OROMIA EDUCATIONAL BUREAU

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FIRST ROUND MODEL EXAM FOR GRADE 12 STUDENTS, 2017/2025.

TIME ALLOWED: 2:30 HRS

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS **PHYSICS FIRST ROUND MODEL EXAM** FOR **GRADE 12** IN THIS BOOKLET, THERE ARE TOTAL OF **60** MULTIPLE CHOICE QUESTIONS.

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE GIVEN ALTERNATIVES AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM QUESTIONS FOR **150 MINUTES ONLY.** WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING ON THE QUESTIONS AND PUT DOWN YOUR PEN/PENCIL AND WAIT FOR WHAT YOU MIGHT BE TOLD TO DO.
ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAM WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAM HALL AND CANCELLATION OF YOUR SCORE.

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAM
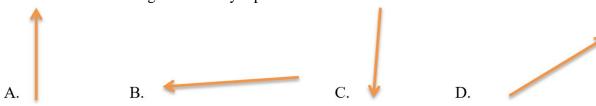
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

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Constant	Symbol	Value
Acceleration due to gravity	g	10 m/s^2
Electrostatic constant	k	$9 \times 10^9 \text{ Nm}^2/\text{C}^2$
Gravitational constant	G	$6.7 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$
Density of water	ρ	1000 kg/m^3
$\sin90^0 = \cos0^0 = 1$		
$Sin0^0 = Cos90^0 = 0$		
$Sin60^0 = \cos30^0 = \frac{\sqrt{3}}{2} = 0.87$		
$Sin30^0 = \cos60^0 = 0.5$		
$Sin45^0 = Cos45^0 = \frac{\sqrt{2}}{2}$		

1. Two vectors $\vec{A}$ and $\vec{B}$ are given as shown in the fig. below.

Which one of the following vectors may represent $\vec{A} - \vec{B}$?

A.   B.   C.   D.

2. Two trains are traveling towards each other on parallel tracks. Train X is moving west at a speed of 80 km/h, and Train Y is moving east at a speed of 60 km/h. If you are on Train X, what is the velocity of Train Y relative to Train X?
   A. 140 km/h towards the east
   B. 60 km/h towards the west
   C. 20 km/h towards the west
   D. 140 km/h towards the west

3. Which of the following is a correct action-reaction force pair?
   A. The force of a ball hitting a wall and the force of gravity pulling the ball down.
   B. The force of a car's tires pushing backward on the road and the road pushing the car forward.
   C. The force of the bat hitting a ball and the force of air resistance on the ball.
   D. The force of a swimmer's arms pushing water backward and the force of gravity pulling them down.

4. A 0.25 kg ball is moving at 4 m/s and collides inelastically with a stationary ball of mass 0.75 kg. After the collision, they stick together. What is the kinetic energy lost during the collision?
   A. 4 J   B. 2 J   C. 3.5 J   D. 1.5 J

5. A block weighing 200 N is placed on a frictionless an inclined plane that rises to a height of 3 m over a distance of 12 m along the plane. What is the mechanical advantage (MA) of the inclined plane?
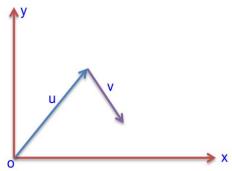   A. 1.67   B. 3.00   C. 4.00   D. 6.00

6. What is the main characteristic of a third-order lever?
   A. The fulcrum is at one end, with the effort on the other end.
   B. The load is positioned between the effort and the fulcrum.
   C. It has a mechanical advantage greater than one.
   D. The effort is applied between the load and the fulcrum.

7. Considering the relationship between atmospheric pressure and altitude, which evaluation best explains the challenges faced by climbers at high elevations?
   A. Climbers are less affected by low atmospheric pressure because they are physically fit.
   B. Decreased atmospheric pressure at high altitudes leads to reduced oxygen levels, which can impair physical performance and increase fatigue.
   C. Climbers do not need to acclimatize as atmospheric pressure has no significant impact on their performance.
   D. High atmospheric pressure at altitudes enhances climbers' endurance and reduces fatigue.

8. Which of the following is correct?
   A. Temperature is the measure of the average molecular kinetic energy of a gas
   B. Internal energy of the system is independent of its mass or the number of molecules in the system
   C. Heat is energy that can be transferred from one object to another at equal temperature
   D. Temperature is a measure of the amount of energy that flows from hot to colder region

9. The sound intensity at a distance of 2 m from a point source is 1 W/m^2. What will be the intensity of sound at a distance of 4 m from the same source, assuming the sound spreads uniformly?
   A. $0.25 \ W/m^2$ B. $0.5 \ W/m^2$ C. $1.0 \ W/m^2$ D. $2 \ W/m^2$

10. Which situation best shows the application of both experiential and non-experiential knowledge in solving a complex problem?
    A. A scientist uses experimental data from a lab experiment and theoretical models to refine their hypothesis.
    B. A teacher applies established classroom management techniques without considering past experiences with students.
    C. A lawyer follows court precedents and applies personal experiences from similar cases to argue in court.
    D. A nurse consults a medical handbook, but only follows their instinct when making decisions.

11. How do physics graduates contribute to the healthcare sector?
    A. Designing promotional campaigns for health care products.
    B. Working in pharmaceuticals for drug development.
    C. Managing healthcare institutions.
    D. Creating, reviewing and maintaining medical technologies in field

12. Which of the following defines a parallel vector?
    A. A vector that is parallel to the ground.
    B. A vector that points in the same or exactly opposite direction to another vector.
    C. A vector that has zero magnitude.
    D. A vector that always points toward the center of the Earth.

13. Figure below, shows the orientation of two vectors $\vec{u}$ and $\vec{v}$ in the xy plane. If $\vec{u} = a\hat{\imath} + b\hat{\jmath}$ and $\vec{v} = p\hat{\imath} + q\hat{\jmath}$, which of the following is correct?

A. a and p are positive while b and q are negative.

B. a, p and b are positive while q is negative.

C. a, q and b are positive while p is negative.

D. a, b, p and q are all positive.

14. A particle moves along a path represented by the vector $\vec{S}(t) = t^2 i + (3t - t^2)j$. At time $t = 2$, what is the work done by a constant force $\vec{F} = 4i + 3j$ over the displacement?

    A. 6 J   B. 12 J   C. 20 J   D. 22 J

15. The velocity of a particle moving with constant acceleration at an instant t_0 is 10 m/s. After 5 seconds of that instant the velocity of the particle is 20m/s. The velocity at 3 second before t_0 is:

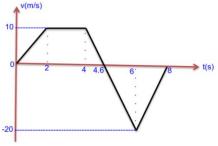   A. 8 m/s   B. 4 m/s   C. 6 m/s   D. 7 m/s

16. The figure below shows a velocity-time graph of a particle moving along a straight line.

The total displacement after 8s is:

    A. -1.0 m   B. 33 m   C. 67 m   D. -34 m

17. A ball is dropped from a height of 80 m. how long will it take to hit the ground?

    A. 3.5 s   B. 4.0 s   C. 5.0 s   D. 6.0 s

18. A car takes a turn on a flat road with a velocity v and radius r. If the velocity is reduced by half, while the radius is kept constant, how does the frictional force required for the circular motion change?

    A. It is halved   C. It is doubled

    B. It remains the same   D. It is quadrupled

19. A 5 kg box is resting on an incline that makes an angle of 30° with the horizontal. The coefficient of static friction between the box and the incline is 0.58. What is the maximum force of static friction that can act on the box before it starts to slide down?

    A. 25 N   B. 15 N   C. 12.5 N   D. 10 N

20. If the force applied to an object is perpendicular to its displacement, what is the work done?

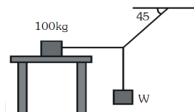   A. Maximum   C. Half of the maximum

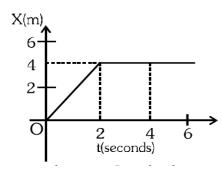   B. Negative   D. Zero

21. The system shown in the figure is in equilibrium. The maximum value of W, so that the maximum value of static frictional force on 100 kg body is 450 N, will be:

A. 100 N

B. 250 N

C. 450 N

D. 1000 N

22. In the figure given below, the position–time graph of a particle of mass 0.1 kg is shown. The impulse at t = 2 sec is:

A. 0.2 kg m/s

B. − 0.2 kg m/s

C. 0.1 kg m/s

D. − 0.4 kg m/s

23. Which of the following scenarios illustrates heat transfer by convection?
   A. A spoon becoming hot when placed in a hot bowl of food.
   B. The sun warming the Earth through the vacuum of space.
   C. A blanket keeping a person warm on a cold night.
   D. A pot of water heating up from the bottom on a stove.

24. A body "A" is ten times the mass and half times the specific heat capacity of body "B". If they applied with equal amount of heat, how do their heat capacities compared?
   A. Heat capacity of A is 10 times greater
   B. Heat capacity of B is 10 times greater
   C. Heat capacity of A is 5 times greater
   D. Heat capacity of B is 5 times greater

25. If two rods of length L and 2L having coefficients of linear expansion α and 2α respectively are connected so that total length becomes 3L, the average coefficient of linear expansion of the composition rod equals:

   A. $\frac{3}{2}\alpha$ B. $\frac{5}{3}\alpha$ C. $\frac{5}{2}\alpha$ D. α

26. When ice melts into water at 0°C, what happens to the temperature of the system until all ice has converted to water?
   A. The temperature increases continuously until it reaches 100°C.
   B. The temperature decreases until all ice has melted.
   C. The temperature remains constant at 0°C despite the addition of heat.
   D. The temperature fluctuates between 0°C and 5°C.

27. Two small spheres with charges $q_1 = 3\mu C$ and $q_2 = -2\mu C$ are placed 6 cm apart in a vacuum. What is the magnitude of the electrostatic force between them?
   A. 1.5 N   B. 9 N   C. 3 N   D. 15 N

28. A chef is preparing food in a clay pot and iron pot of the same size on identical stoves. The food in the clay pot takes longer time to reach the desired temperature, but it stays warm for a longer time after removing from the heat. What is the best explanation for this?
    A. The clay pot has higher specific heat capacity, requiring more heat to raise its temperature but retaining it longer.
    B. The iron pot has a lower specific heat capacity, so it transfers heat to the food more slowly.
    C. The clay pot reflects heat, preventing rapid heating but ensuring gradual cooling.
    D. The iron pot traps heat inside, causing the food to heat up faster but cool down quickly.

29. You are tasked with designing a circuit to convert a galvanometer with a full-scale deflection of 5 mA and a resistance of 30 ohms into a voltmeter that can measure up to 50 V. What value of series resistor (R_s) will you need to add?
    A. 9,970 Ω   B. 10,000 Ω   C. 1,000 Ω   D. 2,000 Ω

30. Which statement best describes why inserting a dielectric material increases capacitance?
    A. The dielectric material reduces the distance between plates.
    B. The dielectric allows for a higher voltage to be applied across the plates.
    C. The dielectric material polarizes and reduces the effective electric field between plates.
    D. The dielectric increases the size of the plates, allowing for more surface area.

31. A scientist finds an ancient wooden artifact and determined that only 25% of its original ^{14}C remains. If the half-life of ^{14}C is 5730 years, how old is the artifact?
    A. 5,730 years   C. 17, 190 years
    B. 11,460 years   D. 22,920 years

32. What makes a body more stable according to Newtonian mechanics?
    A. A narrower base support
    B. The higher center of gravity
    C. A wider base of support and a lower center of gravity
    D. The material of the body

33. Which of the following comparisons accurately highlights a fundamental difference between nuclear fission and nuclear fusion?
    A. Fission involves the combination of light nuclei, while fusion involves the splitting of heavy nuclei.
    B. Both processes require high temperatures to occur, but only fission produces radioactive waste.
    C. Fission occurs naturally in stars, while fusion is primarily used in nuclear reactors.
    D. Fusion releases energy by combining light nuclei, whereas fission releases energy by splitting heavy nuclei.

34. Which of the following statements best explains the relationship between physics and chemistry?
    A. Physics is primarily concerned with the study of matter, while chemistry focuses solely on energy.
    B. Chemistry relies on the principles of physics to explain how atoms and molecules interact and behave.
    C. Physics and chemistry are completely independent fields with no overlap in concepts or applications.
    D. Chemistry is a branch of physics that deals exclusively with chemical reactions.

35. Which of the following scenarios best illustrates the application of nuclear medicine in diagnosing a medical condition?

    A. A patient undergoes an MRI scan to assess brain activity.

    B. A physician uses a PET scan to visualize metabolic activity in a tumor.

    C. A doctor prescribes antibiotics for a bacterial infection.

    D. A patient receives a physical examination to check for signs of illness.

36. Which of the following best explains how the electrical properties of neurons facilitate communication in living systems?

    A. Neurons use electrical signals only for muscle contraction, with no role in intercellular communication.

    B. Electrical signals in neurons are uniform and do not encode different types of information.

    C. Action potentials depend on the selective permeability of the neuronal membrane, which allows specific ion movements that encode information for communication.

    D. Neurons rely solely on chemical signals for communication, not electrical properties.

37. Which type of radiation, related to the application of physics in medicine, is frequently used in cancer treatment?

    A. Gamma-rays   C. Alpha particles

    B. Radio waves   D. Microwaves

38. Which of the following statements best evaluates the effectiveness of infrared wave detection compared to visible light detection in night vision systems?

    A. Infrared detection is less effective than visible light detection because it cannot penetrate fog or smoke.

    B. Infrared detection is superior because it can detect heat emitted by objects, making it useful in low-light conditions where visible light fails.

    C. Infrared detection provides a clearer image than visible light detection under all conditions.

    D. Infrared detection is only useful in military applications and has no relevance in civilian uses.

39. Which branch of physics is most crucial for understanding the transmission of radio waves, microwaves, and infrared waves in communication technologies?

    A. Thermodynamics   C. Quantum mechanics

    B. Electromagnetic theory   D. Classical mechanics

40. At the peak of its trajectory, what is the vertical component of a projectile's velocity?

    A. Maximum   C. Half of initial value

    B. Zero   D. Constant

41. In projectile motion, which of the following is the correct relation between total time of flight (T) and maximum height (H)?

    A. $H = \frac{1}{4}gT^2$ C. $H = \frac{1}{8}gT^2$

    B. $H = \frac{1}{2}gT^2$ D. $H = gT$

42. A projectile is launched with an initial velocity of 50 m/s at an angle of 30^0 to the horizontal from the ground. Which of the equations below is appropriate to calculate the horizontal distance traveled by the projectile before it hits the ground?
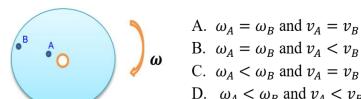
A. $R = \frac{(50\cos(30^0)(2 \cdot 50\sin(30^0))}{g}$

B. $R = \frac{(50\sin(30^0))^2}{g}$

C. $R = 50\cos(30^0) \cdot t$

D. $R = \frac{50^2\sin(60^0)}{g}$

43. Two points A and B are located on a rotating disk as shown below. ω_A and v_A are the angular speed and the tangential speed of point A, ω_B and v_B are the angular speed and the tangential speed of point B. We conclude that:

A. $\omega_A = \omega_B$ and $v_A = v_B$

B. $\omega_A = \omega_B$ and $v_A < v_B$

C. $\omega_A < \omega_B$ and $v_A = v_B$

D. $\omega_A < \omega_B$ and $v_A < v_B$

44. A fan blade starts from rest and reaches an angular velocity of 30 rad/s in 6 s. If the angular acceleration is constant, what is the angular displacement during this time?
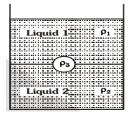
A. 90 rad   B. 120 rad   C. 180 rad   D. 210 rad

45. A solid disk ($I = \frac{1}{2}mr^2$) and a hollow cylinder ($I = mr^2$) of the same mass and radius are rolling down an incline without slipping. If both start from rest at the same height, which of the following statements correctly compares their final velocities at the bottom of the incline?

A. The solid disk will have a greater final velocity than the hollow cylinder.

B. The hollow cylinder will have a greater final velocity than the solid disk.

C. Both will have the same final velocity.

D. The final velocities cannot be determined without additional information.

46. A rotating system consists of three point masses at different positions from axis of rotations: $m_1 = 2\,kg$ at $r_1 = 1\,m$, $m_2 = 3\,kg$ at $r_2 = 2\,m$, and $m_3 = 4\,kg$ at $r_3 = 3\,m$. What is the total moment of inertia **I** about the axis of rotation?

A. 34 kg·m²   B. 38 kg·m²   C. 42 kg·m²   D. 50 kg·m²

47. Which statement correctly summarizes all three of Kepler's Laws?

A. All planets have circular orbits; their speeds vary; their distances affect their speeds.

B. Planets orbit in straight lines, move at constant speeds, and have periods that depend on their masses.

C. Planets orbit in ellipses, sweep equal areas, and have periods related to their distances from the Sun.

D. All celestial bodies are attracted to each other; they move in random paths; and their speeds are equal

48. Two moons orbit a planet. Moon A has an orbital radius of R, and Moon B has an orbital radius of 4R. How does the orbital period of Moon B compare to moon A?

A. Twice as long

B. 8 times as long

C. 4 times as long

D. 2 times as long

49. Two masses 4 kg and 6kg are separated by a distance of 2 m. What is the gravitational force between them?

   A. 4.0×10^{-11} N
   B. 8.0×10^{-10} N   .
   C. 2.0×10^{-11} N
   D. 4.0×10^{-10} N

50. Kepler's third law is generalized by Newton by showing that it applies to:

   A. Only planet orbiting the Sun
   B. Any two orbiting bodies
   C. Only elliptical orbits, not circular orbits
   D. System where gravity is negligible

51. What is the primary cause of pressure in a gas?

   A. Gas particles colliding with the walls of their container
   B. The weight of the gas
   C. The volume of the gas
   D. The temperature of the gas

52. Which of the following correctly expresses the relationship between absolute pressure, guage pressure, and atmospheric pressure?

   A. Absolute pressure equals gauge pressure minus atmospheric pressure.
   B. Gauge pressure equals absolute pressure plus atmospheric pressure.
   C. Atmospheric pressure equals absolute pressure plus gauge pressure.
   D. Absolute pressure equals gauge pressure plus atmospheric pressure.

53. What is the force needed to apply to hydraulic press of piston 2 cm radius in order to result a force of 7200 N at the working piston of radius 6 cm?

   A. 2400 N   B. 800 N   C. 1050 N   D. 667 N

54. A scientist measures the pressure at different depths in a liquid-filled tube. At a depth of 1 m, she records a pressure of 50 kPa. If she descends to a depth of 3 m in the same liquid, what can she conclude about the relationship between depth and pressure based on her observations?

   A. Pressure increases as depth increases.
   B. Pressure decreases as depth increases.
   C. Pressure remains constant regardless of depth.
   D. There is no consistent relationship between depth and pressure

55. A student is using an open-ended manometer to measure the pressure of gas sample. If the mercury level is higher on the gas side than on the open side, what can be concluded?

   A. The gas pressure is greater than atmospheric pressure
   B. The gas has no pressure
   C. The gas pressure is equal to atmospheric pressure
   D. The gas pressure is less than atmospheric pressure

56. A cube with a side length of 0.5 m is submerged in a fluid with a density of 1200 kg/m³. What is the buoyant force acting on the cube?

   A. 1500 N   B. 500 N   C. 1200 N   D. 250 N

57. A liquid flows through a horizontal pipe where the diameter decreases from 10 cm to 5 cm. If the velocity at the larger section is 4 m/s, what is the velocity at the smaller section?

   A. 4 m/s   B. 8 m/s   C. 12 m/s   D. 16 m/s

58. Which of the following best describes a turbulent fluid flow?
    A. Velocity is constant at every point
    B. Motion of the fluid is smooth and predictable
    C. Fluid particles follow irregular, chaotic paths
    D. Fluid flows with a well-defined layer

59. A jar is filled with two non-mixing liqudis 1 and 2 having densities ρ_1 and ρ_2 , respectively. A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 & ρ_3?

    A. $\rho_3 < \rho_1 < \rho_2$
    B. $\rho_1 > \rho_3 > \rho_2$
    C. $\rho_1 < \rho_2 < \rho_3$
    D. $\rho_1 < \rho_3 < \rho_2$

60. During the operation of a high-pressure steam turbine, you detect unusual noises and vibrations. What should be your immediate response to mitigate potential risks?
    A. Increase the steam flow to compensate for the performance issues.
    B. Continue operation and report the anomalies during the next scheduled maintenance.
    C. Reduce the load and initiate an immediate inspection to identify and address the cause.
    D. Temporarily shut down the turbine and wait for the anomalies to resolve.

The End!