**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATION 2017/2018**

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF**

**BACHELOR OF SCIENCE IN MECHANICAL/MARINE/MECHATRONICS AND**

**AGRICULTURAL AND BIOSYSTEMS ENGINEERING.**

**SPH 2173: PHYSICS FOR ENGINEERS 1**

**DATE: JANUARY 2018 TIME: 2 HOURS**

**INSTRUCTIONS:**

* This question paper contains FOUR questions.
* Attempt QUESTION ONE (COMPULSORY) and any other two questions.
* Question one carried 30 marks and the rest carry 20 marks each
* Take the acceleration due to gravity ,g= 9.8m/s2
* Take the gravitational constant of proportionality, G=6.67× 10-11 N.m2/kg2

**QUESTION ONE (COMPULSORY)**

1. Surface tension is not buoyancy;
2. State the molecular definition of surface tension (1 mark)
3. A needle has a length of 3.2 cm.when placed gently on the surface of water of temperature 20 oC it floats, what is the weight of the heaviest needle that can be used in this demonstration? (4 marks)
4. A mass of 3.5 kg is gradually applied to the lower end of a vertical wire and produces an extension of 0.8mm. Calculate;
5. The energy stored in the wire (2 marks)
6. The loss in gravitational potential energy of the mass in loading (2 marks)
7. Compare the answer in b)i) and b)ii) and give an account (2 marks)
8. By definition distinguish among the following stresses experienced by a body under the influence of forces; (3 marks)
9. Tension
10. Compression
11. Torsion
12. Is the equation **x=xo + vxot+** $\frac{1}{2}$**axt** dimensionally correct? (1 mark)
13. What is the difference between kinematics and dynamics? (1 mark)
14. Derive the kinematic equation of motion for a constant acceleration (4 marks)
15. A diver jumps from a cliff 40m high into the ocean.
16. How long does the fall last? (1 mark)
17. What is the diver’s impact velocity on the water? (1 mark)
18. A car drives around a traffic circle of radius of 30 m. if the maximum possible speed is 15m/s, what must be the maximum transverse acceleration that the wheels can withstand without skidding ? (1 mark)
19. The mass of the Moon is 7.35× 1022kg and its radius is 1.74× 106m.
20. Calculate the acceleration due to the moon’s gravity. (1 mark)
21. For an upward jump of 1 m here on earth, what would be the height of the same jump on the moon? (1 mark)
22. A block of mass M is sliding down a smooth, frictionless plane inclined at an angle$ θ$.
23. Find the acceleration of the block along the inclined plane (2 marks)
24. Find the magnitude of the normal force that the exerts on the block (2 marks)

**QUESTION TWO**

1. Outline the general concept of kinetic theory of matter (2 marks)
2. Explain how the kinetic theory of matter can be used to describe the following;
3. Evaporation (2 marks)
4. Latent heat (2 marks)
5. Viscosity (2 marks)
6. State five assumptions made in the derivation of the kinetic theory formula (5 marks)
7. Show that P=ρc2 ,where P is pressure exerted on the surface of a container, ρ is the gas density

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and C2 is the mean square velocity of the gas molecules. (7 marks)

**QUESTION THREE**

1. Viscosity is a common property of fluids;
2. Define viscosity (1 mark)
3. Outline FIVE types of fluids based on the Newtonian experiment on viscosity of fluids (5marks)
4. Calculate the time taken for a particle of carbon of density 2300Kg/m3 and radius 0.0001m to fall 2.0m through the air ( viscosity of air is 0.01 Pa.s) (4 marks)
5. State and explain the Newton’s law of motion. (3 marks)
6. A ball is thrown upwards from the top of a roof with an upward speed of 15m/s and on its way down, it just misses the wall. Find
7. The ball’s position and velocity 1 second and 4 seconds after leaving the hand. (2 marks)
8. The ball’s velocity when its 5 m above the roof (1 mark)
9. Maximum height reached (1 mark)
10. The ball’s acceleration when its at maximum height (1 mark)
11. At what time after being released has the ball fallen 5m below the roof? (2marks)

**QUESTION FOUR**

1. State and explain any two types of motion in mechanics (2 marks)
2. A projectile is fired from the ground with an initial velocity **Vo** and an angle $θ$ above the horizontal. Find
3. Time of flight (2 marks)
4. Horizontal range (2 marks)
5. A ball on a string is moving up and down in a simple harmonic motion with a frequency of 100Hz and has an amplitude of 3cm. Assuming that the time t=0 the ball is at position x=0 cm and its velocity is negative, find:
6. The equation describing the motion of the ball (3 marks)
7. How long does it take the ball to travel from x=0cm to x= 8cm? (2 marks)
8. The following figure shows a box hung by strings. The box remains at rest. Assuming the strings are weightless, and the mass of the box is 3Kg, what is the magnitude of the forces **F1** and **F2**? (5 marks)

 30O 45O

 F1 F2

1. A person weighs his weight on a spring balance inside a moving elevator.
2. Show that if the elevator accelerates either upwards or downwards, the spring scale gives a reading that is different from the weight of the man. (3 marks)
3. Suppose the elevator cable breaks and the elevator and its contents are in free fall. What happens to the reading of the scale? (1 mark)