



b) A box barge 30 m long and 8 m beam floats at a level keel draught of 3 m and has a mid-length compartment 6 m long. Calculate the new draught if this compartment is bilged;

i) with permeability 100 %

ii) with permeability 75 % (6)

4. A vessel of constant triangular cross-section has a depth of 12 m and a breadth at the deck of 15 m.

Calculate the draught at which the vessel will become unstable if the centre of gravity is 6.675 m above the keel. (14)

5. A vessel of 8000 tonne displacement has 75 tonne of cargo on the deck. It is lifted by a derrick whose head is 10.5 m above the centre of gravity of the cargo and placed in the lower hold 9 m below the deck and 14 m forward of its original position. Calculate the shift in the vessel's centre of gravity from its original position when the cargo is:

i) Just clear of the deck

ii) At the derrick head

iii) In its final position (14)

6. A ship 120 m long and 9100 tonne displacement floats at a level keel draught of 6.50 m in fresh water of  $1.0 \text{ t/m}^3$ . MCTI cm 130 tonne-m, TPC in sea water 16.5, LCB 2.30 m forward of midship. LCF 0.6 m aft of midship.

Calculate the new draughts if the vessel moves in to sea water of  $1.025 \text{ t/m}^3$  without change in displacement. (14)

7. A ship 150 m long has draughts of 7.70 m forward and 8.25 m aft, MCTI cm 250 tonne-m, TPC 26 and LCF 1.8 m forward of midship. Calculate the new draughts after the following masses have been added:

50 tonne, 70 m aft of midship

170 tonne, 36 m aft of midship

100 tonne, 5 m aft of midship

130 tonne, 4 m forward of midship

40 tonne, 63 m forward of midship (14)

8. A 6 m model of a ship has a wetted surface area of  $7 \text{ m}^2$ , and when towed in fresh water at 3 knots, has a total resistance of 35 N. Calculate the effective power of the ship, 120 m long, at its corresponding speed.

$n = 1.825$ ;  $f$  from formula:  $\text{SCF} = 1.15$ . (14)