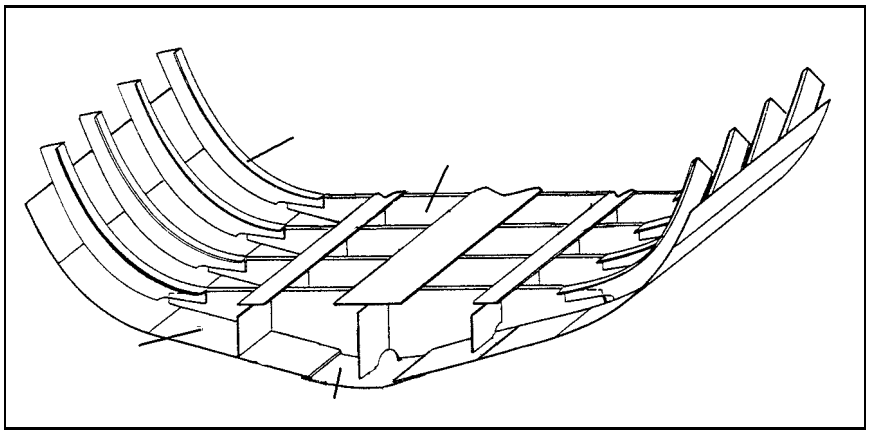
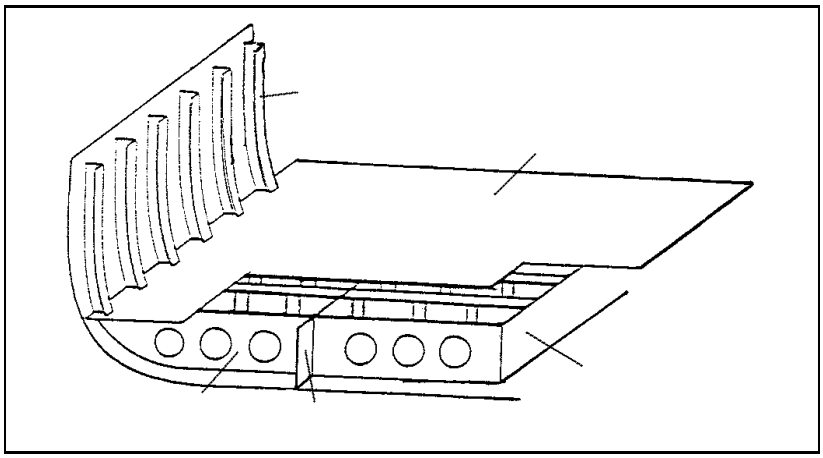
Ship knowledge questions

Part 1

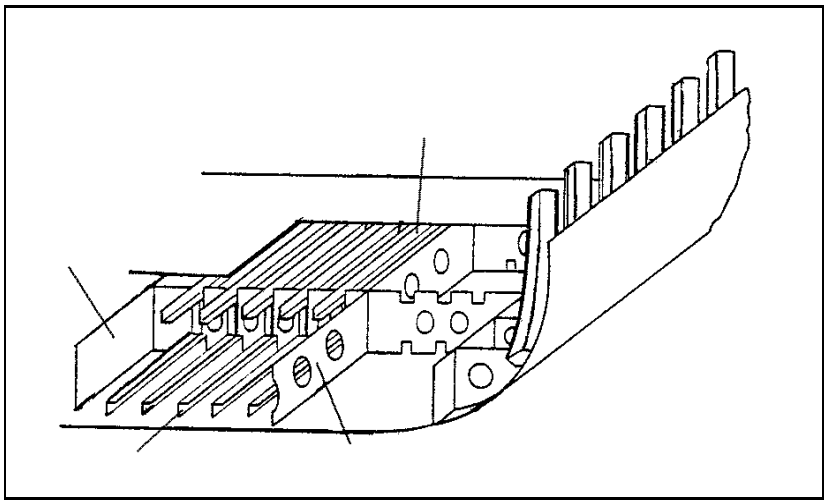
1. In the following sketch, label the parts indicated by (———).



2. In the following sketch, label the parts indicated by (———).



3. In the following sketch, label the indicated by (———).



4. Explain the function of double bottom on a vessel.

5. What is meant by Panting?

6. With the aid of a sketch, describe a typical arrangement to resist panting at the fore end of a vessel.

7. Describe the arrangements to resist pounding.

8. With the aid of sketches, explain what is meant by the terms “hogging” and “sagging”.

9. Describe the function of shell plating.

10. Describe the cause and effect of point loading.

11. What arrangements are made to ensure watertight Integrity when a ventilation trunk or a pipe passes through a watertight bulkhead?

12. Explain the arrangements provided to control massive flooding of a vessel.

In the following questions,circle the most correct answer.

13. The Duct Keel is used for
    a) carrying pipework
    b) storing fuel
    c) storing ballast water

14. The bottom shell plating is stiffened by
    a) transverse & longitudinal frames
    b) transverse beams
    c) double bottom

15. Double bottom constructions are found
    a) on very small vessels
    b) on large vessels
    c) only on tankers

16. The stem is the
    a) aftermost part of the vessel
    b) the foremost part if the vessel
    c) the end of the mast

17. Panting results from
    a) incorrect loading of the vessel
    b) incorrect ballasting of the vessel
    c) pitching of the vessel

18. The shell plating at the after end
    a) terminates at the sternframe
    b) terminates at the rudder stock
    c) terminates in the aft peak tank

19. Information regarding point loading limits can be obtained from a vessel's :
    a) Fire Control Plan
    b) Capacity Plan
    c) Master

20. The superstructure of a vessel is provided for:
    a) carrying extra cargo
    b) protection of propulsion machinery
    c) protection of openings in the freeboard deck

21. A vessel's hull is subdivided into watertight compartments by
    a) Watertight bulkheads
    b) Partial bulkheads
    c) Watertight doors

22. The collision bulkhead is located
    a) just aft of the engine room
    b) at the forward end of the vessel
    c) at the aft end of the vessel

23. A cargo vessel of less than 60 metres in length, and machinery space aft, must have a minimum of
    a) 3 watertight bulkheads
    b) 4 watertight bulkheads
    c) 5 watertight bulkheads

24. The collision bulkhead must extend to
    a) the highest point on a vessel
    b) first deck above the load waterline
    c) uppermost continuous deck

25. Openings in watertight bulkheads must be
    a) as large as possible
    b) as small as possible
    c) fitted with sliding doors

26. Fore peak and aft peak bulkheads are tested for watertightness by
    a) hose test
    b) chalk test
    c) filling the peaks with water up to the top of the air pipe.

27. Watertight bulkheads of compartments not forming boundaries of liquid carrying spaces are tested by
    a) hose test
    b) chalk test
    c) filling the compartments with water up to the top of the air pipe.

28. When a hatchway is cut into the deck of a vessel
    a) the corners are rounded
    b) the corners are squared
    c) the corners can be any shape

29. Doors providing access from the main deck to lower compartments
    a) must be of the sliding type

b) must have sills
c) must be as large as possible

30. In most cases, hatch covers are made weathertight by a gasket resting against
a) wedges
b) cleats
c) compression bar

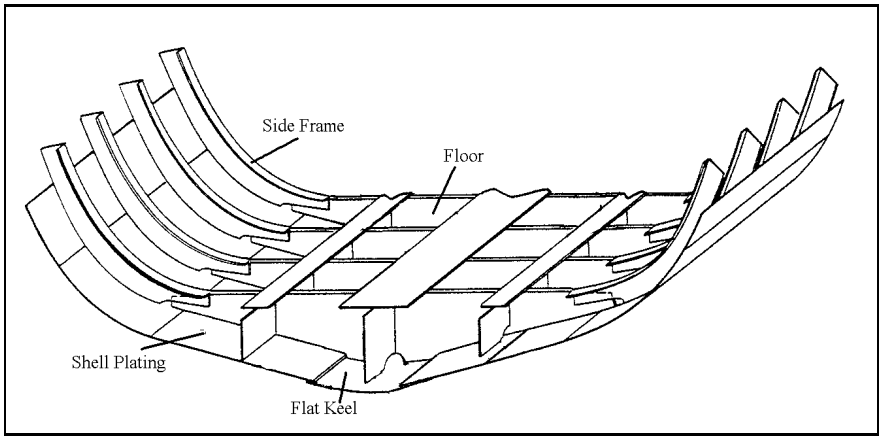
31. Accommodation spaces must be separate from machinery space
a) only by fire retardant bulkheads
b) only by fire retardant decks
c) by fire retardant bulkheads and decks

32. An 'A' class division is made of
a) timber
b) steel
c) fibre glass

33. On a steel vessel of 40 metres length, accommodation spaces should be separated from cargo spaces by
a) 'A' class bulkheads and decks
b) 'B' class bulkheads and decks
c) 'C' class bulkheads and decks

Part 1 Answers

1.



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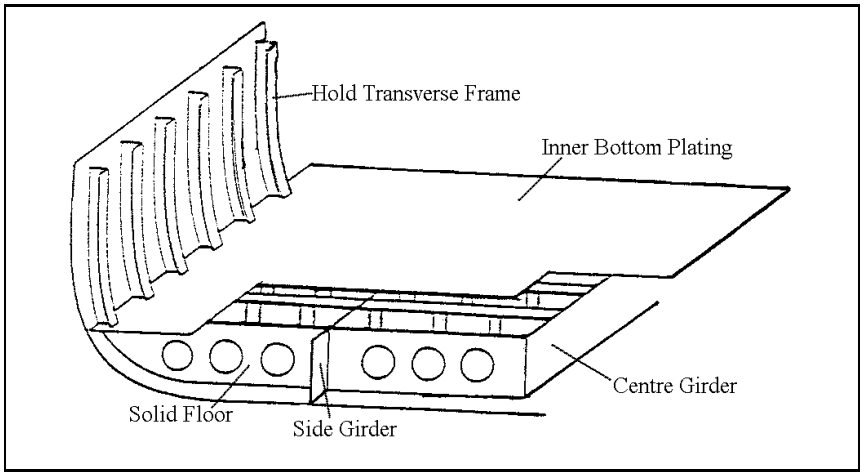

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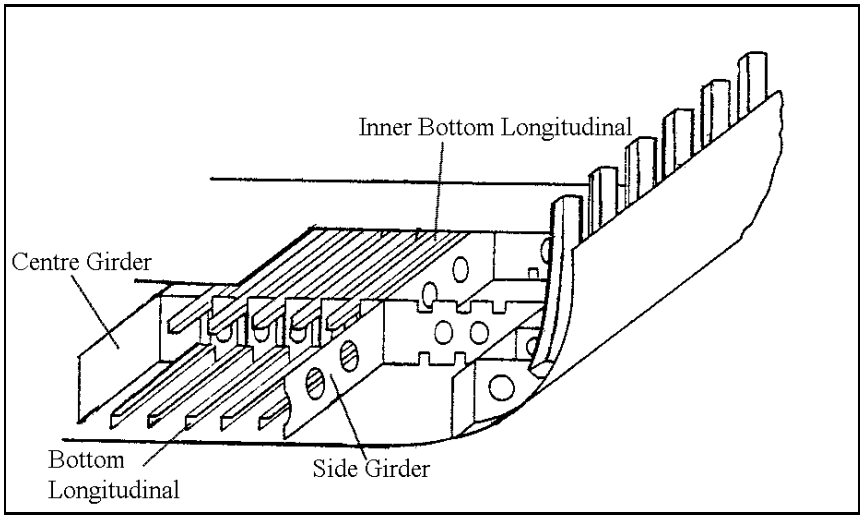


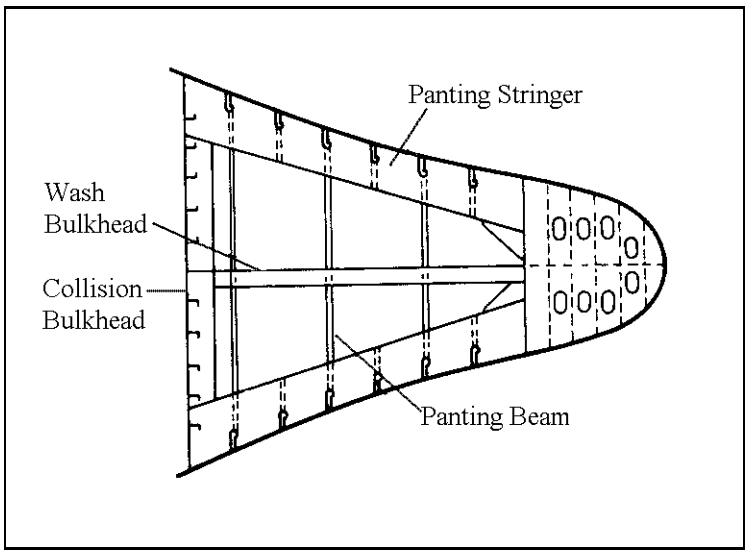
4. The double bottom space can be used for carrying fuel, ballast and fresh water. In addition it provides an extra margin of safety, since in the event of bottom shell damage only the double bottom space may be flooded.

5. Panting is the in-and-out movement of a vessel's shell plating that results from variations in water pressure as a vessel pitches in a seaway.

6. Panting arrangements include:

- horizontal plates welded to the sides of the vessel (known as panting stringers)
- transverse beams extending from side to side (known as panting beams)
- partial bulkheads

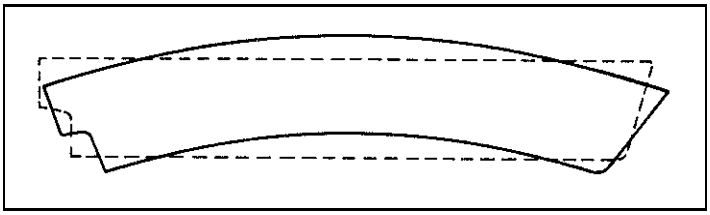
On some vessels, panting beams are replaced by perforated flats. Perforated flats are flat plates, similar to decks, with round holes cut in them.



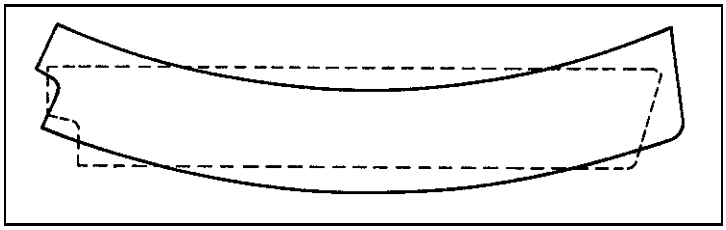
7. To resist pounding the shell plating is increased in thickness, frame spacing is reduced, and additional side girders and solid plate floors are fitted in the forward region.

8. Hogging is a condition where the ends of a vessel are deeper in water than amidships.

Sagging is a condition where the amidships region of a vessel is deeper in the water than the ends.



Hogging



Sagging

9. The weather deck, bottom, and side shell plating form a watertight envelope that provides the buoyancy to keep the vessel afloat. The shell plating is subject to static water pressure, as well as dynamic effects of pitching, rolling and wave action, Stiffening against compressive forces of the sea is provided by transverse or longitudinal frames. Additional plate thickness is provided at the forward and aft ends of the vessel to withstand local stresses.

10. Point loading occurs when the mass of an object is distributed over a very small area. This can cause temporary or permanent distortion of the vessel's structure.

11. Wherever possible, piping and ventilation trunks should not pass through watertight bulkheads. Where this cannot be avoided, the following measures must be adopted.

- Pipes must be flanged to the bulkhead, not pass through it.
- Ventilation trunks must be fitted with a watertight shutter.
- If the collision bulkhead is to be pierced by a pipe, a valve must be fitted at the bulkhead. This valve should normally be kept closed and may be operated by remote control and/or an extended spindle.

12. A vessels hull is subdivided into a number of large watertight compartments by means of watertight bulkheads. The purpose of these bulkheads is to prevent rapid and massive flooding and hence rapid sinking should the vessel be holed below the waterline, by containing the flooding in the compartment that has been holed.

13. a)
14. a)
15. b)
16. b)
17. c)
18. a)
19. b)
20. c)
21. a)
22. b)
23. a)
24. c)
25. b)
26. c)
27. a)
28. a)
29. b)
30. c)

31. c)
32. b)
33. a)

Part 2 questions

35. Give 5 examples of the parts of a vessel that are most liable to corrosion.

36. Describe two ways of preventing corrosion.

37. Describe in general terms the surface preparation required prior to painting the surface.

38. Explain in general terms the routine maintenance of watertight doors.

39. Explain in general terms the routine maintenance of hatch covers.

40. Explain in general terms the routine maintenance of cargo handling equipment.

41. Explain in general terms the routine maintenance of mooring and anchoring equipment.

42. List the survey items that require a vessel to be removed from water.

43. List the items checked by a surveyor during an annual loadline survey.

44. Describe the method of removing a vessel from the water using a patent slip.

45. Describe the method of removing a vessel from the water using a graving dock.

46. Describe the method of removing a vessel from the water using a floating dock.

47. Describe the method of removing a vessel from the water using a Synchrolift.

48. Describe the method of removing a vessel from the water using a travel lift.

49. Describe the method of removing a vessel from the water by careening.

50. Describe the method of removing a vessel from the water by heaving down.

51. Describe the general precautions to be observed in a dry dock.

52. List the undocking checks that should be carried out prior to returning a vessel to the water.

53. Explain the difference between preventative and corrective maintenance.

In the following questions,circle the most correct answer.

54. Saltwater encourages corrosion because
    a) it is an excellent conductor of electricity
    b) it is denser than fresh water
    c) it dissolves paint

55. Sacrificial anodes are usually found
    a) near the propeller
    b) inside cargo holds
    c) on the main deck

56. The drying of paint can be retarded by
    a) high temperatures
    b) low humidity

c) pollutants in the air

57. Propellers and rudders are inspected during
a) annual surveys
b) two yearly surveys
c) four yearly surveys

58. Life saving and fire-fighting appliances are surveyed during
a) annual surveys
b) two yearly surveys
c) four yearly surveys

59. Anchors and cables are surveyed during
a) annual surveys
b) two yearly surveys

60. A loadline certificate is usually valid for
a) one year
b) three years
c) five years34. Explain the causes of corrosion in vessel structures.

61. During an annual loadline survey, the surveyor checks
a) the watertight integrity of the vessel
b) the condition of life-saving appliances
c) the condition of fire-fighting appliances

62. When a vessel is removed from the water using a graving dock, the critical moment for stability occurs
a) just before the water level starts falling
b) just before the vessel settles on the keel blocks
c) just after the dock is completely dry

63. Prior to dry-docking, the dockmaster should be informed about
a) the vessel's last port of call
b) the location of echo sounder transducers
c) the vessel's maneuvering characteristics

64. One advantage of planned maintenance is that
a) it involves less paperwork
b) there are fewer breakdowns and repairs
c) the vessel has to be dry-docked less often

Part 2 Answers

34 *Chemical corrosion* is the attack of metals by solutions of acids or alkalines which will chemically combine with the metal to form entirely new products. The material can be considered as being dissolved in the solution. Such attack is usually caused by spillage of liquids such as battery acids, galley refuse, or in toilet areas.

Electrochemical corrosion is the most common type of corrosion. It is caused by very small electrical currents flowing between one metallic area to another. These electrical currents cause the material which is being corroded to change to a completely different substance; for example, steel changes to rust.

35. Parts of a vessel that are especially liable to corrosion include:

- Ballast tanks.
- Bilges.
- Hull plating between light and load waterline.
- In vicinity of scuppers and overboard discharges.
- Areas where water can accumulate (eg stringers used for stiffening).
- Stern in the vicinity of propeller.
- Storerooms.
- Below wood deck sheathing.
- Areas not easily accessible for maintenance.

36.
1. By providing a piece of material which will corrode in preference to the vessel. Such a substance is usually found attached to the hull near the propeller or attached inside a tank, in the form of a sacrificial anode.

2. By coating the surface with a substance such as paint. Paints prevent the electrolyte from coming into contact with the metal.

37. In general, surfaces can be prepared for painting by:

- Cleaning and, where necessary, degreasing the surface.
- Removal of corrosion products (rust) and/or defective paint coats by abrasive blast cleaning, mechanical or hand cleaning.
- Using rust converters/inhibiters.
- Roughening of the old paint where needed.
- Removal of dust.
- Drying the surface.

38. Examine closely the packing and rims and keep free from rust and scale. Keep packing clean of paint. All clips should be free, and hinges well oiled so the opening can be closed rapidly and efficiently.

39. Paintwork aside, the primary object in the successful maintenance of hatch covers is to keep them weathertight. To this end, careful attention must be paid to the heavy rubber sealing strips on the underside of the hatches. These must be kept firmly bonded in place with no gaps between the segments. The packing channels should be kept clear of rust, and the packing itself free of grease and paint. When the hatch is closed for sea, (battened down) check for a good seal. If there is a gap, you must open the hatch and find out why it hasn't sealed tight. Keep the trackways and compressor bars clean - if this is not the problem, replace the offending packing segment.

40. In Australia, the Marine Orders govern the use and maintenance of vessels' cargo handling gear. It is of vital importance to see that all moving parts are kept thoroughly lubricated so that they don't seize up in service. A regular, comprehensive greasing routine is the only answer. Periodic inspections and examinations will enable any faults to be quickly spotted and rectified, and should be carried out:

- Before starting to use the gear.
- At regular intervals while the gear is in use.
- As per the vessel's maintenance program and survey requirements.

41. Windlasses, capstans, mooring winches, roller fairleads, anchor chains and mooring lines (rope and wire) all have to be in good working order. A comprehensive lubrication and maintenance program should be instituted to care for this equipment. It is not sufficient just to pump grease into the machines, they should be carefully examined at the same time. Windlass and winch brakes should be operated to see that they are working correctly; fairleads spun so they don't freeze. Periodically the gear should be stripped down and cleaned off - old grease and paint removed, bearings examined, grease nipples and cups cleaned out and the unit relubricated.

42. Inspection of hull externally, sea cocks and valves, bilge injection valves and overboard discharge valves, propellers, rudders and underwater fittings, screw and tube shafts.

43. During the Annual Periodic Survey the surveyor checks:

(a) the position of the load line marks;

(b) if the structural strength has deteriorated;

(c) the water tight integrity of the hull;

(d) whether any alterations have been made to the hull or superstructure;

(e) the condition of the fittings and appliances for the protection of openings, guard rails, freeing ports and means of access to crew's quarters; and

(f) if the vessel has on board the following:

i) Stability Information Booklet

ii) Conditions of Assignment

44. The patent slip is basically a sloping, reinforced concrete runway which extends well below the low water mark. On the slip itself is built a set of railway tracks set well apart. Wheeled carriages run on these tracks and depending on the size of the vessel being dry docked, carriages can be linked together to form a single unit. *Cradles* are fitted onto these carriages with keel blocks on the centre line atop the carriage. The entire assembly is made up to suit the vessel being dry docked.

The vessel is manoeuvred onto the cradle under its own power and is secured with “springs”. As the vessel settles onto the cradle bed, wedges are inserted to keep the vessel upright. The entire assembly is slowly winched up the slipway. As the vessel takes to the keel blocks, securing beams are drawn tight and any shores, if required, are fitted. The vessel now secure in its cradle on the carriage is slowly winched out of the water.

45. The graving dock is excavated from the land and closed to the sea by means of a large watertight door or gate known as the “Caisson Gate”.

The edge of the dock bottom beneath the gate is referred to as the sill. The dock bottom has a very rigid construction and is usually made of reinforced concrete. The dock bottom always has a slight slope towards the sill to aid drainage. The sides of the dock are usually terraced to enable side shoring.

Along the centre line of the dock are blocks of concrete topped up with timber. They form the *keel blocks*. Two parallel rows of blocks on either side form the *bilge blocks* or *side blocks*. **Depending on the** size of the vessel and the shape of the underwater hull, the blocks are repositioned to suit the particular vessel.

On the sides of the dock at ground level are rails on which winches travel along the length of the dock. Wires from the winches are used, two on the forward beam and two on the

after beam, to help position the vessel over the keel blocks when the vessel is brought in. Cranes are used for heavy lifting.

When the vessel is in position the lock gates are shut and pumping out commences. A diver may be employed to ensure that the vessel's keel is in line with the keel blocks. As water is pumped out the diver keeps checking that the vessel is taking to the blocks as planned. Sometimes blocks are shifted so that maintenance can be done on a sea chest valve, drain plug, etc.

46. The basic structure of the floating dry dock is a very strong and rigid double walled "U". The bottom is constructed very similar to the bottom structure of ships. The sides of the dock are vertical wing tanks. Keel blocks and bilge blocks are laid on top of the double bottomed structure. The whole dock forms a floating, watertight structure which can be submerged by flooding the double bottom and wing tanks.

The vessel to be dry docked is simply floated into the dock and positioned above the keel and bilge blocks by use of mooring lines. Shores are fitted to provide support and as the dock tanks are pumped out the dock rises until the pontoon deck is dry.

47. The vessel is floated in over a submerged platform and is then lifted clear of the water by raising the platform. The synchrolift is a land-based platform which is lowered into the water by a series of synchronised winches lining either side of the dock.

48 A narrow dock is excavated and then opened to the sea. The vessel to be lifted manoeuvres slowly into the dock and secured temporarily with mooring lines while a mobile straddle carrier is positioned above the vessel. Broad slings which will eventually distribute the weight of the hull are then put in place. The weight is taken up by the slings. The moorings are released and the vessel is lifted clear of the water. The straddle crane, under its own power, carries the slung vessel to a suitable position in the shipyard, where it is lowered on blocks and shored and the slings removed.

The main advantage of this system is that many vessels an be docked at the same time and the slipping facility is not laid up for the duration of the vessel's stay.

49. This method does not require a slipway or dry dock, so it is suitable for repairs in an isolated area or in an emergency. The only requirement is a tidal range greater then the vessel's draught.

The vessel is driven to a flat, cleared section of the beach or river bank and positioned parallel to the shore or bank, to give even support along its length as the water level falls and rises. The bank should not be too steep, and must be clear of obstructions. The vessel *must* fall up hill if flooding on the incoming tide is to be avoided. It may be positioned between poles driven into the bed or simply weighted to fall up hill. Hawser lines may be tied to solid sections of the vessel, eg. the foot of a mast, and secured to points on-shore to help prevent the vessel from falling downhill. When the water level is low enough, shoring is installed on the downhill side to prevent rolling over.

50. In this method, a vessel is heeled over, while afloat, by means of tackles set up between its masts and another ship, or shore attachments. This method is not as successful as careening in exposing the hull, but since the vessel is afloat, there is little hull stress, and the dangers, through touching the bottom, or damage to the hull and the intakes, are minimal. It must be remembered that by heeling a vessel you increase its draft, and you should be sure that there is sufficient under-keel clearance for the job.

51.

- Echo Sounder, Log, and Sonar transducers should be covered with grease and then masking tape to prevent them from being painted over.
- Remove drain (docking) plugs from all tanks that need to be drained. Put them in a safe place and keep a written record of which plug goes where. Ensure that plugs are all replaced prior to flooding the dock or entry into the water.
- Ensure that safe access is provided to and from the vessel.
- Ensure that fire safety precautions are adhered to.
- Ensure that all tanks, void spaces etc are opened, vented and ready for inspection by surveyors at the appropriate time.
- Ensure that all pollution control requirements are met. (Remember that sewage and garbage cause pollution too.)

52. Ensure that:

- all docking plugs have been replaced
- all intake gills/grates have been replaced
- all transducers are uncovered and wiped clean
- all tanks are boxed up (manhole/inspection covers are replaced)
- anchors are secured
- all loose gear is secured
- new paint is dry to manufacturer's specifications
- there is sufficient water depth to unslip
- there is no distribution of weights on board that would cause the vessel to take up an unwanted list or trim when it takes to the water.
- preferably the vessel should be in the same stability condition for undocking as it was at docking.

53. *Preventative* maintenance is aimed at preventing failures or discovering a failure at an early stage. *Corrective* maintenance is aimed at repairing failures that were expected, but were not prevented because they were not critical for safety or economy.

54. a)
55. a)
56. c)
57. b)
58 a)
59. c)
60. c)
61. a)
62. b)
63. b)
64. b)

Part 3 questions

65. Explain what is meant by 'Conditions of Assignment of Loadlines'.

66. Sketch the typical loadline marks as marked on a vessel trading solely in Australia.

67. Draw a sketch to show how draft marks are marked on a vessel and give the dimensions of the marks.

68. A vessel of length 72 metres, and breadth 10.5 metres is floating in salt water at a draft of 2.4 metres. The vessel's block coefficient of fineness is 0.71. Find the displacement of the vessel in tonnes.

69. A vessel has a mean draft of 2.6 metres. The load draft is 3.2 metres, and TPC of the vessel for this draft is 1.8 tonnes. Calculate the amount of cargo that can be loaded so that the vessel will float at its load draft.

70. A vessel is loading in dock water of density 1010 kg/m ❸ . Its fresh water allowance is 150 mm. By what amount can it submerge its summer loadline?

71. M.V. Box Barge is floating at a draft of 1.4 metres. Using the hydrostatic particulars provided, find the new draft if 105 tonnes of cargo is loaded.

Draft (m)	Displacement (tonnes	TPC	MCT 1 cm (t-m)	LCF	KM (m)
0.7	109	1.7	2.7	1.5	6.0
0.8	126	1.7	2.7	1.6	5.3
0.9	144	1.8	3.0	1.2	4.9
1.0	160	1.8	3.3	0.9	4.6
1.1	179	1.9	3.7	0.5	4.4
1.2	199	2.0	4.1	0.0	4.3
1.3	219	2.0	4.7	-0.5	4.2
1.4	239	2.1	4.9	-0.7	4.0
1.5	261	2.1	5.2	-0.9	3.8
1.6	282	2.2	5.5	-1.2	3.6
1.7	306	2.2	5.5	-1.4	3.5
1.8	328	2.2	5.6	-1.1	3.4
1.9	351	2.2	5.6	-1.1	3.3
2.0	373	2.2	5.7	-1.0	3.2
2.1	395	2.2	5.7	-1.0	3.1

72. M.V. Box barge is floating at a mean draft of 1.6 metres and freeboard 1.8 metres, What will be the new mean draft and freeboard if 45 tonnes of cargo is discharged.

In the following questions, circle the most correct answer.

73. The summer loadline mark should not be submerged
    a) in a Tropical zone
    b) in a Summer zone
    c) in Port

74. A seasonal zone is one that
    a) is associated with good weather all the year round
    b) is associated with bad weather all the year round
    c) changes its name at different times of the year

75. A vessel loaded to full draft in a winter zone will have a waterline
    a) at the top of the winter loadline mark
    b) at the bottom of the winter loadline mark

c) at the top of the plimsoll mark.

76. The letters on either side of the loadline disc indicate
a) the name of the vessel
b) the initials of the vessel's owner
c) the initials of the survey authority

77. Draft is the distance from
a) the keel to the waterline
b) the keel to the freeboard deck
c) the keel to the highest point on the vessel.

78. A vessels forward draft is 1.6 metres and aft draft is 2.4 metres. The vessel's trim is:
a) 1.2 metres
b) 0.8 metres
c) 2.0 metres

79. A vessel's forward draft is 1.2 metres and aft draft is 2.1 metres. The vessel's mean draft is:
a) 1.8 metres
b) 1.65 metres
c) 1.5 metres

80. Hydrostatic draft is the true mean draft measured at:
a) the centre of flotation
b) amidships
c) aft draft marks

81. The specific gravity of a substance is the ratio between its density and
a) the density of steel
b) the density of fresh water
c) the density of salt water

82. Fresh water allowance is the number of millimetres by which a vessel's mean draft changes when
a) the vessel loads 1 tonne of fresh water
b) the vessel loads 1 tonne of salt water
c) the vessel passes from salt water to fresh water.

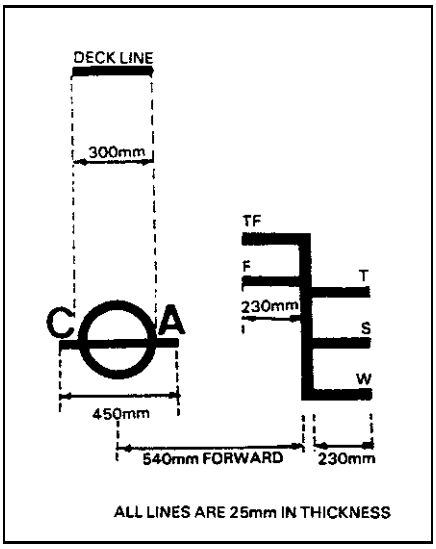
83. TPC for a given draft can be obtained from a vessel's
a) capacity plan
b) trim and stability booklet
c) loadline certificate

Part 3 answers

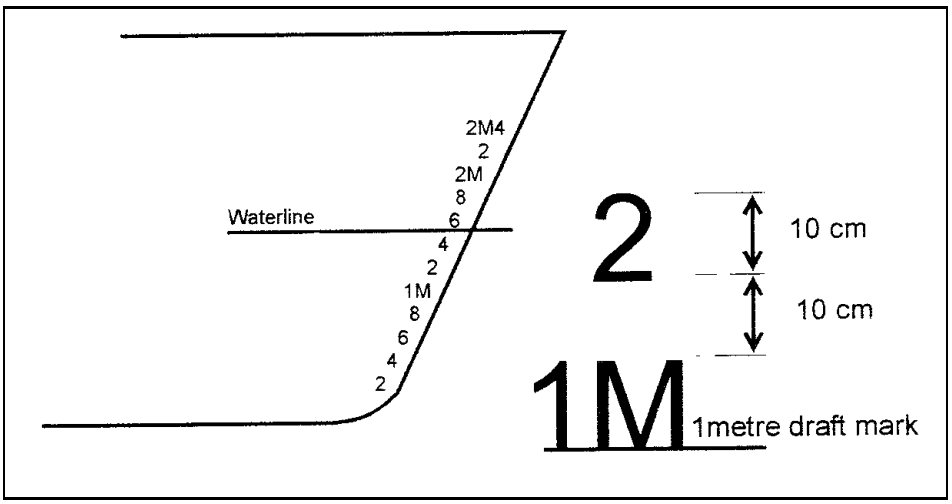
65. Conditions of assignment are regulations to ensure that a vessel is provided with efficient means:

- of protection for all openings to the hull and superstructure
- for the protection of crew in heavy weather, and
- for the rapid freeing of water from the weather decks

66.



67.



68. Displacement = 1320.43 tonnes

69. Amount of cargo = 108 tonnes

70. It can submerge its loadline by 90 mm.

71. New draft = 1.9 metres

72. New draft = 1.36 metres
New freeboard = 2.04 metres

73. b)
74. c)
75. a)
76. c)
77. a)
78. b)
79. b)
80. a)
81. b)
82. c)
83. b)

Part 4 questions

84. Explain the meaning of the term KG of a vessel.

85. Explain the meaning of the term LCG of a vessel.

86. What is meant by the term ‘Displacement’ of a vessel?

87. What is meant by the term ‘Deadweight’ of a vessel?

88. Define MCT 1 cm.

89. With the aid of a sketch, explain the meaning of the term ‘metacentric height’ (GM) of a vessel.

90. With the aid of a sketch, explain the meaning of the term ‘righting lever’ (GZ) of a vessel.

91. With the aid of a sketch, explain the effect on a vessel’s centre of gravity when a weight is added to the vessel.

92. With the aid of a sketch, explain the effect on a vessel’s centre of gravity when a weight is removed from the vessel.

93. With the aid of a sketch, explain the effect on a vessel’s centre of gravity when a weight is shifted on the vessel.

94. With the aid of sketches, explain how the relative positions of LCG and LCB determine the way a vessel trims.

95. Explain the effect of change in freeboard on the stability of a vessel.

96. Explain what is free surface effect.

97. How is free surface effect minimised at the design stage of a vessel?

98. Describe the operational practices that will minimise free surface effect.

99. Explain the effect on stability when a vessel is heeled by wind.

In the following questions, circle the most correct answer.

100. GM can be obtained from the following formula

a) GM = KG - KM

b) GM = KM - KG

c) GM = KM + KG

101. GM gives an indication of initial stability up to about
a) 5 degrees heel
b) 15 degrees heel
c) 25 degrees heel

102. The true measure of a vessel's stability can be obtained from its
a) GZ curve
b) GM
c) KM

103. The 'range of stability' defines all angles of heel for which a vessel has
a) positive righting lever
c) zero righting lever
c) negative righting lever

104. The angle to which a vessel must be heeled before water could enter the hull through openings that have been left open, is called
a) actual angle of immersion
b) actual angle of flooding
c) potential angle of flooding

105. On a GZ curve, the point of deck edge immersion shows up as the point where
a) the curve starts to get steeper
b) the curve begins to get less steep, and starts to level off
c) the curve becomes a straight line

106. When a weight is added on a vessel, its centre of gravity moves
a) towards the added weight
b) away from the added weight
c) vertically upwards

107. When a weight is discharged from a vessel, its centre of gravity moves
a) towards the point from where the weight was discharged
b) away from the point from where the weight was discharged
c) vertically downwards

108. When a weight is added on a vessel, its
a) draft decreases and freeboard increases
b) draft increases and freeboard decreases
c) draft and freeboard remain unchanged

109. A reduction in freeboard is associated with

a) increased stability
b) no effect on stability
c) decreased stability

110. When freeboard is increased, the angle of heel at which the deck edge immerses is
a) increased
b) decreased
c) unaffected

111. When a vessel's centre of gravity is raised, its stability is
a) increased
b) decreased
c) unaffected

112. If a vessel's LCB is aft of LCG, the vessel will
a) trim by the bow
b) trim by the stern
c) not trim at all

113. If a vessel's LCB is forward of LCG, the vessel will
a) trim by the bow
b) trim by the stern
c) not trim at all

114. The longitudinal centre of flotation (LCF) is the centre of a vessel's
a) underwater volume
b) main deck area
c) water plane area

115. When a vessel trims, it rotates about the
a) LCG
b) LCB
c) LCF

116. When a weight is lifted by a crane, the centre of gravity of the weight is transferred to
a) the point of suspension
b) the base of the crane
c) the actual position of the weight

117. The main factor affecting free surface effect of liquid in a tank is
a) the quantity of liquid in the tank
b) the depth of liquid in the tank
c) the free surface area of the liquid in the tank

118. A stiff vessel has a
a) negative GM
b) large GM
c) small GM

119. A tender vessel has a
a) negative GM
b) large GM
c) small GM

120. A vessel's roll period is governed by its
a) GM
b) length over all
c) LCF

121. If a vessel's GM is reduced, its roll period
a) becomes shorter
b) becomes longer
c) is unaffected

122. A stiff vessel
a) is more likely to experience synchronous rolling
b) is less likely to experience synchronous rolling
c) will not experience synchronous rolling

123. List or heel will cause
a) an increase in the range of stability
b) a decrease in the range of stability
c) no change to the range of stability

Part 4 answers

84. KG is the vertical distance of the centre of gravity from the base line. The base line is a line drawn through the lowest part of the keel parallel to the designed waterline of the vessel.

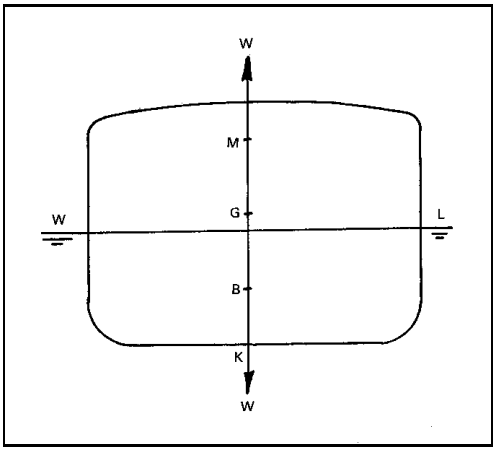
85. LCG is the horizontal distance of the centre of gravity from amidships.

86. Displacement is the total weight of the vessel at any draft.

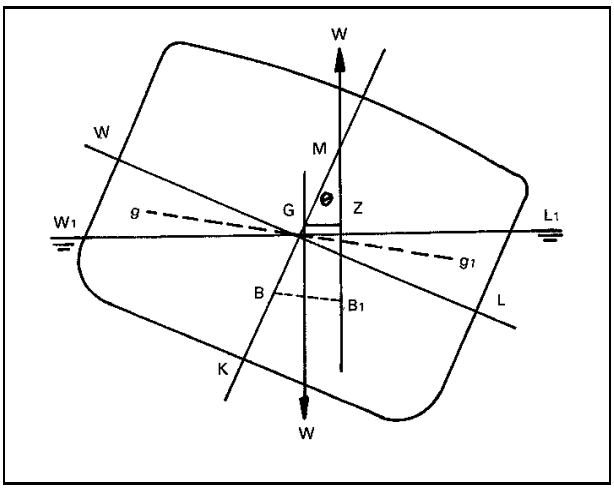
87. Deadweight is the total weight of the contents of individual fuel and water tanks, cargo, crew and effects, stores, provisions, etc.

88. It is the moment required to cause a one centimetre change of trim in the vessel.

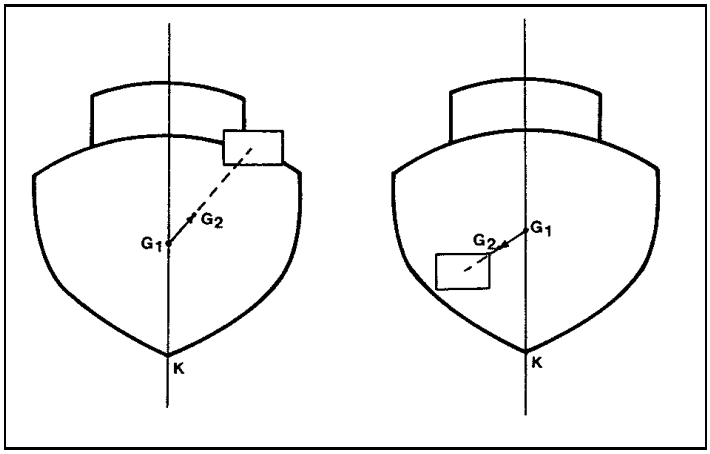
89. The Metacentric height (GM) is the vertical distance between the metacentre and the centre of gravity.



90. GZ is the righting lever. When a vessel is heeled by an external force, the centre of buoyancy moves towards the lowside, the force of buoyancy acts vertically upwards through B, (the centre of buoyancy), the force of gravity (weight) acts vertically downwards through G. The horizontal distance between the vertical lines drawn through these points is the size of the righting lever (GZ).

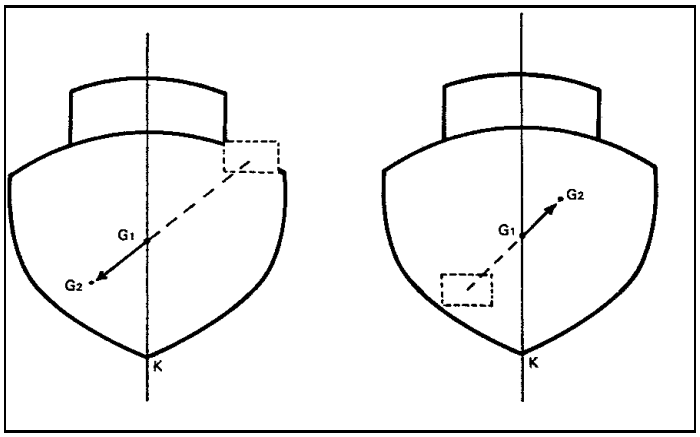


91. The centre of gravity moves towards an added weight.



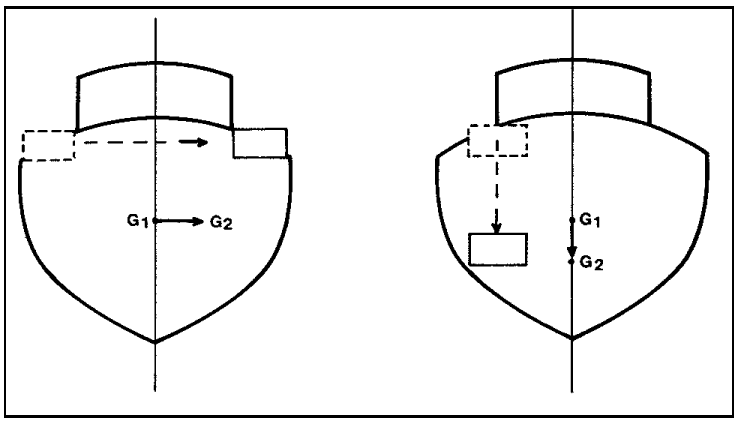
Weight Added

92. The centre of gravity moves away from a discharged weight.



Weight Removed

93. The centre of gravity moves parallel to the movement of a weight which is already on board.



Shifting Weights

94. If the position of LCG and LCB are as shown in Fig. 1, then the actions of buoyancy and weight will cause the vessel to rotate as shown by the arrow. The stern will sink deeper, the bow will rise higher. As the vessel rotates, the shape of the underwater volume will change and LCB will move to the new centre.

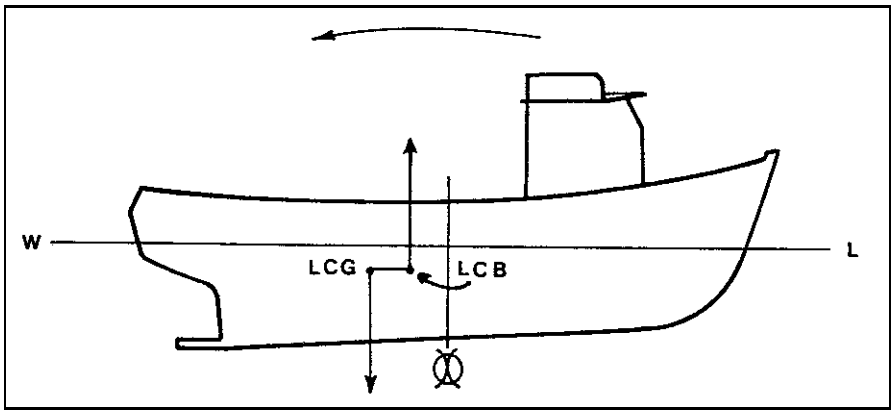


Figure 1

LCB Forward of LCG - Vessel trims by the stern

When LCG and LCB are in the same vertical line, the rotation will stop, the vessel will be trimmed by the stern as shown in Fig 2

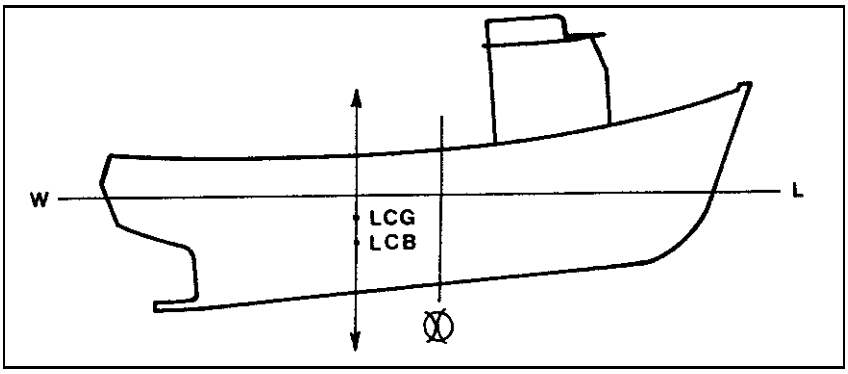


Fig 2

LCG and LCB in same vertical line - no trimming moment.

If the vessel had started with LCB aft of LCG then the rotation would cause a trim by the bow.

95. An increase in freeboard is associated with an increase in stability. Conversely, a decrease in freeboard is associated with a decrease in stability.

96. Free surface effect is the reduction in stability of a vessel caused by shifting water in slack tanks. Free surface effect reduces the size of GM. Therefore the size of GZ is reduced, and consequently the ability of the vessel to return to the upright position is reduced.

97. Free surface effect is minimised by partitioning tanks longitudinally. Where tanks are not divided by watertight divisions, there are usually longitudinal wash bulkheads which act as baffle plates. While these do not stop the sideways motion of fluids in the tank, they are designed to retard the flow so that the heeling force caused by the free surface effect is out of phase with the rolling of the vessel.

98. Free surface effect can be reduced by keeping the number of slack tanks to a minimum. As many tanks as possible should either be completely full or completely empty.

99. Heeling lever caused by wind pressure has the effect of reducing the righting lever and the range of stability.

100. b)

101. b)
102. a)
103. a)
104. c)
105. b)
106. a)
107. b)
108. b)
109. c)
110. a)
111. b)
112. a)
113. b)
114. c)
115. c)
116. a)
117. c)
118. b)
119. c)
120. a)
121. b)
122. a)
123. b)

Part 5 questions

124. A vessel with a light displacement of 1150 tonnes and KG 4.2 metres, loads the following cargo:

- 30 tonnes deck cargo KG 7.5
- 6 containers, total weight 24 tonnes, KG 8.5
- 20 tonnes Packaged cargo, KG 4.5
- 100 tonnes Fuel, KG 1.8
- 40 tonnes water, KG 2.4

Calculate the final KG of the vessel

125. A vessel displacing 970 tonnes, KG 3.4 metres, carries out the following operations :

Loads

- dry cargo 40 tonnes, KG 1.8 metres
- Ballast water 75 tonnes, KG 1.1 metres
- Fresh water 25 tonnes, KG 2.1 metres

Discharges

- cargo 74 tonnes, KG 2.4 metres
- ballast 22 tonnes, KG 0.9 metres

Consumes

fuel 12 tonnes, KG 1.5 metres

Calculate the final KG of the vessel

126. MV Twosuch is in condition 6 at sea and about to return to port when another vessel asks you to transport an engine back to port. The engine (weight 5.0 tonnes) will be lifted on board using your lifting boom, height 11.4 metres. What will be the Kgf and LCG the moment the weight is taken by the boom and would you consider this operation to be safe?

127. MV Twosuch is in condition 6, except that the catch is 50% and all the fish are stowed at the aft end of the hold at a KG of 2.6 metres and a LCG of -1.1 metres. Find the Kgf and LCG and state whether the vessel meets the requirements.

128. MV Twosuch is in condition 8 except that the catch is 50% and all the fish are stored at the aft end of the hold at KG of 2.6 metres and a LCG of -1.1 metres. Find the Kgf and the LCG and state whether the vessel meets the requirements.

Part 5 answers

124. Final KG = 4.12 metres

125. Final KG = 3.28 metres

126. Kgf = 3.52
LCG = -0.62
The operation is unsafe because the vessel does not meet the requirements.

127. Kgf = 3.36
LCG = -0.67
The vessel meets the requirements

128. Kgf = 3.34
LCG = -0.83
Kgf is within limits but LCG is a borderline case.