NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT: NATURAL AND APPLIED SCIENCES

QUALIFICATION : BACHELOR OF HUMAN NUTRITION BACHELOR OF ENVIRONMENTAL HEALTH SCIENCES BACHELOR OF HEALTH INFORMATION SYSTEMS MANAGEMENT BACHELOR OF MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BOHN, 08BOHS, 07BHIS, 08BBMS	**LEVEL:** 5
COURSE CODE: HSP511S	**COURSE NAME**: HEALTH SCIENCE PHYSICS
SESSION: JUNE 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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Instructions

1. Answer **all** questions.
2. Answer the questions in the booklet provided
3. All written work MUST be done in blue or black ink
4. Mark all answers clearly with their respective question numbers

THIS EXAMINATION PAPER CONSISTS OF 5 PAGES (INCLUDING THIS FRONT PAGE)

SECTION A

QUESTION 1 (20)

1.1 Power is measured in: (2)

A. $W\ s^{-1}$ B. $J\ s^{-1}$ C. m/s D. W^2

1.2 One of these statements is not true for acceleration due to gravity, g. (2)

A. it is not a constant B. it is a universal constant

C. it is a vector quantity D. its magnitude is bigger than 0.

1.3 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

1.4 A streamline flow is also called ..... (2)

A. Laminar flow B. Turbulent flow

C. Volume flow D. Bernoulli's flow

1.5 A steel bar is precisely 1.60 m at 25^0 C. Its length is then increased to 1.64 m? Determine its initial temperature in Kelvin. (2)

A. 273 B. 198 C. 25 D. 298

1.6 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

1.7 .....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

1.8 ..... is a method of determining universal gravitational constant, G: (2)

A. Simple pendulum method B. Boyle's method

C. Universal method. D. Gravitational method

1.9 Determine the density of copper if a copper ball with radius 1 cm has a mass of 37.3 g. (2)

A. 7.77×10^3 kg.m^{-3} B. 44×10^2 g

C. 8.88×10^3 kg.m^{-3} D. 1×10^2 g

1.10 Which statement is incorrect for assumptions made in the derivation of Bernoulli equation? (2)

A. The flow is steady B. The flow is incompressible

C. The viscosity of fluid in non-zero D. The flow is irrotational

SECTION B

QUESTION 2 (15)

2.1 Explain why or why not displacement, acceleration and velocity vector be added together. (4)

2.2 Determine whether the following equations are dimensionally correct, if NOT, how can you make them dimensionally correct?

(i) $P = \sqrt{\varrho g h}$ (3)

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

2.3 In an investigation, small spheres are dropped into a long column of a viscous liquid and their terminal speed ***V*** of a sphere depends on the product of powers of its radius ***r***, its weight *mg* and the viscosity **η** of the liquid. Derive an equation for the velocity of the sphere using dimensional analysis. (6)

QUESTION 3 (15)

3.1 Given three vectors;

a = i + 2j +3k,

b = 2i +3j + k

c = 7i +2j +k,

(i) Calculate $(\bar{a} + \bar{b}).\bar{c}$ (3)

(ii) Evaluate vector **p**, such that **p = (a x b) + (a x c)** (5)

3.2 The distance covered by a car at a time, t is given by $x = 20t + 6t^4$, calculate

(i) the instantaneous velocity when t = 1 (3)

(ii) the instantaneous acceleration when t = 1 (4)

QUESTION 4 (15)

4.1 Given that a car start with a speed of $\boldsymbol{u}$ km/h and attain a final velocity of $\boldsymbol{v}$ km/h after a time $\boldsymbol{t}$ hours. Given that the distance covered by the car is **H** km, derive an equation for the velocity of the car and also show that this velocity can be written as:

$$\boldsymbol{v = \sqrt{u^2 + 2aH}} \quad (5)$$

4.2 A projectile is launched from a cliff 100m above the ground with an initial velocity of 200 m/sec at angle of 30^0 above the horizontal ground. Determine;

(ii) The maximum height reached by the projectile (H) (5)

(ii) Time of flight (T) (5)

QUESTION 5 (10)

5.1 Differentiate between elastic and inelastic collision with reference to the conservation of momentum and conservation of kinetic energy. (2)

5.2 Show that the rate of energy transfer of a particle is given by;

f x v (3)

5.3 A 1.0 kg object moves to the right at 2.0 m/sec and collides with a stationary 3.0 kg object. Assume the two objects are not stuck to each other after collision. Assuming elastic collision and both momentum and kinetic energy are conserved, what will be the final velocities of the two objects. (5)

QUESTION 6 (15)

6.1 A bicycle wheel starts from rest and accelerates to an angular frequency of 3.50 rev/s. Determine the wheel's average period T and centripetal velocity V_c of the edge of the a wheel when the radius is 0.75 m. (5)

6.2 An object of mass *m* is attached to a spring of length *l*. If the spring is extended by a distance *e* and released. Show that the period, T, of the oscillation is given by $T = 2\pi\sqrt{\frac{e}{g}}$. (4)

6.3 A spacecraft of mass 256 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} $Nm^2 kg^{-2}$]. Start with two forces that can be used for this scenario. (6)

QUESTION 7 (10)

7.1 Explain the terms adhesion and cohesion. (3)

7.2 Describe two pieces of evidence for surface tension based on cohesive and adhesive forces. (4)

7.3 During the time when a man had flu, he ran a fever of 2.0°C above normal. His body temperature was 39.0°C instead of the normal 37.0°C. Assuming that the man has a mass of 80 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)

END OF QUESTION PAPER