

NEFAS SILK LAFTO SUBCITY ADMINISTRATION EDUCATIONAL OFFICE
ADDIS ABABA
PHYSICS MODEL EXAMINATION FOR GRADE 12
GINBOT 2012 /MAY 2020

GENERAL DIRECTION

THIS BOOKLET CONTAINS **PHYSICS** EXAMINATION FOR **NATURAL SCIENCE** STREAM. THE SUBJECT CODE FOR THIS EXAMINATION IS **04** AND THE CODE FOR THIS PARTICULAR BOOKLET IS **84**. PLEASE COPY THESE CODES ON YOUR ANSWER SHEET WHERE IT READS SUBJECT CODE AND BOOKLET CODE. THEN, BLACKEN THE CORRESPONDING BOXES IN THE COLUMNS BELOW EACH NUMBER.

IN THIS EXAMINATION, THERE ARE **50** MULTIPLE CHOICE QUESTIONS. FOLLOW THE INSTRUCTIONS CAREFULLY. SELECT THE CORRECT ANSWER AND BLACKEN ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. USE ONLY PENCILS TO MARK YOUR ANSWERS. YOUR ANSWER MARK SHOULD BE HEAVY AND DARK COVERING THE ANSWER SPACE COMPLETELY. PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY FROM YOUR ANSWER SHEET.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR **2:15 HOURS**. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING. PUT YOUR PENCIL DOWN AND WAIT FOR FURTHER INSTRUCTION.

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

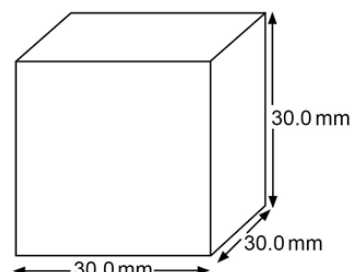
PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAMINATION.

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

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

Constant	Symbol	Value
Acceleration due to gravity	g	10m/s^2
Permittivity of vacuum (free space)	ϵ_0	$8.85 \times 10^{-12} \text{ F/m}$
Charge on an electron or proton	e	$1.6 \times 10^{-19} \text{ C}$
density of water	ρ	1000kg/m^3
Permeability of vacuum (free space)	μ_0	$4\pi \times 10^{-7} \text{ T.m/A}$
Specific heat capacity of water	c	4200J/kg
Planck's constant	h	$6.63 \times 10^{-34} \text{ J.s}$
Speed of light in vacuum	C	$3 \times 10^8 \text{ m/s}$
$\sin 30^\circ = \cos 60^\circ = 0.5$ $\sin 37^\circ = \cos 53^\circ = 0.6$ $\sin 45^\circ = \cos 45^\circ = 0.71$ $\sin 53^\circ = \cos 37^\circ = 0.8$ $\sin 60^\circ = \cos 30^\circ = 0.87$		

- In science, an educated guess is called a/an
 A. Question
 B. Conclusion
 C. Hypothesis
 D. Observation
- The dimensions of a cube are measured with Vernier calipers. The measured length of each side is 30.0 mm. If the Vernier calipers can be read with an uncertainty of $\pm 0.1 \text{ mm}$. What is the approximate percentage uncertainty in the value of the volume?



- Which one of the following is **TRUE** about multiplication of unit vectors?
 A. $\hat{k} \times \hat{i} = \hat{j}$
 B. $\hat{i} \cdot \hat{j} = \hat{k}$
 C. $\hat{i} \cdot \hat{i} = 0$
 D. $\hat{j} \times \hat{i} = \hat{k}$
- $(\vec{A} + \vec{B})$ is a unit vector along x-axis. If $\vec{A} = \hat{i} - \hat{j} + \hat{k}$, then vector $\vec{B}$ is
 A. $\hat{i} + \hat{j} - \hat{k}$
 B. $\hat{j} - \hat{k}$
 C. $\hat{i} + \hat{j} + \hat{k}$
 D. $\hat{j} + \hat{k}$
- Let $\vec{A} = 4\hat{i} + 8\hat{j} + 6\hat{k}$ and $\vec{B} = 2\hat{i} + 4\hat{j} + 3\hat{k}$. The magnitude of $\vec{A} \times \vec{B}$ is
 A. 0
 B. 1
 C. 58
 D. $\sqrt{58}$
- Which of the following decreases in motion along a straight line with constant retardation?
 A. Speed
 B. Acceleration
 C. Displacement
 D. Distance

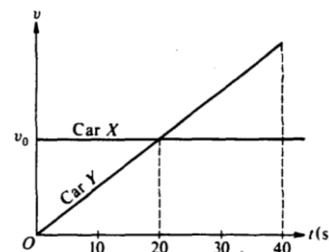
7. The position of a particle as it moves along the x axis is given for $t > 0$ by $x = (t^3 - 3t^2 + 3t)$ m, where t is in s. Where is the particle when it achieves its minimum speed (after $t = 0$)?

A. 1 m B. 2 m C. 3 m D. 4 m

8. A body is projected horizontally from the top of a tower with initial velocity 18m/s. It hits the ground at an angle of 45° . What is the vertical component of velocity when it strikes the ground?

A. 9m/s B. $9\sqrt{2}$ m/s C. $18\sqrt{2}$ m/s D. 18 m/s

9. The graphs of speed v versus time t for two cars are shown in the figure. At time $t = 0$, car X traveling with speed V_0 passes car Y which is just starting to move. Both cars then travel on two parallel lanes of the same straight road. Which of the following is true at time $t = 20$ seconds?



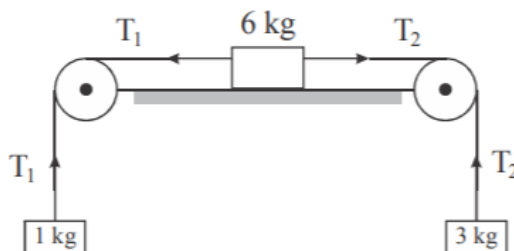
A. Car Y is behind car X. C. Car Y is passing car X.
B. Car Y is in front of car X. D. Both cars have the same acceleration.

10. A box is sliding along a frictionless surface. The amount of force needed to keep it going equals:

A. twice the force with which it was originally pushed.
B. one half of the force with which it was originally pushed
C. the same amount of force with which it was originally pushed
D. zero, since no force is necessary to keep it moving.

11. Three masses 1kg, 6kg and 3kg are connected to each other with threads and are placed on a table as shown in the figure. The acceleration with which the system is moving is

A. 0m/s^2
B. 1m/s^2
C. 2m/s^2
D. 3m/s^2



12. The magnitude of linear momentum P of a particle varies with the time as follows: $P = a + bt^2$, where a and b are constants. The magnitude of the net force acting on the particle is

A. proportional to t^2 C. zero
B. proportional to t D. constant

13. The diagram shows the masses and velocities of two trolleys just before they collide on a level bench.



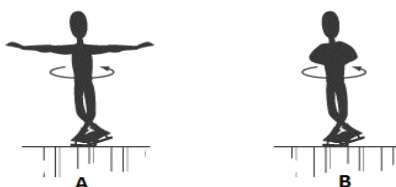
After the collision, the trolleys move along the bench joined together. How much kinetic energy is lost in this collision?

A. 24 J B. 6.0 J C. 12 J D. 18 J

14. When the net work done on an object is zero, then

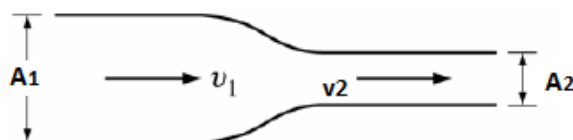
A. the kinetic energy of the object is zero.
B. the change in kinetic energy of the object is zero.
C. the work done by the net force is positive.
D. the work done by the applied force is zero.

15. An engine exerts a force on a 1200 kg car changing the speed of the car from 10 m/s to 15 m/s in 30 sec. What is the power developed by the engine?
 A. 75 kW B. 12.5 kW C. 2.5 kW D. 1.8 kW
16. Two external forces that are opposite in direction are applied on a rigid body. Which of the following is the necessary condition for the body to be in rotational motion?
 A. The forces must have the same magnitude.
 B. The forces must have different magnitudes.
 C. The forces must have different lines of action.
 D. The forces must have the same line of action.
17. A 5 kg body has a moment of inertia of 30 kgm^2 about an axis through its center of mass. What will the moment of inertia of the mass be if it is rotated about an axis perpendicular through a point whose displacement vector is $(2\mathbf{i} + 3\mathbf{j}) \text{ m}$?
 A. 95 kgm^2 B. 65 kgm^2 C. 46 kgm^2 D. 35 kgm^2
18. A skater spins with the arms stretched out given that the net torque on him is zero, due to the conservation of angular momentum, $L_i = L_f$. The skater is able to move at varying speeds. What is the direction of angular momentum, and how does the skaters speed change from A to B?



	Direction	Skater's spinning speed
A	Downward	Faster
B	Upward	Faster
C	Upward	Slower
D	Downward	Slower

19. Which one of the following is necessarily true for an object in equilibrium?
 A. Zero velocity C. Linearly varying velocity
 B. Constant acceleration D. Zero acceleration
20. A uniform meterstick of mass 0.20 kg is pivoted at the 40 cm mark. Where should, from the same reference point, one hangs a mass of 0.50 kg to balance the stick?
 A. 36 cm B. 44 cm C. 46 cm D. 54 cm
21. If the velocity of a fluid is the same at a given point at all times, then the flow is
 A. turbulent C. rapid
 B. viscous D. laminar
22. A pipe with area $A_1 = 8\text{m}^2$, and velocity $v_1 = 2 \text{ m/s}$ moves through a pipe, if the velocity at $v_2 = 4 \text{ m/s}$, what is the area of A_2 ?



- A. 4m^2 B. 3m^2 C. 2m^2 D. 1m^2
23. At what point of a stretching wire gives a sudden increase in the extension?
 A. Elastic limit C. Yield point
 B. Breaking point D. Fracture point

24. The specific heat capacity of iron is approximately half that of aluminum. Two balls of equal mass, one made of iron and the other of aluminum, both at 80°C , are dropped into a thermally insulated jar that contains an equal mass of water at 20°C . Thermal equilibrium is eventually reached. Which one of the following statements concerning the final temperatures is true?
- A. Both balls will reach the same final temperature.
 - B. The iron ball will reach a higher final temperature than the aluminum ball.
 - C. The aluminum ball will reach a higher final temperature than the iron ball.
 - D. The difference in the final temperatures of the balls depends on the initial mass of the water.
25. Absolute zero is best described as that temperature at which
- A. water is at its triple point.
 - B. the molecules of a substance have a maximum kinetic energy.
 - C. the molecules of a substance have a maximum potential energy.
 - D. the molecules of a substance have minimum kinetic energy.
26. James Joule did much to establish the value of the
- A. universal gravitational constant.
 - B. speed of light.
 - C. mechanical equivalent of heat.
 - D. charge of an electron.
27. The maximum efficiency of a heat engine that operates between temperatures of 1500 K in the firing chamber and 600 K in the exhaust chamber is most nearly
- A. 33%
 - B. 40%
 - C. 60%
 - D. 67%
28. An ideal gas is enclosed in a container. The volume of the container is reduced to half the original volume at constant temperature. According to kinetic theory, what is the best explanation for the increase in pressure created by the gas?
- A. The average speed of the gas particles decreases, but they hit the container walls more frequently.
 - B. The average speed of the gas particles is unchanged, but they hit the container walls more frequently.
 - C. The average speed of the gas particles increases as does the frequency with which they hit the container walls.
 - D. The average speed of the gas particles increases, overcoming the decreased frequency that they hit the container walls.
29. A wave has a frequency of 50 Hz . The period of the wave is:
- A. 0.010 s
 - B. 0.20 s
 - C. 0.020 s
 - D. 20 s
30. A place of zero displacement on a standing wave is called
- A. an antinode.
 - B. a node.
 - C. the amplitude.
 - D. the wave number.
31. A tube is open at both ends with the air oscillating in the 4th harmonic. How many displacement nodes are located within the tube?
- A. 2
 - B. 3
 - C. 4
 - D. 5
32. In Young's double slit experiment, the second order bright band of one light source overlaps the third order band of another light source. If the first light source has a wavelength of 660 nm , what is the wavelength of the second light source?
- A. 1320 nm
 - B. 990 nm
 - C. 495 nm
 - D. 440 nm
33. In an experiment to measure the wavelength of light using a double slit apparatus, it is found that the bright fringes are too close together to easily count them. To increase only the spacing between the bright fringes, one could
- A. increase the slit width
 - B. decrease the slit width
 - C. increase the slit separation
 - D. decrease the slit separation

34. A wave moves from one medium to a second medium with a different index of refraction. Which of the following wave properties would NEVER change?

- A. frequency B. wavelength C. speed D. angle

35. The electron volt is a measure of

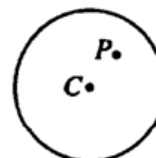
- A. charge B. energy C. impulse D. momentum

36. The capacitance of a parallel-plate capacitor can be increased by increasing which of the following?

- A. The distance between the plates C. The area of the plates
B. The charge on each plate D. The potential difference across the plates

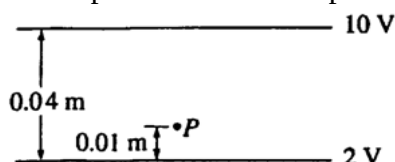
37. The metal sphere shown below is positively charged. Point C is the center of the sphere and point P is any other point within the sphere. Which of the following is true of the electric field at these points?

- A. It is zero at both points.
B. It is zero at C, but at P it is not zero and is directed inward.
C. It is zero at C, but at P it is not zero and is directed outward.
D. It is zero at P, but at C it is not zero.



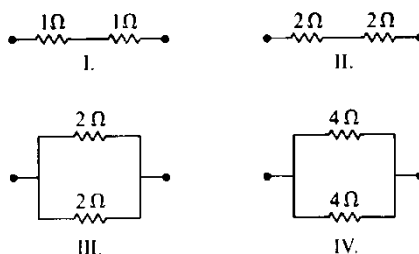
38. Two large, flat, parallel, conducting plates are 0.04 m apart, as shown below. The lower plate is at a potential of 2 V with respect to ground. The upper plate is at a potential of 10 V with respect to ground. Point P is located 0.01 m above the lower plate. The electric potential at point P is

- A. 10 V
B. 8 V
C. 6 V
D. 4 V



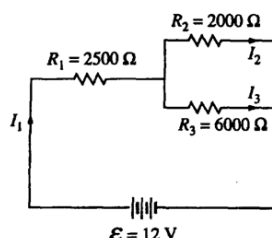
39. Which two arrangements of resistors shown below have the same resistance between the terminals?

- A. I and II
B. I and IV
C. II and III
D. II and IV



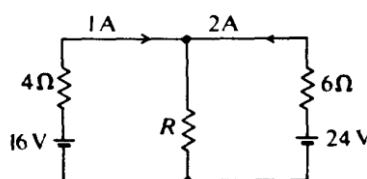
40. From the given circuit, what is the current I_1 ?

- A. 0.8 mA
B. 1.0 mA
C. 2.0 mA
D. 3.0 mA



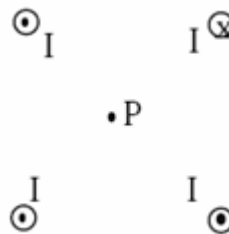
41. In the circuit shown below, what is the resistance R?

- A. 3 Ω
B. 4 Ω
C. 6 Ω
D. 12 Ω



42. Four infinitely long wires are arranged as shown in the accompanying figure end-on view. All four wires are perpendicular to the plane of the page and have the same magnitude of current I . The conventional current in the wire in the upper right-hand corner is directed into the plane of the page. The other conventional currents are out of the plane of the page. Point P is a distance “a” from all four wires. What is the total magnetic field at point P?

- A. $\frac{\mu_0 I}{2\pi a}$ toward the upper left-hand corner
 B. $\frac{\mu_0 I}{2\pi a}$ toward the lower left-hand corner
 C. $2 \frac{\mu_0 I}{2\pi a}$ toward the upper left-hand corner
 D. $2 \frac{\mu_0 I}{2\pi a}$ toward the lower left-hand corner



43. Two long, parallel wires, fixed in space, carry currents I_1 and I_2 . The force of attraction has magnitude F . What currents will give an attractive force of magnitude $4F$?
- A. $2I_1$ and $\frac{1}{2}I_2$ B. I_1 and $\frac{1}{4}I_2$ C. $\frac{1}{2}I_1$ and $\frac{1}{2}I_2$ D. $2I_1$ and $2I_2$
44. The rate of change of flux has a unit
- A. Farad. B. Joule. C. Volt. D. Weber.
45. Lenz's law concerning the direction of an induced current in a conductor by a magnetic field could be a restatement of
- A. The Law of Conservation of Energy C. Tesla's Law
 B. Ohm's Law D. Ampere's law
46. A battery is connected between the rails and causes the electrons in the bar to drift to the east. The resulting magnetic force on the bar is directed
- A. north B. south C. east D. west
47. A square loop of copper wire is initially placed perpendicular to the lines of a constant magnetic field of 5×10^3 tesla. The area enclosed by the loop is 0.2 square meter. The loop is then turned through an angle of 90° so that the plane of the loop is parallel to the field lines. The turn takes 0.1 second. The average emf induced in the loop during the turn is
- A. 1.0×10^4 V B. 0.01 V C. 100 V D. 400 V
48. In RLC circuit, capacitance is changed from C to $2C$. For the resonant frequency to remain unchanged, the inductance should be changed from L to
- A. $4L$ B. $2L$ C. $L/2$ D. $L/4$
49. Light of a single frequency falls on a photoelectric material but no electrons are emitted. Electrons may be emitted if the
- A. frequency of light is decreased C. intensity of light is increased
 B. frequency of light is increased D. velocity of light is increased
50. The following nuclear reaction equation is an example of
- $${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{133}_{51}\text{Sb} + {}^{99}_{41}\text{Nb} + 4({}^1_0\text{n})$$
- A. fission B. fusion C. alpha decay D. beta decay

End!