec.}$ in 2 seconds. What is the linear acceleration of a point on the edge of the disk during this time interval?

    A. $\frac{3}{2}m/s^2$ B. $-\frac{3}{2}m/s^2$ C. $-3m/s^2$ D. $3m/s^2$

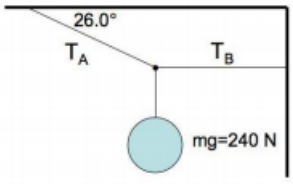
18. Three identical spheres, each of mass 1 kg are kept as shown in figure below, touching each other, with their centres on a straight line.



    If their centres are marked P, Q and R respectively, distance of centre of mass of the system from P is

    A. $\frac{PQ+PR}{3}$ B. $\frac{PQ+PR+QR}{3}$ C. $\frac{PQ+QR}{3}$ D. Zero

19. A 240-newton mass is hanging from two cords as shown in the figure below, one connected horizontally to the wall, and one making a 26.0° angle to the point where it connects to the ceiling.



The tension T_A in the cord connected to the ceiling and the tension T_B in the cord connected to the wall respectively

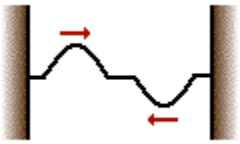
A. 492.75 N and 547.5 N
B. 273.75 N and 246.4 N
C. 246.4 N and 273.75 N
D. 547.5 N and 492.75 N

20. Which of the following is **NOT** correct with regards to static equilibrium?
    A. It is the equilibrium of a system whose parts are in motion.
    B. It refers to any system in which the sum of the forces, and torque, on each particle of the system happens to be zero.
    C. It takes place when all the forces acting on an object are balanced and the object is not in motion in relation to the relative plane.
    D. An object which is in static equilibrium is unable to move.
21. When an iron needle is slowly placed on the surface of the water, it floats because
    A. it is dependent on the shape.
    B. surface tension is responsible.
    C. the density of the material used in the needle is lesser than that of water.
    D. water is displaced which is equal to the weight of the needle.
22. A fluid is in streamline flow across a horizontal pipe of variable area of cross – section. For this which of the following statements is correct?
    A. The velocity is maximum at the narrowest part of the pipe and pressure is maximum at the widest part of the pipe.
    B. Velocity and pressure both are maximum at the narrowest part of the pipe.
    C. Velocity and pressure both are maximum at the widest part of the pipe.
    D. The velocity is minimum at the narrowest part of the pipe and the pressure is minimum at the widest part of the pipe.
23. A body of mass 1 kg is attached to one end of a wire and rotated in horizontal circle of diameter 40 cm with a constant speed of 2 m/s. what is the area of cross-section of the wire if the stress developed in the wire is 5×10^6 N/m²?
    A. 2 mm^2 B. 3 mm^2 C. 4 mm^2 D. 5 mm^2
24. Which of the following is **NOT** an application of Pascal's law?
    A. Hydraulic brakes C. Hydraulic lift
    B. Hydraulic press D. Aerodynamic lift
25. According to the Stefan-Boltzmann law of thermal radiation for a perfect radiator, the rate of radiant energy per unit area is proportional to
    A. the fourth power of the temperature of that radiator.
    B. the temperature of that radiator.
    C. the square of the temperature of that radiator.
    D. the cube of the temperature of that radiator.
26. Zeroth law of thermodynamics
    A. deals with conversion of mass and energy.
    B. deals with reversibility and irreversibility of process.
    C. states that if two systems are both in equilibrium with a third system, they are in thermal equilibrium with each other.
    D. deals with heat engines.
27. An ideal gas with an internal energy U initially 0 ℃ is heated to 273℃. What is the new internal energy in terms of U?
    A. U B. $\frac{1}{2}$ U C. $\frac{1}{4}$ U D. 2 U
28. Which of the following is a correct statement of the Second Law of Thermodynamics?
    A. The random motion of gas molecules will be decreased if energy is added to a gas.
    B. Heat will not flow spontaneously from a cold object to a hot object.
    C. There is no process that can make heat flow from a cold object to a hot object.
    D. Real heat engine can have an efficiency of greater than 100%.

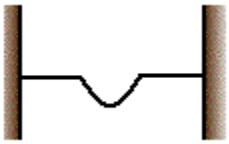
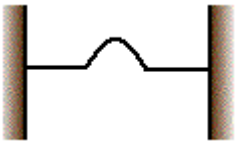
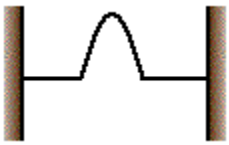
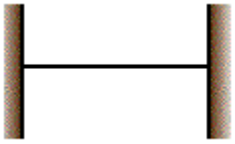
29. A mass – spring oscillating undergoes SHM with maximum amplitude A. If the amplitude is doubled what effect will it produce on the mechanical energy of the system?

    A. The energy is increased by factor two.
    B. The energy is decreased by factor four.
    C. The energy is increased by factor four.
    D. It doesn't affect the energy.

30. Two pulses are traveling in opposite directions along the same medium as shown in the diagram below.

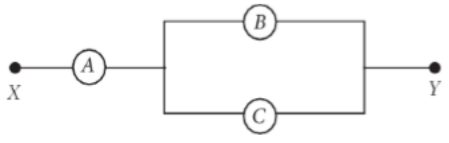


    Which diagram below best depicts the appearance of the medium when each pulse meets in the middle?

    A. 
    C. 
    B. 
    D. 

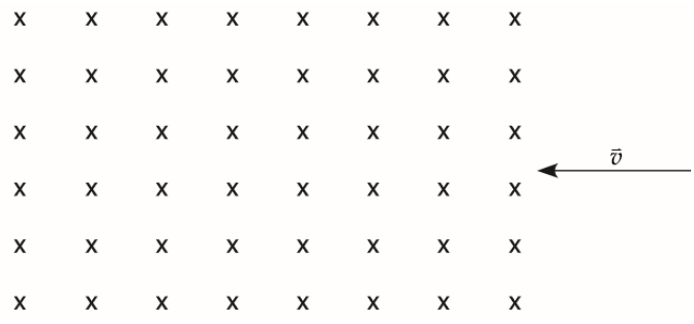
31. A source emits sound with a frequency of 1000Hz. It and an observer are moving in the same direction with the same speed, 100m/s. If the speed of sound is 340m/s, the observer hears sound with a frequency of:
    A. 545 Hz B. 1830 Hz C. 1000 Hz D. 3400 Hz
32. A long string is constructed by joining the ends of two shorter strings. The tension in the strings is the same but string I (one) has 4 times the linear density of string II (two). When a sinusoidal waves passes from I (one) to string II (two)
    A. The frequency decreases by a factor of 4
    B. The frequency decreases by a factor of 2
    C. The wavelength decreases by a factor of 2
    D. The wavelength increases by a factor of 2
33. To demonstrate the phenomenon of interference, we require two sources which emit radiations of
    A. the same frequency having a definite phase relationship.
    B. the same frequency.
    C. nearly the same frequency.
    D. different frequency.
34. In Michelson interferometer
    A. Two plane mirrors and one concave lens are used.
    B. Two plane mirrors and one half silvered glass plate are used.
    C. Two convex lenses and one half silvered glass plate are used.
    D. Two concave mirror and one half silvered glass plate are used.
35. Light with unknown wavelength passes through two narrow slits 0.3 mm apart and forms an interference pattern on a screen 2.0 m away from the slits. If the distance between the fringes in the interference pattern is 3 mm, what is the wavelength of the light?
    A. 4500nm B. 45nm C. 405nm D. 450nm

36. An uncharged conductor is placed near a charged conductor, then what will happen?
    A. The uncharged conductor gets charged by conduction.
    B. The uncharged conductor is attracted first and then charged by induction.
    C. The uncharged conductor gets charged by induction and then attracted towards the charging body.
    D. It remains unchanged.
37. What is the magnitude of the electric field intensity at a point where a proton experiences an electrostatic force of magnitude of 2.30×10^{-25}N?
    A. 1.44×10^{-6} N/C
    B. 1.44×10^{44} N/C
    C. 3.68×10^{6} N/C
    D. 3.68×10^{-44} N/C
38. The electrostatic potential on the surface of a charged conducting sphere is 100V. Which of the following statement is **NOT** correct?
    A. At any point inside the sphere, the electrostatic potential is 100V.
    B. At any point inside the sphere, electric intensity is zero.
    C. The net electric charge of a conductor resides entirely on its spherical surface.
    D. The electric field at the surface of the conducting sphere is perpendicular to that surface.
39. A parallel plate capacitor of capacitance **C** has plates of area **A** with separation **d** between them. When it is connected to a battery of voltage **V**, it has charge of magnitude **Q** on its plates. It is then disconnected from the battery and the plates are pulled apart to a separation **2d** without discharging them. After the plates are **2d** apart, the magnitude of the charge on the plates and the potential difference between them are
    A. $\frac{1}{2}\,Q, \frac{1}{2}\,V$
    B. $Q, 2V$
    C. $Q, \frac{1}{2}V$
    D. $2Q, 2V$
40. In a loop in a closed circuit, the sum of the currents entering a junction equals the sum of the currents leaving a junction because
    A. The potential of the nearest battery is the potential at the junction.
    B. There are no transformations of energy from one type to another in a circuit loop.
    C. Charge is neither created nor destroyed at a junction.
    D. Current is used up after it leaves a junction.
41. Which of the following quantities do **NOT** change when a resistor connected to a battery is heated due to the current?
    A. Drift speed
    B. Resistance
    C. Resistivity
    D. Number of free electrons
42. **A**, **B** and **C** are voltmeters of Resistance **R**, **1.5R** and **3R** respectively as shown in figure. When some potential difference is applied between **X** and **Y**, the voltmeter readings are $\mathbf{V_A}$, $\mathbf{V_B}$ and $\mathbf{V_C}$ respectively. Then



    A. $\mathbf{V_A = V_B \neq V_C}$
    B. $\mathbf{V_A = V_B = V_C}$
    C. $\mathbf{V_A \neq V_B \neq V_C}$
    D. $\mathbf{V_A \neq V_B = V_C}$

43. A beam of electrons is moving towards the west. The beam is about to enter a magnetic field that is directed "into the page."



The direction of the magnetic force on the electrons is
A. upwards (north).
B. downwards (south).
C. in the same direction as the magnetic field into the page.
D. opposite the direction of the magnetic field, out of the page.

44. What is the magnetic force that acting on a charged particle of charge – 2 μC in a magnetic field of 2 T acting in Y direction, when the particle velocity is $(2i + 3j) \times 10^6$ m/s?
A. 4 N in Z direction
B. 8 N in – Z direction
C. 8 N in Y direction
D. 8 N in Z direction

45. The magnetic forces that two parallel wires unequal currents flowing in opposite directions exert on each other are:
A. attractive and unequal in magnitude.
B. repulsive and unequal in magnitude.
C. attractive and equal in magnitude.
D. repulsive and equal in magnitude.

46. A uniform electric field and a uniform magnetic are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron
A. will turn towards right of direction of motion.
B. will turn towards left of direction of motion.
C. speed will decrease.
D. speed will increase

47. Earth's magnetic field at a place is 7×10^{-5}T. This field is to be neutralized by the magnetic field produced at the center of circular loop 50 cm in radius. Then the current required to be passed through the loop is:
A. 0.56A B. 56A C. 2.8A D. 5.6A

48. If the number of turns per unit length of a coil of solenoid is doubled, then what will be the value of the self – inductance of the solenoid?
A. Remain unchanged
B. Be doubled
C. Be halved
D. Become four times

49. "The direction of the induced current in a circuit is always such that it opposes the cause due which it is produced." This law is named as
A. Lenz's law B. Kirchhoff's law C. Ohm's law D. Faraday's law

50. Which of the following statement is **NOT** correct?
A. Whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in circuit.
B. The induced emf lasts so long as the change in magnetic flux continues.
C. The direction of induced emf is given by Lenz's law.
D. Lenz's law is a consequence of the law of conservation of momentum.