



THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF PHYSICS

PHY1015 – INTRODUCTORY PHYSICS FOR MEDICAL SCIENCES
TEST I – MAY 2023
Duration – Two (2) hours
Total marks – 100

Section A: Questions 1-25 are multiple choice [3 marks each]. Mark a cross (X) on the answer sheet.

Section B: Questions 26-30 are numerical questions [5 marks each]. Only write your final calculated value in the space provided on the answer sheet.

Where necessary use:

$$g = 9.8 \text{ m/s}^2; P_A = 1.013 \times 10^5 \text{ N/m}^2; 1 \text{ Pascal} = 1 \text{ N/m}^2; \rho_{\text{water}} = 1000 \text{ kg/m}^3$$
$$1 \text{ hp} = 746 \text{ W}; 1 \text{ ton} = 1000 \text{ kg}$$

Some equations you may find useful:

$$v_f = v_i + at; v_f^2 = v_i^2 + 2as; s = v_i t + \frac{1}{2} at^2; s = \bar{v}t; \bar{v} = \frac{v_i + v_f}{2}; a = \frac{v_f - v_i}{t}$$
$$y = x \tan \theta - \frac{g}{2v_o \cos^2 \theta} x^2; R = \frac{2v_i^2 \sin \theta \cos \theta}{g} = \frac{v_i^2 \sin 2\theta}{g}; t = \frac{2v_i \sin \theta}{g}$$

The question paper **MUST** be submitted together with the answer sheet.

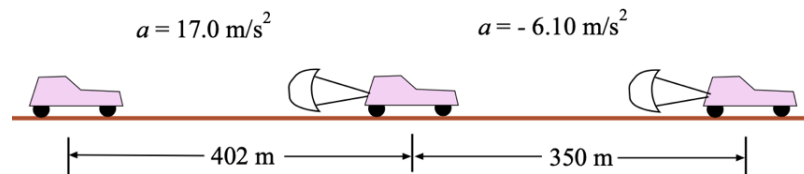
Write your particulars below.

SURNAME: _____ MIDDLE NAME: _____ FIRST NAME _____

COMPUTER ID: _____ TUTORIAL GROUP _____

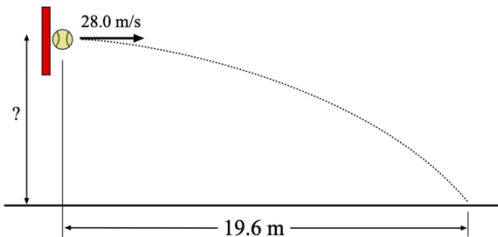
SECTION A: 75 MARKS**MARK THE LETTER OF YOUR CHOICE WITH A CROSS (X) ON THE ANSWER SHEET**

- Which of the following is not a base unit?
 - second
 - newton
 - metre
 - kilogram
- The mass of a parasitic wasp can be as small as 5×10^{-6} kg. What is this mass in micrograms (μg)?
 - 5×10^5
 - 5×10^2
 - 5×10^3
 - 5×10^4
- A student walks 5.0 m due east then 2.1 m at an angle of 20.0° north of east and finally 0.50 m due north. Her final direction is
 - 9.9° due east
 - 9.0° due east
 - 8.9° due east
 - 8.8° due east
- An aircraft travelling northward is landing with a speed of 69 m/s. Once it touches down, it has 750 m of a runway in which to reduce its speed to 6.1 m/s. Compute the average acceleration of the aircraft during landing.
 - $+3.15 \text{ m/s}^2$
 - -3.15 m/s^2
 - $+2.35 \text{ m/s}^2$
 - -2.35 m/s^2
- A race car starting from rest speeds up for 402 m with an acceleration of $+17 \text{ m/s}^2$. A parachute then opens slowing the car with an acceleration of -6.10 m/s^2 as shown below. How fast is the car moving 350 m after the parachute opens?



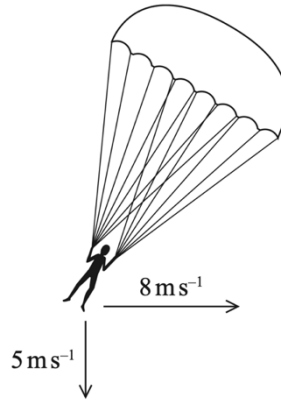
- 50.6 m/s
 - 40.6 m/s
 - 30.6 m/s
 - 20.6 m/s
- From her bedroom window, a girl drops a water-filled bottle to the ground 6.0 m below. If the bottle is released from rest, how long is it in the air?
 - 1.01 s
 - 1.21 s
 - 2.22 s
 - 1.11 s
 - A student throws a ball vertically upward and later catches it after 2.00 s. What is the maximum height the ball attained?
 - 4.00 m
 - 3.00 m

- (c) 4.90 m
(d) 2.90 m
8. What law is also known as the law of inertia?
(a) Netwon's third law
(b) Newton's first law
(c) Netwon's second law
(d) Netwon's first and second laws
9. A student stands at the edge of a cliff and throws a rock downward with a speed of 12.0 m/s. Sometime later, it strikes the ground 110 m below the place where it was thrown. How long does it take to reach the ground?
(a) 3.57 s
(b) 3.17 s
(c) 3.07 s
(d) 3.67 s
10. A dolphin leaps out of the water at an angle of 35° above the horizontal. The horizontal component of the dolphin's velocity is 7.7 m/s. Find the magnitude of the vertical component of the velocity.
(a) 2.4 m/s
(b) 3.4 m/s
(c) 4.4 m/s
(d) 5.4 m/s
11. The unit of force is the newton. One newton is equivalent to
(a) 1.0 kg
(b) 2.0 kg·m/s
(c) 2.0 g·m/s
(d) 1.0 kg·m/s²
12. A tennis ball is struck such that it leaves the racket horizontally with a speed of 28.0 m/s. The ball hits the court at a horizontal distance of 19.6 m from the racket as shown below. What is the height of the tennis ball when it leaves the racket?



- (a) 2.4 m
(b) 2.3 m
(c) 2.2 m
(d) 2.1 m
13. During the International Nurses Day, May 12, 2023, a just deployed nurse rolls a ball off a horizontal cliff with an initial speed of 11.4 m/s. The ball falls a vertical distance of 15.5 m into a lake below. Given that the ball spends 1.8 s in the air, what is the speed of the ball just before it strikes the water?
(a) 18.8 m/s
(b) 20.8 m/s
(c) 16.8 m/s
(d) 22.8 m/s

14. An Olympic long jumper leaves the ground at an angle of 23° and travels through the air for a horizontal distance of 8.7 m before landing. What is the takeoff speed of the jumper?
- (a) 15 m/s
 - (b) 13 m/s
 - (c) 17 m/s
 - (d) 11 m/s
15. A 4000 kg ambulance is parked on a 15° slope. How big is the friction force on the truck?
- (a) 2.09×10^4 N
 - (b) 1.01×10^4 N
 - (c) 3.11×10^4 N
 - (d) 1.99×10^4 N
16. If \mathbf{B} is added to $\mathbf{C} = 3.0\hat{i} + 4.0\hat{j}$, the result is a vector in the positive direction of the y -axis with a magnitude equal to that of \mathbf{C} . What is the magnitude of \mathbf{B} ?
- (a) 5.0
 - (b) 2.3
 - (c) 3.2
 - (d) 5.2
17. During a hard sneeze, a patient's eyes shut for 0.5 s. If the ambulance is moving at 90 km/h during such a sneeze, how far does the ambulance move during that time?
- (a) 0.017 km
 - (b) 0.015 km
 - (c) 0.010 km
 - (d) 0.013 km
18. A projectile's launch speed is five times its speed at maximum height. What is the launch angle θ in radians? (You may use the conversion factor: $360^\circ = 2\pi$)
- (a) 2.37 rad
 - (b) 5.37 rad
 - (c) 1.37 rad
 - (d) 3.37 rad
19. The motion of an object is given by the equation $x(t) = 2 + 3t - 2t^2$ where x is the position in metres and t is the instant in seconds. What is the velocity of the object at $t = 5$ s?
- (a) +10 m/s
 - (b) +12 m/s
 - (c) -17 m/s
 - (d) -25 m/s
20. The coefficient of static friction between Teflon and scrambled eggs is about 0.04. What is the smallest angle from the horizontal that will cause the eggs to slide across the bottom of a Teflon-coated frypan?
- (a) 0°
 - (b) 4°
 - (c) 1°
 - (d) 2°
21. The diagram shows a student during a parachute jump on a windy day. The vertical component of his velocity is 5.0 m s^{-1} . The horizontal component of his velocity is 8.0 m s^{-1} . He descends at an angle θ to the vertical.

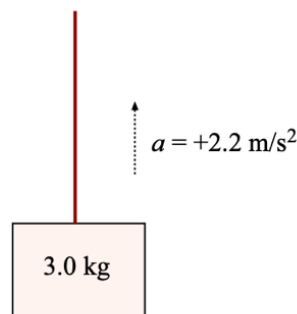


- What is the angle of the student's resultant velocity?
- (a) 59.99°
 - (b) 38.68°
 - (c) 57.99°
 - (d) 51.32°
22. Which of the following does not affect frictional force?
- (a) area of contact
 - (a) surface roughness
 - (b) reaction of surface
 - (d) force causing motion
23. The slope of an acceleration-time graph gives a quantity called
- (a) jerk
 - (b) velocity
 - (c) distance
 - (d) retardation
24. Choose a scalar quantity from the following?
- (a) weight
 - (b) speed
 - (c) friction
 - (d) displacement
25. Which of the following statements is correct?
- (a) static friction is proportional to the normal force
 - (b) an object undergoing projectile motion is known as a trajectory
 - (c) the path followed by an object in a projectile motion is known as a projectile
 - (d) friction has disadvantages only

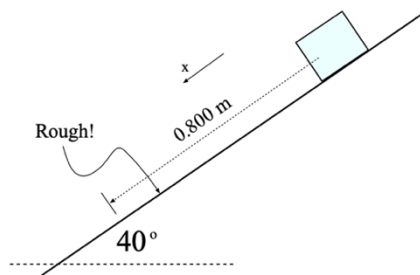
SECTION B: 25 MARKS

ONLY WRITE YOUR FINAL CALCULATED VALUE ON THE ANSWER SHEET PROVIDED

26. An ampoule contains a solution of a drug of $300 \mu\text{g}/5\text{ml}$. Convert this dose into grams per litre (g/l).
27. An object is launched at a velocity of 20 m/s in a direction making an angle of 25° upward with the horizontal. What maximum height in metres (m) is reached by the object?
28. A 3.0 kg syringe box is pulled upward by means of an attached rope such that its acceleration is $+2.2 \text{ m/s}^2$ as shown below. What is the tension T of the rope in newton (N)?



29. The car accelerates uniformly on a straight road from rest to a speed of 10 m/s in $2T$ seconds. It then travels at a constant speed for 60 seconds. The car then decelerates uniformly to rest in a further $8T$ seconds. If the total distance travelled by the car is 800 m , find the value of T .
30. A block slides down a rough incline sloped at an angle of 40° from the horizontal as schematically illustrated in the diagram below.



Starting from rest, it slides a distance of 0.800 m down the slope in 0.6 s . What is the coefficient of kinetic friction for the block and surface to one decimal place?