# NAMIBIA UNIVERSITY
## OF SCIENCE AND TECHNOLOGY

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

**SCHOOL OF NATURAL AND APPLIED SCIENCES**

**DEPARTMENT OF BIOLOGY, CHEMISTRY AND PHYSICS**

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|---|---|
| **QUALIFICATION** : BACHELOR OF SCIENCE<br>BACHELOR OF HUMAN NUTRITION<br>BACHELOR OF ENVIRONMENTAL HEALTH SCIENCES<br>BACHELOR OF HEALTH INFORMATION SYSTEMS MANAGEMENT<br>BACHELOR OF MEDICAL LABORATORY SCIENCES | |
| **QUALIFICATION CODE:** 07BOSC, 08BOHN, 08BOHS, 07BHIS, 08BBMS | **LEVEL:** 5 |
| **COURSE CODE:** GNP501S<br>HSP511S | **COURSE NAME:** GENERAL PHYSICS 1A<br>HEALTH SCIENCE PHYSICS |
| **SESSION:** JUNE 2023 | **PAPER:** THEORY |
| **DURATION:** 3 HOURS | **MARKS:** 100 |

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| **FIRST OPPORTUNITY EXAMINATIONS QUESTION PAPER** | |
| **EXAMINER(S)** | DR MUNYARADZI ZIVUKU<br>DR VAINO INDONGO |
| **MODERATOR:** | PROF. DIPTI SAHU |

## INSTRUCTIONS:

1. Answer all the questions in the booklet provided
2. Show clearly all the steps used in the calculations
3. All written work MUST be done in blue or black ink and sketches must be done in pencils.

### PERMISSIBLE MATERIALS

Non-Programmable Calculator

**THIS QUESTION PAPER CONSISTS OF 7 (INCLUDING THIS FRONT PAGE)**

**SECTION A** [40]

**QUESTION 1** (40)

**Multiple choice questions types: Each question carries two marks**

1.1 The dimensions of Volume are given by; (2)

    A. $L^3$      B. $L^2T^2$      C. dimensionless      D. $MLT^{-1}$

1.2 ............... is the unit of impulse. (2)

    A. W      B. Hz      C. Ns      D. NS

1.3 One of these is the dimension of force. (2)

    A. $ML^2$      B. $MLT^{-1}$      C. $M^2T^2$      D. $MLT^{-2}$

1.4 _____ is a unit of force. (2)

    A. $kg.m/s^2$

    B. kg

    C. m/s

    D. $cm^3$

1.5 Which of the following physical quantity is dimensionless? (2)

    A. Angle

    B. Strain

    C. Specific gravity

    D. All of the above

1.6 The dimensional formula of angular velocity is............ (2)

    A. MLT

    B. $MLT^2$

    C. $M^0L^0T^{-1}$

    D. $M^{-1}LT^{-1}$

1.7 The dimensions of WORK are;                                                    (2)

    A. MLT

    B. $ML^2T^{-2}$

    C. $MLT^{-1}$

    D. $ML^2T^{-1}$


1.8 The rate of change of displacement of a particle is referred to as ............... (2)

    A. speed

    B. velocity

    C. acceleration

    D. power


1.9 Which of the following is a physical quantity that has a magnitude but no

    direction?                                                     (2)

    A. Vector

    B. Frame of reference

    C. Resultant

    D. Scalar


1.10   The difference between speed and velocity is:                       (2)

    A. speed has no units

    B. they use different units to represent their magnitude

    C. speed shows only magnitude, while velocity represents both magnitude

       (strength) and direction

    D. velocity has a higher magnitude


1.11   A dot product of any two vectors gives a _____ .                (2)

    A. vector

    B. vector and scalar

    C. scalar

    D. unit vector

1.12 _____ is the rate of change of energy? (2)

  A. Work

  B. Power

  C. Frequency

  D. Viscosity

1.13 The forces of 20 N towards north and 12 N towards south are acting on an object. What will be resultant force? (2)

  A. 32 N toward north

  B. 20 N towards north

  C. 32 N towards south

  D. 8 N towards north

1.14 A steel bar is precisely 1.6 m at $25^0$ C. At what temperature will its length be 1.4 mm longer? (2)

  A. 48°C    B. 98°K    C. 48°K    D. 98°C

1.15 When a liquid freezes to become a solid: (2)

  A. it absorbs energy    B. its temperature increases

  C. its temperature decreases    D. it emits energy

1.16 How much heat is required to raise the temperature of a 0.04 kg stainless steel cup from 20°C to 50°C if the specific heat capacity of stainless steel is 0.50 kJ / kg.°C. (2)

  A. 200 J    B. 400 J    C. 800 J    D. 1000 J

1.17 ………… Is a vector that is tangential to path of an object in a circle: (2)

  A. angular force    B. centripetal acceleration

  C. centripetal velocity    D. centripetal force

1.18 When the rate of increase of velocity is constant, we say .......... has occur: (2)

  A. deceleration                    B. acceleration

  C. uniform retardation             D. uniform acceleration


1.19 Which of these statements is not true about why weight varies? (2)

  A. due to rotation of the earth about its axis

  B. due to constant in density of earth

  C. due to elliptical shape of the earth

  D. due to variation in latitude


1.20 Whenever a liquid is touched slightly, small ripples run across the surface. This statement is an evidence of ................ (2)

  A. surface tension     B. capillarity     C. angle of contact     D. proxy

**SECTION B** [60]

**QUESTION 2** (18)

2.1 Briefly differentiate between the following terms with examples

  (i) Random errors and systematic errors (2)

  (ii) Accuracy and precision (2)

2.2 Derive the dimensions of:

  (i) Density (2)

  (ii) Momentum (2)

2.3 Determine whether the following equation is dimensionally correct.

  (i) $v = u + at^2$ (2)

2.4 Suppose A = $B^m C^n$, where A has dimension, LT, B has dimension $L^2T^{-1}$, and C has dimensions $LT^2$. Determine the dimension of n and m values. (3)

2.5 The mass 'm' of the largest stone that can be moved by a flowing river depends upon the velocity 'v' of water, density 'd' of water and acceleration due to gravity 'g'. Use the method of dimensional analysis to deduce the expression mass of a stone (7)


**QUESTION 3** (12)

3.1 Determine the angle between the two vectors using the dot product approach: (3)

  $\bar{A} = 2\,\breve{\imath} - 2\,\hat{\jmath} + 3\,\breve{k}$   and   $\bar{B} = -4\,\breve{\imath} + 2\,\hat{\jmath} - \breve{k}$

3.2 Given that: $\hat{a} = -2\breve{\imath} + 2\,\hat{\jmath} - 2\,\breve{k}$, find the magnitude of $\hat{a}$, and the unit vector in the direction of $\hat{a}$. (3)

3.3 The position $\bar{r}$ of an object is given by [ (2.5t )$\dot{i}$ + (2.5t – 4.9 t²) j] m (with t in seconds). Determine;

  (i) the velocity when t = 2 seconds (3)

  (iii) the magnitude of the velocity when t = 2 seconds (3)

6

**QUESTION 4** (15)

4.1 A passenger plane accelerated from rest down a runway at a constant acceleration of 2.5 m.s$^{-2}$.

    (i)    Determine the position and velocity of the plane 8 seconds after it starts to move. (3)

    (ii)    If the speed of 45 m/s is required for take-off, what is the minimum length of runway required? (2)

4.2 A spacecraft of mass 300 kg land on the moon. Calculate the moon's gravitational acceleration, g, on the spacecraft. [Take mass of moon = 7.5 x 10$^{22}$ kg, radius of the moon = 1.6 x 10$^{6}$ m, G = 6.67 x 10$^{-11}$ Nm$^{2}$ kg$^{-2}$]. (3)

4.3 A rocket of mass 150 kg is launched on planet Jupiter's surface into space. Calculate the

    (i) energy required to overcome the gravitational force of Jupiter. (3)

    (ii) velocity of rocket upon launching. (2)

4.4 A CD starts from rest and accelerates to an angular frequency of 12.5 rev/s. Determine the disc's average period T and centripetal velocity $V_c$ of the edge of the a disc when the radius is 3.5 x 10$^{-3}$ m. (2)


**QUESTION 5** (15)

5.1 Explain the terms adhesion and cohesion. (2)

5.2 Suppose that a huge tank 50m high and filled with water is open to the atmosphere and is hit with a stray bullet. The bullet pierces one side of the tank allowing water to flow out. The hole is 2m above the ground. If the hole is so small in comparison with the size of the tank. How quickly will the water flow? Consider acceleration due to gravity to 9.8 m/s$^2$ (6)

5.3 Determine the density of a sphere material, given that it has a radius of 8.2 mm with mass of 200 g. (4)

5.4 During the time when a man had flu, he ran a fever of 7.0°C above normal. His body temperature was 44.0°C instead of the normal 37.0°C. Assuming that the man has a mass of 40 kg and that the human body is mostly water, how much heat is required to raise his temperature? [Take specific heat capacity of liquid as, c = 4186 J / kg.°C] (3)

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