

ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU
ADDIS ABEBA
GRADE 12 PHYSICS MODEL EXAMINATIONS
TAHASAS 2015/JANUARY 2023

NUMBER OF QUESTIONS: 50

TIME ALLOWED: -2 HOURS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **EXAMINATION PHYSICS** .IN THIS EXAMINATION, THERE ARE A TOTAL OF **50 MULTIPLE CHOICE QUESTIONS**. CAREFULLY SELECT THE BEST ANSWER AND **BLACKEN** ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER CAREFULLY. USE ONLY **PENCIL** 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 **3 HOURS**. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING, PUT YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS.

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 UNTIL YOU ARE TOLD TO DO SO.

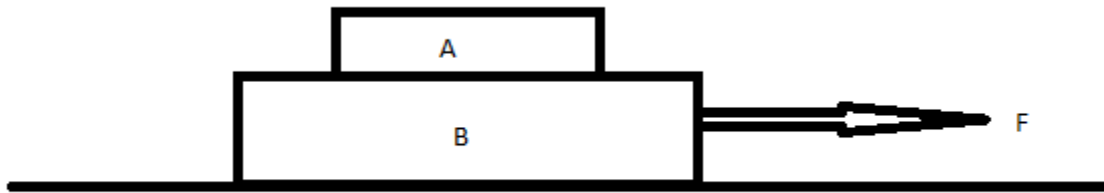
You may refer to the information given below when you need to work on some of the question

Number of constants	symbol	value	
Acceleration due to gravity	g	10m/s^2	
Mass of proton	m_p	$1.67 \times 10^{-27}\text{kg}$	
Mass of electron	M_e	$9.11 \times 10^{-31}\text{kg}$	
The charge of electron	e^-	$1.67 \times 10^{-19}\text{C}$	
Universal gravitation constant	G	$6.67 \times 10^{-11}\text{Nm}^2/\text{kg}$	
Density of water	ρ	1000 kg/m^3	
Molar gas constant	R	8.31J/mol.K	
Permittivity of vacuum	ϵ_0	$8.85 \times 10^{-12}\text{F/m}$	
Magnetic permeability of free space	μ_0	$4\pi \times 10^{-7}\text{ TM/A}$	
Coulomb constant	K	$9 \times 10^9\text{ Nm}^2/\text{C}^2$	
$\sin 30 = 0.5 = \cos 60$			
$\sin 60 = 0.87 = \cos 30$			
$\sin 37 = 0.6 = \cos 53$			

1. A good scientific theory is one which is
 - A. simple (less complex), has a wide scope, and is accurate and consistent.
 - B. simple (less complex), specific in scope, and is accurate and consistent.
 - C. more complex, has a wide scope, is accurate and consistent.
 - D. more complex, specific in scope, consistent but not accurate.
2. The number of significant digits in a quantity $m = 7.10 \times 10^{30}$ kg is
 - A. 3
 - B. 2
 - C. 32
 - D. 33
3. Given $\vec{A} = ai + bj + 2k$ and $\vec{B} = 4i + 2j - 4k$. What must be the value of 'a' and 'b', respectively, for the two vectors to be parallel?
 - A. -2 and -1
 - B. 2 and 1
 - C. -1 and -2
 - D. 1 and 2
4. For what value of "a" the two vectors $\mathbf{A} = a\mathbf{i} + 2\mathbf{j} + 5\mathbf{k}$ and $\mathbf{B} = 1/2\mathbf{i} + 6\mathbf{j} + 2\mathbf{k}$ are orthogonal to each other?
 - A. 1
 - B. -44
 - C. -1
 - D. 4
5. What is the area of a parallelogram formed by vectors $\mathbf{A} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$ and $\mathbf{B} = 3\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$?
 - A. $\sqrt{111}$
 - B. $\sqrt{121}$
 - C. $\sqrt{131}$
 - D. $\sqrt{141}$
6. What is the magnitude of $\mathbf{A} \cdot (\mathbf{A} \times \mathbf{B})$ if θ is the angle between vector $\mathbf{A}$ and vector $\mathbf{B}$?
 - A. $BA \sin \theta$
 - B. $BA^2 \sin \theta$
 - C. $B^2 A \sin \theta$
 - D. zero
7. Which of one of the following vector properties is **WRONG**?
 - A. Scalar product is commutative.
 - B. Vector addition is associative.
 - C. Both scalar and vector products are distributive over addition & subtraction
 - D. The magnitudes of $\mathbf{A} \times \mathbf{B}$ and $\mathbf{B} \times \mathbf{A}$ are different.

8. A, B and C are three points, in that order, on a straight line road with $AB=40\text{km}$ and $BC=90\text{km}$. A woman travels from A to B at 10kmh^{-1} and then from B to C at 15kmh^{-1} . What is the average speed of the woman for the journey from A to C?
- A. 25kmh^{-1} B. 13kmh^{-1} C. 5kmh^{-1} D. 6kmh^{-1}
9. A stone is thrown upward with a speed of 20 ms^{-1} from a point at a height h meters above the horizontal ground level. If the stone hits the ground 5 seconds later, what is the height h ?
- A. zero B. 100m C. 25m D. 20m
10. A truck traveling with constant speed of 20m/s along a straight line passes a motorcycle. Just as the truck passed the motorcycle accelerates from rest at 2ms^{-2} to overtake the truck. How fast the motorcycle traveling while it overtakes the truck?
- A. 2m/s B. 20m/s C. 30m/s D. 40m/s
11. Which one the following statement is **CORRECT** about two dimensional motions?
- A. The acceleration in a uniformly circular motion is constant.
- B. In a projectile motion the vertical and horizontal parts its motion are independent to each other.
- C. The maximum range of projectiles can be achieved at an angle of 90° .
- D. The velocity of a vertical circular motion is maximum at the top the vertical circle.
12. A man of mass 80kg stands on a balance inside an elevator .If the balance reads 900N , the elevator is
- A. ascending with constant velocity. C. ascending with constant acceleration.
- B. descending with constant velocity. D. descending with constant acceleration.

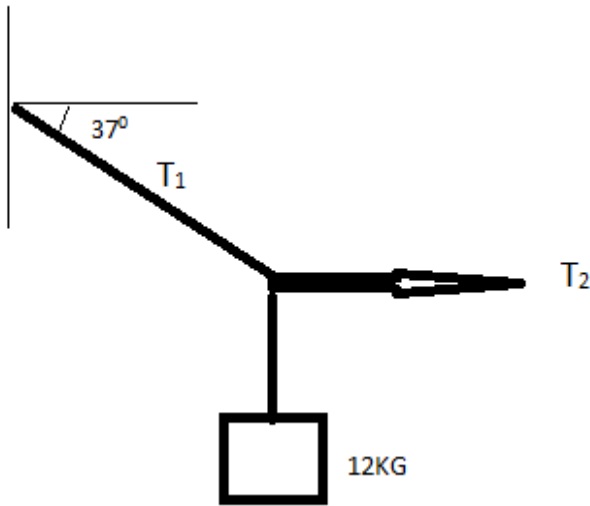
13. In the figure shown below; the masses of block A and block B are 4kg and 8kg, respectively. Coefficient of static friction between block A and block B is 0.25 and the coefficient of kinetic friction between the horizontal surface and block B is 0.2. What is the maximum value of force F that can accelerate the system without sliding block A?



- A. 54N B. 24N C. 30N D. 10N
14. A 32kg big fish moving with 10m/s to the east swallows a small 4kg fish moving with a speed of 5m/s to the west. The velocity of the big fish after impact is
- A. 8.3m/s, east. B. 10m/s, east. C. 10m/s, west. D. 8.3m/s, west.
15. A 10kg object moving with a velocity of $(6\mathbf{i})$ m/s explodes into two equal fragments. One flies off with a velocity $(2\mathbf{i}-\mathbf{j})$ m/s. What is the velocity of the other fragment?
- A. $(3\mathbf{i}+5\mathbf{j})$ m/s B. $(-3\mathbf{i}-5\mathbf{j})$ m/s C. $(10\mathbf{i}+\mathbf{j})$ m/s D. $(6\mathbf{i}-5\mathbf{j})$ m/s
16. What should be the coefficient of static friction at the pavement of a flat road for a car moving with a maximum speed of 15m/s in a circle of radius 45m to make turns safely?
- A. 0.2 B. 0.3 C. 0.4 D. 0.5

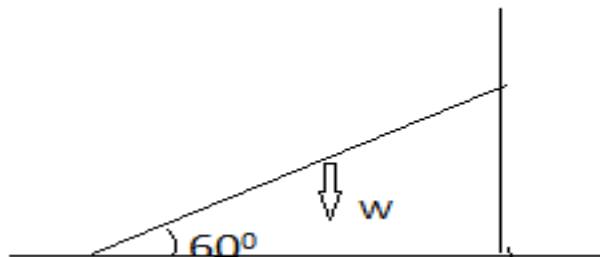
17. The dimension of energy is
A. ML^2T^{-2} B. MLT^{-2} C. ML^2T^{-3} D. MLT^{-3}
18. A force of $F = (2i + 4k)$ N is exerted on a block to move it with a velocity of $V = (6j + 8k)$ m/s. What is the power exerted on the block?
A. 12W B. 32W C. 24W D. 16W
19. A block of mass 2.5kg is attached to a spring with spring constant of 40N/m. If it is pulled down a displacement of 30cm and released, what would its speed be as it passes the equilibrium position?
A. 1.6m/s B. 1.2m/s C. 1.4m/s D. 1m/s
20. What is the moment of inertia of a thin rod of mass M and length L about an axis perpendicular to the rod at a distance of $\frac{L}{4}$ from one end? ($I_{cm} = \frac{1}{12}ML^2$)
A. $\frac{7}{48}ML^2$ B. $\frac{7}{12}ML^2$ C. $\frac{5}{12}ML^2$ D. $\frac{1}{3}ML^2$
21. The angular displacement described by a particle is given as $\theta(t) = 10 + 20t - 4t^2$ where θ in radian and t in seconds. What is the value of t when the particle becomes momentarily at rest?
A. 5s B. 2.5s C. 2s D. 1s
22. A solid cylindrical grinding stone ($I = \frac{1}{2}MR^2$) has a radius of 0.4m and mass of 40kg. A constant unbalanced torque acting on it changes its angular speed to 40 rad/s from rest in 20 seconds. What is the magnitude of the desired net torque?
A. 6.4Nm B. 16Nm C. 3.2Nm D. 8Nm

23. A ring ($I=MR^2$) is released and rolled down an inclined plane which is 10m above the horizontal ground. What is the linear velocity of the ring at the bottom of the incline?
- A. $2\sqrt{10}$ m/s B. $\sqrt{10}$ m/s C. 100 m/s D. 10 m/s
24. Real gases behave like an ideal gas at
- A. Low temperature and high pressure.
B. High temperature and low pressure.
C. Low temperature and low pressure.
D. High temperature and high pressure.
25. A Carnot engine working between 27°C and 327°C has a work output of 800J per cycle. The amount of heat energy supplied to the engine from the source in each cycle is
- A. 800J B. 1600J C. 3200J D. 6400J
26. If one mole of an ideal gas doubles its volume as it undergoes an isothermal expansion, its pressure is
- A. quadrupled B. doubled C. halved D. quartered
27. The rms speed of an ideal gas at a temperature of 120K is V . What would the rms speed be if its temperature becomes 480K?
- A. $\frac{V}{4}$ B. $\frac{V}{2}$ C. $4V$ D. $2V$
28. A 12Kg object is suspended by two cables as shown in the figure below. If the system is in equilibrium, the values of T_1 and T_2 , respectively, are
- A. 200N, 160N B. 160N, 200N C. 80N, 120N D. 120N, 80N



29. An electron (mass = $9 \times 10^{-31} \text{ Kg}$ and charge = $1.6 \times 10^{-19} \text{ C}$) is released from rest in a uniform electric field of strength $9 \times 10^3 \text{ N/C}$. How long does the electron take to travel a distance of 1.28m?
- A. $2 \times 10^{-8} \text{ s}$ B. $4 \times 10^{-7} \text{ s}$ C. $4 \times 10^{-8} \text{ s}$ D. $2 \times 10^{-7} \text{ s}$
30. A hollow metal sphere of radius 10cm is charged to a potential of 100V. What is the potential at the center of the sphere?
- A. Zero B. 50V C. 200V D. 1 00V

31. A 10m ladder that weighs 50N leans at an angle of 60° with the horizontal against a wall. What is the coefficient of friction between the floor and the ladder as the ladder is just on the verge of slipping?



- A. 0.13 C. 0.34
B. 0.29 D. 0.45
32. A body is said to be in neutral equilibrium if
- its center of gravity is above the axis of rotation.
 - its center of gravity is below the axis of rotation.
 - its center of gravity coincides (meet at a point) with the axis of rotation.
 - its center of gravity produces net torque about the axis of rotation.
33. A body is said to be charged positively if it has
- excess of protons.
 - excess of electrons.
 - deficiency of protons.
 - deficiency of electrons
34. A. 10^{-6}F capacitor is charged with a 10V battery. What is the energy of the Capacitor?
- A. $50\mu\text{J}$ B. $100\mu\text{J}$ C. $150\mu\text{J}$ D. $200\mu\text{J}$
35. The intensity level (loudness level) changes from $L_1=60\text{dB}$ to $L_2=90\text{dB}$. What is the ratio of intensities I_2/I_1 ?
- A. 3 B. 30 C. 300 D. 1000

36. A 0.5Kg object attached to a spring undergoes SHM with amplitude of 8cm and period of $0.2\pi s$. What is the maximum force acting on an object?
- A. 80N B. 50N C. 8N D. 4N
37. When light travels from one medium to another which is separated by a sharp boundary the characteristic that does not change is
- A. velocity B. wavelength C. frequency D. amplitude
38. Monochromatic green light of wavelength $5 \times 10^{-7} \text{m}$ illuminates two slits 1mm apart. If the screen and the slits are 2m apart, the separation between two successive bright fringes is
- A. 0.25mm B. 0.1mm C. 1mm D. 0.01mm
39. A tube closed at one end containing air produces a fundamental frequency of 512Hz. If the same length of tube is open at both ends the fundamental frequency that can be produced is
- A. 1024Hz B. 512Hz C. 256Hz D. 125Hz
40. A uniform spring of force constant K is cut into two equal pieces. What is the force constant of each piece?
- A. 2K B. $\frac{3}{2}K$ C. K D. K
41. A progressive wave is represented by the equation
- $$Y(t,x) = (0.2)\sin(6.28t - 12.56x),$$
- where x and y are in meter and t in seconds.
- The velocity of the wave is
- A. 2m/s B. 1.5m/s C. 1m/s D. 0.5m/s
42. Which pair of quantities are expressed in the same units?
- A. Stress and strain C. Young's modulus and stress
- B. Young's modulus and strain D. Shear modulus and strain

43. A 0.5m long guitar string of cross-sectional area 10^{-6} m^2 has Young's modulus of $Y=2 \times 10^9 \text{ N/m}^2$. By how much length you stretch the string to obtain a tension of 20N?
- A. 2mm B. 3mm C. 4mm D. 5mm
44. Which one of the following statements is WRONG?
- A. Wave fronts of point source of light are concentric spheres.
B. Light rays and wave fronts intersect at right angles.
C. Light rays and wave fronts are parallel.
D. Rays and the radii of spherical wave fronts.
45. In a hydraulic brake system a force of 20N is applied to piston 1 which has a cross-sectional area of 4 cm^2 . What is the force on piston 2 if its cross-sectional area is 60 cm^2 ?
- A. 200N B. 300N C. 400N D. 500N
46. Bernoulli's principle is based on
- A. conservation of momentum C. conservation of energy
B. conservation of mass D. mass-energy equivalence
47. The speed water flowing through a horizontal pipe is 10m/s at a point where the cross-sectional area of the pipe is 0.1 cm^2 . If there is a point in the pipe where its cross-sectional area is 1 cm^2 , what is pressure difference between these points?
- A. $4.95 \times 10^4 \text{ Pa}$ B. $5.95 \times 10^4 \text{ Pa}$ C. $6.95 \times 10^4 \text{ Pa}$ D. $7.95 \times 10^4 \text{ Pa}$
48. The transfer heat by the direct movement of molecules is called
- A. conduction B. convection C. radiation D. induction

49. A window has a glass surface of 2000cm^2 and thickness of 4mm. the Temperature inside and outside the glass are 21°C and -3°C , respectively. What is the rate of heat flow through the window? ($K=0.2\text{W/m}^\circ\text{C}$)
- A.480W B.48W C, 84W D.240W
50. A piece of iron(specific heat= $450\text{J/Kg}^\circ\text{C}$) is dropped from a height of 900m above the ground. Assuming all the energy is converted to heat the iron, what will be the rise in temperature of the iron in degree centigrade?
- A. zero B. 8 C.20 D.24