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BNA-012

B.Sc. (NAUTICAL SCIENCE)

Term-End Examination

June, 2015

00305

BNA-012 : APPLIED SCIENCE

Time : 2 hours *Maximum Marks : 70*

Note : *This question paper consists of two sections, Section A and Section B. Attempt all questions. Use of non-programmable scientific calculator is allowed.*

SECTION A

1. Attempt ***all*** parts. *5×1=5*

(a) Weight of a freely falling body is _____ Newton.

(b) What is anomalous expansion of water ?

(c) Period of oscillation of seconds pendulum is _____ seconds.

(d) Doppler effect of sound is a _____ phenomena.

(e) What is the relation between refractive index and critical angle ?

2. Attempt any ***two*** parts. *2×5=10*

(a) Velocity of sound in fresh water is 1450 m/s. Determine the adiabatic compressibility of water. Density of water is 1000 kg/m^3.

(b) Derive the relation $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ in the case of a concave mirror.

(c) 10 gm of ice at 0°C is added to 100 gm of water at 20°C. If the final temperature of the mixture is 10·9°C, find the latent heat of fusion of ice. Specific heat of water is 4200 J/kg-K.

3. Attempt any ***two*** parts. *2×5=10*

(a) State parallelogram law of forces and find the magnitude of the resultant of two equal forces F inclined at 120°.

(b) (i) Explain damped and undamped oscillation.

(ii) Differentiate between forced oscillation and resonance.

(c) At what height above the surface of the Earth, does the acceleration due to gravity become 1/8 of that on the surface of the Earth ? Radius of Earth = 64000 km.

4. Attempt any ***two*** parts. *2×5=10*

(a) Define work, power and energy and prove that kinetic energy is $\frac{1}{2}mv^2$.

(b) State the laws of refraction and condition for total internal reflection.

(c) What is the amplitude of motion of a wave in the path of a 80 dB, 1000 Hz sound wave ? Assume that the density of air is 1·29 kg/m^3 and the velocity of sound in air is 330 m/s.

SECTION B

5. Attempt ***all*** parts. *5×1=5*

(a) Minamata disease is caused by the metal _____ .

(b) Mass number of an element is the total number of _____ and _____ .

(c) What is an endothermic reaction ?

(d) The bond formed by the sharing of electrons and atoms is known as _____ bond.

(e) In a modern periodic table elements are arranged with increasing _____ .

6. Attempt any ***two*** parts. *2×5=10*

(a) State Boyle's law and Charles' law and explain the terms used.

(b) Explain the formation of an ionic bond with an example and the term ionisation energy.

(c) What is the product formed in the following reactions :

(i) $CH_3 - CH = CH_2 + HBr \rightarrow$

(ii) $CH_3 - CH_2 - CH_2 - Cl \xrightarrow{\text{Alcholic KOH}}$

7. Attempt any ***two*** parts. *2×5=10*

(a) Complete the following reactions :

(i) $CH_3 - OH + PCl_5 \rightarrow$

(ii) $C_6H_5 - OH + CHOCl \rightarrow$

(iii)  $+ HNO_3 \xrightarrow{H_2SO_4}$

(iv) $CH \equiv CH + Cl_2 \rightarrow$

(v) $CH_3 - CH = CH_2 + HBr \xrightarrow[\text{of peroxides}]{\text{in presence}}$

(b) (i) State Aufbau principle and Hund's rule for maximum multiplicity, with examples.

(ii) Define Acid Rain.

(iii) A vessel containing air is sealed at 15°C. To what temperature should it be heated to double the pressure inside it ?

(c) Define polymerisation. Explain condensation polymerisation and additional polymerisation with examples.

8. Attempt any ***two*** parts. *2×5=10*

(a) Write the orbital-wise electronic configuration of the following elements :

(i) Mg^{2+}, Cr, Cu

12 24 29

(ii) Define dipole moment. Arrange the given bonds in the increasing order of polarity.

N – H, H – F, O – H

(b) Give the IUPAC names of the following compounds :

(i) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3$

(ii) $CH_3 - CH_2 - CH_2 - CHO$

(iii) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle O}{\underset{||}{C}} - CH_3$

(iv) $CH_3 - \underset{\displaystyle CH_2 - CH_3}{\underset{|}{CH}} - CH_2 - CH_3$

(v) $HC \equiv C - CH_2 - CH = CH_2$

(c) An organic compound on analysis gave the following percentage composition, Carbon 40%, Hydrogen 6·66% and rest is Oxygen. The vapour density of the compound was found to be 30. Find out the empirical and molecular formula.