UNIVERSITY OF RUHUNA

BACHELOR OF SCIENCE HONOURS IN FISHERIES AND MARINE SCIENCE DEGREE

Level - II, Semester - I Examination

August/September 2018

LIM 2111: Physics of Water

Time 1½ hours

Answer all questions in Part - I, II and only <u>one question</u> in Part-III

Part-I

1. Choose the correct statement

   i.   In water molecules, hydrogen bond between molecule is about 5-10% as strong as covalent bond within a molecule

   ii.   Water drops are round in shape because of their adhesive property

   iii. High heat capacity of water enable spiders to walk on water surface

   iv. Cohesion causes water drops to cling to other surfaces

   v.   Shear waves are better supported in an aquatic medium

2. Consider the following statements, and select the correct statement/s
   a. The first law of thermodynamics is a version of the law of conservation of energy
   b. Heat energy transfer through radio magnetic waves is called convection
   c. Angle of the water molecule in liquid water is higher than that of ice
   d. Bacterium has a lower Reynold's number compared to a copepod

     i.   a and b   iv. a and d

    ii.   b and c   v.   all

   iii. c and d

3. Width, depth and the water flow velocity of a rectangular channel are 34 m, 2.1 m and 4.5 m/s respectively. This channel passes through a narrow channel of 2.7-m wide where flow velocity increases to 6.0 m/s. How deep is this narrow part of the channel?

    I.   18.9 m

    II.   24.3 m

    III.   19.8 m

    IV.   15.7 m

    V.   21.6 m

4. Water flow velocity in an open channel is a function of
   i. Wetted perimeter
   ii. Nature of the riparian vegetation
   iii. Slope of the adjacent land
   iv. Area of the bottom substrate
   v. Heat Capacity of water

5. Select the correct statement
   i. Isolated systems only exchanged thermal energy
   ii. The change in the internal energy of a closed system is equal to the heat acquired by the system
   iii. Inertia is the resistance of a body to change its state of motion
   iv. Turbulent flow makes unidirectional forces on aquatic plants
   v. Different phases are clearly visible at the critical point of water

(2 x 5 =10 Marks)

Part-II

1. How can aquatic life survive in frozen lakes during winter?

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(4 Marks)

2. List four ecological importance of high heat capacity of water.

   i. ....
   ii. ....
   iii. ....
   iv. ....

(4 Marks)

3. Briefly explain, why smaller particles take longer time to settle out in water than larger particles

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(4 Marks)

4. Explain the difference between an open system and a close system

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(4 Marks)

5. Define the term "phase of a substance"

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(4 Marks)

6. Show the all possible phase transitions of water

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(4 Marks)

7. Explain the reason for the low solubility of salts in super critical water.

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(4 Marks)

8. List four important applications of electrical conductivity in limnological studies
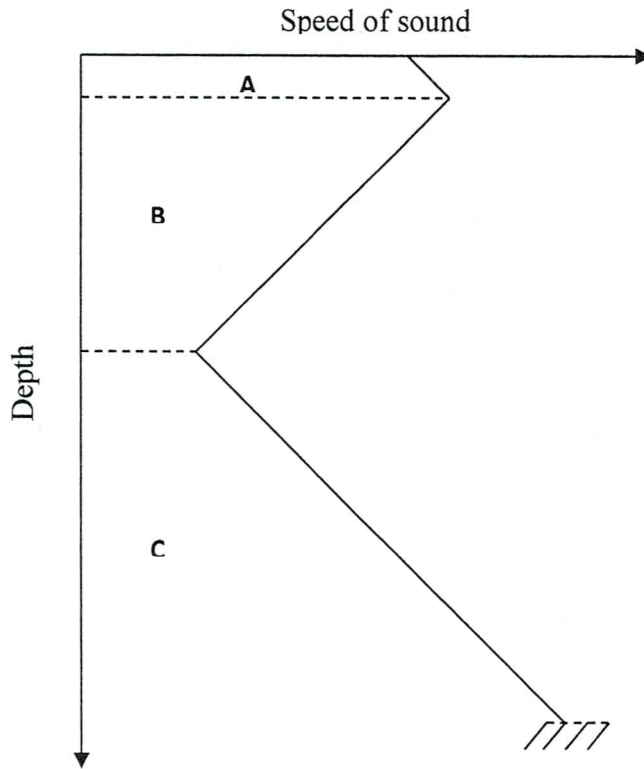   i. ....
   ii. ....
   iii. ....
   iv. ....

(4 Marks)

9. Give four potential applications of sound waves in aquatic ecological studies?
   i. ....
   ii. ....
   iii. ....
   iv. ....

(4 Marks)

10. This question is based on following diagram which shows the behavior of sound speed against the depth of a water body

Speed of sound

Depth

A

B

C

a. Label the zone A and B
    i. A: ....
    ii. B: ....

(02 Marks)

b. List four factors that influence to the behavior of sound in the zone A

    i.   ....
    ii. ....
    iii. ....
    iv. ....

(04 Marks)

c. How do you identify the boundaries of the zone B

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(04 Marks)

d. Define the term "*critical point*" in relation to the sound speed in water and mark it in the above diagram

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(04 Marks)

Part-III

Answer only <u>one (01)</u> question

(40 Marks)

1. Formation of a fully developed velocity profile inside a pipe is a complex process.
   a. Describes the flow development process in a pipe

   b. Water at 20^0C flow in a circular pipe of 3.5 cm diameter. Determine the range for the average water flow velocity where the flow is always in transition condition

      Note: density and viscosity of water at 20^0C are 998 kg.m³ and 1.002 x 10⁻³ kg.ms respectively

2. Application of supercritical water is one of the modern techniques in many processes.
   a. Describe the process of supercritical water oxidation
   b. Explain the importance of the supercritical water oxidation process compared to the general incineration
   c. Write short notes on followings
      i. Supercritical water biomass gasification
      ii. Triple point vs Critical point of water