DIPLOMA IN NAUTICAL SCIENCE

Term-End Examination

June, 2006

BNA-012 : APPLIED SCIENCE

Time : 2 hours   *Maximum Marks : 70*

Note :   *This question paper consists of two parts : Part A and Part B. Attempt all questions. Use of calculator is allowed.*

PART A

1.   Attempt **all** parts :   *1×5*

   (a)   In an atom, an electron is revolving around the nucleus. What is the work done ?

   (b)   Can the specific heat of a gas be infinity ?

   (c)   At what displacement, is the K.E. of a simple harmonic oscillator maximum ?

   (d)   Newton assumed that the sound wave travels in air under _____ condition.

(e) The magnifying power of a telescope is given by

   (i) $f_o + f_e$

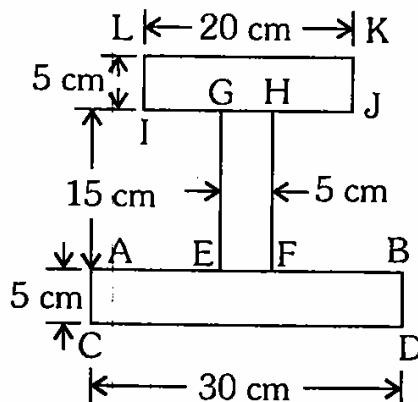   (ii) $\dfrac{f_o}{f_e}$

   (iii) $f_o - f_e$

   (iv) $f_o f_e$

2. Attempt any *two* parts :   5×2

(a) A cluster of clouds at a height of 1000 m above the earth burst and enough rain fell to cover an area of 10^6 square metres with a depth of 2 cm. Calculate the work that would have been done in raising water to the height of the clouds.

(b) Determine the centroid of the cross-sectional area shown below :

(c) Derive the relation $C_p - C_v = \dfrac{R}{J}$, where signs have their usual meanings.
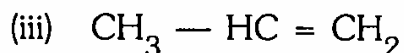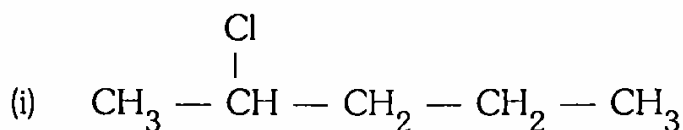
3. Attempt any *two* parts : 5×2

(a) One end of a 0·25 m long metal bar is in steam and the other end is in contact with ice. Calculate the thermal conductivity of metal if 12×10^{-3} kg of ice melts per minute.

(b) Define SHM. Show how it can be realised in practice as the projection of a uniform circular motion.

(c) A stationary source emits sound of frequency 1200 Hz. If wind blows at a speed of 0·1 c, what is the percentage change in wavelength ?

4. Attempt any *two* parts : 5×2

(a) What do you understand by refraction of light ? If the refractive indices of glass and water w.r.t. air are 3/2 and 4/3 respectively, what is the refractive index of glass w.r.t. water ?

(b) A pendulum gives correct time. What is the error in time per day if the length of the pendulum increases by 0·05% ?

(c) What is an optical fibre ? State and explain two applications of optical fibre.

6. Attempt any **four** parts : 4×3

(a) A sample of gas is found to occupy a volume of 900 cm^3 at 27° C. Calculate the temperature at which it will occupy a volume of 300 cm^3.

(b) What are the defects of Mendeleev's periodic table ?

(c) Explain the terms COD and BOD.

(d) What do you understand by oxidation and reduction ? Give one example of each.

(e) Write the IUPAC names of the following organic compounds :

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

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

(iii) $CH_3 - HC = CH_2$

(f) Write the reactions involved in chlorination of methane.

7. Attempt any **two** parts : $6\frac{1}{2}\times 2$

(a) What are primary and secondary cells ? Give the constructional details of a dry cell.

(b) Name two ores of iron. Describe the method of extraction of iron from any one of the ores. Give the names of commercial forms of iron.

(c) (i) Define the terms empirical formula, molecular formula and molecular weight.

(ii) What products are obtained by sulphonation, nitration and combustion of alkanes ?