

DIPLOMA IN NAUTICAL SCIENCE

Term-End Examination

December, 2006

BNA-012 : APPLIED SCIENCE

Time : 2 hours

Maximum Marks : 70

Note :

- (i) *Non-programmable scientific calculator may be used.*
 - (ii) *This question paper consists of Section A and Section B.*
 - (ii) *Attempt three questions from each section. Questions No. 1 and 5 are **compulsory**.*
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SECTION A

(Nautical Physics)

Note : *Question no. 1 is **compulsory**. Attempt **two** more questions from this section.*

1. (a) State and explain Law of Conservation of Energy. 5

- (b) The pitch of the whistle of an engine appears to drop to $\frac{5}{6}$ th of the original frequency when it passes a stationary observer. Calculate the speed of the engine. Take velocity of sound = 340 m/s. 5
- (c) Differentiate between the following : 5
- (i) Damped and Undamped Oscillation
- (ii) Forced Oscillation and Resonance
2. (a) Define the apparent coefficient and real coefficient of expansion of a liquid. Give relationship between them. 5
- (b) How much amount of steam at 100° C will just melt 2500 gm of ice at — 10° C ? 5
- Given :
- Latent heat of vaporization of water = 540 cal/gm
- Latent heat of fusion of ice = 80 cal/gm
- Specific heat of ice = 0.5 cal/gm-°C
- Specific heat of water = 1 cal/gm-°C
3. (a) Point out the error in Newton's formula for velocity of sound in a gaseous medium. How did Laplace correct it ? 5
- (b) If a body has a translational velocity of 20 m/s and starts climbing a plane inclined at an angle 30° to the horizontal, how far along the plane would it climb ? 5

4. (a) With the help of ray diagram give the details of image formed by a concave mirror when
- (i) the object is located beyond the centre of curvature
 - (ii) the object is located at the centre of curvature (C)
 - (iii) the object is located between the focal point (F) and pole (P) 5
- (b) Velocity of light in a liquid is 2.5×10^{10} cm/s, while in air it is 3×10^{10} cm/s. A ray of light passes from liquid to air. Calculate the critical angle. 5

SECTION B
(Nautical Chemistry)

Note : Question no. 5 is **compulsory**. Attempt **two** more questions from this section.

5. (a) An organic compound containing oxygen, carbon, hydrogen and nitrogen contains 20% carbon, 6.7% hydrogen and 46.67% nitrogen. Its vapour density was found to be 30. Find the molecular formula of the compound.
[Atomic weight — C = 12, H = 1, N = 14, O = 16] 5
- (b) State and explain Dalton's law of partial pressure. 5
- (c) Define metallurgy. Give various steps involved in the extraction of metal from its ore. 5
6. (a) Define flash point. How is it determined using close cup method ? Support your answer giving a schematic diagram. 5
- (b) Calculate
- (i) The volume of 3.2 g of oxygen at N.T.P.
- (ii) The number of moles of a gas occupying 560 ml at S.T.P.
- Given $R = 0.0821 \text{ l-atm/mol-K}$. 5

7. (a) Differentiate between the following. Also give examples. 5
- (i) Exothermic and Endothermic reaction
 - (ii) Calcination and Roasting
- (b) What are primary air pollutants ? List any five of them along with their respective sources. 5
8. (a) What is petroleum refining ? Draw a labelled diagram of fractionating tower. 5
- (b) Write the structural formula of the following compounds : 5
- (i) 2-methyl propanol
 - (ii) Pentan-2-one
 - (iii) 2-Bromo-3-chlorobutane
 - (iv) Butanoic acid
 - (v) Methyl ethanoate