

Candidate's Name:

**Ports and Shipping Organization
Seafarer's Examination and Certification Directorate**

Exams Cycle:

Subject: Stability

Date:

Rank : Chief Mate (GT≥3000)

Time allowed: 2.5 Hrs

01-A vessel of 14500 t displacement, LBP = 160 m, MCTC = 800 t-m, TPC = 60, LCF = 72 m forward of the aft perpendicular, draft (forward) = 7.90 m & draft (aft) = 8.10 m in salt water.

Calculate the amount of cargo to be loaded in hold no.1 with LCG=140 m forward of the aft perpendicular & hold no.4 with LCG = 45 m forward of the aft perpendicular, if true mean draft should not exceed 8.20 m and the vessel ends up on even keel. **(20M)**

02-A vessel of displacement= 10000 t, KG = 7.00 m loads the following grain cargoes (Stowage Factor = 1.25 M3/t)

<u>Hold</u>	<u>Status</u>	<u>Weight (t)</u>	<u>kg (m)</u>	<u>TVGHM(m4)</u>
1	PARTIAL	3000	7.60	10000
2	FULL	3500	7.40	3500
3	FULL	3500	7.40	3500
4	FULL	4500	7.50	4000

Note; The values of kg are the centroid of the grain in compartments, except hold NO.1, rest are full)

Extracts from the Max. Allowable Grain Heeling Moment table in t-m;

KG \ DISP.	7.30	7.40	7.50	7.60
23500	19600	19410	19230	19060
24000	19520	19330	19160	19000
24500	19465	19280	19110	18960

During the voyage 400 t of consumable at kg of 0.20 m is anticipated to be used and the FSE = 0.15 m .

- Demonstrate whether or not she is complying with IMO Grain Rules. **(15M)**
- Calculate the approximate angle of heel due to the assumed grain shift. **(10 M)**

03-A box shaped vessel, floating on even keel in salt water has the following particulars;

Length = 130.0 m, Breadth = 20.0 m, draft = 5.0 m , KG = 4.50 m

There is an empty forward end compartment of 20.0 m in length, that extends the full width and depth of the vessel .

Calculate the final drafts forward & aft if this compartment is bilged.

(20M)

04-A ship with LBP=143.16 m, sailed from port in condition No.8 as attached .Soon after departure she grounded on an isolated rock, without damage to her hull. The drafts then were observed to be Forward; 5.90 m & Aft; 9.30 m .Calculate the upthrust provided by the rock.

(20M)

05-A ship steaming at 10 kts (1852 m/hr) in a circle of radius .GM=0.24 m, BM=3.7 m. Calculate the heel produced.

(15M)

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Q.1) Calculate the change in the transverse metacentric height of a box shaped vessel ,having a beam of 20 m & a S.W. draft of 7.0 m even keel on passing from seawater with R.D.=1.025 to water of R.D. = 1.000. **(20 M)**

Q.2) A vessel of 10000 t Displacement, KM = 7.50 m and KG = 6.50 m, has a fresh water tank measuring 35 X 10 X 1.8 m and pressed up with fresh water (the fresh water tank has no appreciable effect on the list).
Prior loading a cargo of 50 t, fresh water ROB is checked and the sounding was 1.0 m .Calculate the list, when the cargo is hanging from the ship's derrick head which is 22.0 m above the keel and 15.0 m to stbd of the centre line. **(20 M)**

Q.3) A vessel with attached hydrostatic particulars is floating at displacement of 18820 t. KG=7.728 m and FSC = 0.092 m. The vessel is to be dry docked.
Calculate the maximum trim by the stern allowable to ensure a virtual GM of at least 0.3 m on taking the blocks fore and aft. **(20 M)**

Q.4) Due to vertical shift of cargo in a cargo ship, the KG has increased by 0.22 m.

- a) Using GZ ordinates as given below draw her statical stability curve, upto a heel of 30°. **(10 M)**
.
b) From the curve drawn, estimate her initial GM. **(5 M)**
c) Calculate the dynamical Stability of the vessel at an angle of heel of 30°. **(10 M)**

Heel (Θ°)	GZ(m)
0	0.000
10	0.191
20	0.383
30	0.500

Q.5) A box shaped vessel with 12 m beam is floating upright at a draft of 6.70 m .Find the increase in draft if the vessel is now listed 18 °. **(15 M)**

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Q.1) - A vessel has the following particulars:

LBP=200 m, MCTC = 800, TPC =60, LCF = 90 m FOAP (forward of aft perpendicular), Summer true mean draft = 10.10 m, drafts; forward = 9.70 m, aft =10.20 m (draft marks are 3.0 m aft and 7.0 m forward of the end perpendiculars respectively).

Compute how much cargo should be loaded in hold No.1 with centre of gravity 65.0 m forward of amidships and hold No.5 having centre of gravity 80.0 m aft of amidships ,so that she is down to her marks on an even keel draft. **(20M)**

Q.2)-A vessel is loaded with grain in bulk of stowage factor 1.80 cu.m/t has displacement of 68012 t, KM of 11.40 m and free surface moment =4220 tm. Two holds are partly filled and their combined VHM is 3009 m4. All other holds are full and their total VHM is 18981 m4. The KG of the ship calculated assuming the centre of gravity of the cargoes in the filled compartments are at the volumetric centroid of each of those compartments is 10.50 m. The angle of flooding is 41°.

The KN values for her displacement are as follows;

Heel(deg) ; 12 15 30 40 45 60 75 90
KN (m) ; 2.782 3.508 7.033 9.356 10.206 11.288 11.270 10.385

Determine whether the ship satisfies the intact stability criteria for vessels laden with bulk grain. (VHM = Volumetric Heeling Moment) **(25 M)**

Q.3) - A Ship in light condition has the following particulars;

Draft; Forward = 1.06 m, Aft = 3.11 m, Displacement = 3831.0 t, LCF =71.12 m,

LCG = 61.67 m, MCTC = 130.10, KG= 8.21 m, LBP = 137.5 m.

The ship loads cargo as follows;

COMP.	WT(t)	LCG(m)	Kg(m)	FSM
1	2082	114.5	3.10	-
2	5606	89.9	3.44	-
3	4169	51.7	3.44	-
4	1954	17.2	5.80	-
5	1364	42.0	2.96	2450

For loaded condition the hydrostatic data are as follow;

Displacement; 19006 t corresponding an even keel draft of 8.87 m, KM= 8.46 m, LCB=69.19m FOAP, LCF = 65.70 m FOAP, MCTC = 211.04. Calculate;

a) The sailing drafts . **(12M)**

b)The sailing GM. **(8 M)**

Q.4)- A box shaped vessel 60.0 m long and having breadth of 9.0 m is floating on an even keel draft of 4.50 m in seawater .The vessel has an amidships compartment 12.0 m long and extending full breadth of the vessel. Compute the new draft and change in stability if this compartment is bilged;

a) Whilst empty. **(12 M)**

b) Whilst stowed with timber of S.F. = 1.32 m³/ t & R.D. = 0.831 **(8 M)**

Q.5)-A ship of 12250 t displacement has KM= 8.00m ,KB=3.80m ,KG=8.00 and is floating upright .Find the list if a weight of 2.0 t , already on board is shifted transversely through a horizontal distance of 12.0m, assuming that the ship is wall –sided. **(15 M)**

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Q.1) A Vessel is listed 3° to STBD due to uneven distribution of cargo and has following particulars;
 Disp. = 16000 t, KG (solid) = 9.10 m, KM = 10.20 m (KM to be assumed constant)
 There are two tanks, each partially filled with bunker (RD = 0.90), the tabulated F.S.M. for these tanks are;

No.6 D.B = 1800 t-m

No.2 DEEP TK = 400 t-m

The vessel now loads same type of bunkers as follow;

- 1) 250 t, kg = 0.60 m, on C/L to fill up No.6 D.B.
- 2) 150 t, kg = 6.00 m, on C/L in No.2 DEEP TK.

The deep tank No.2 is still slack.

The vessel has to load a total of 1200 t of cargo, divided between No.1 P & S tweendeck at kg = 11.0 m and with C.G. = 8.0 m out of C/L on each side.

Calculate;

- a) The weight of cargo to load in each side to bring the vessel upright.
- b) The final residual GM

(14marks)

(6 marks)

Q.2) A ship of 8000 t Disp. Takes the ground on a sand bank on a falling tide with an even keel draft of 5.20 m, KG = 4.0 m.

The predicted depth of water over the sand bank at the following low water is 3.20 m. Calculate the GM and moment of statical stability at 5° heel at this time, assuming KM = 5.00 m and the mean TPC = 15

(20 marks)

Q.3) A vessel loaded particulars are as follow;

Disp. = 19000 t, KG(solid) = 7.47 m, KM = 8.46 m, FSC = 0.13 m, angle of deck edge immersion (Θ de) = 16°, angle of progressive flooding (Θ f) = 38° & the KN values for this condition are as follow;

HEEL°	0°	10°	20°	30°	40°	50°
KN (m)	0.00	1.47	2.90	4.20	5.20	6.00

Draw the curve of statical stability and using this curve, determine the vessel ability to comply with Load Line Rules.

(25 marks)

Q.4) A box shaped vessel floating on even keel in sea water has the following particulars;

L = 120.0 m, B = 20.0 m, draft = 5.20 m

There is an empty amidship bottom compartment 20 m in length extending the full beam of the vessel with a watertight flat 6.0 m above the keel.

Calculate the change in initial GM if this compartment is bilged.

(20 marks)

Q.5) A vessel with high deck cargo will experience adverse effects due to strong beam winds on the lateral windage areas.

Explain with the aid of diagrams, how these effects can be determined and state the minimum stability requirements with respect to wind heeling under the current regulations.

(15 marks)