



**DIRECTORATE OF MERCHANT SHIPPING**  
**GOVERNMENT OF SRI LANKA**  
**CERTIFICATE OF COMPETENCY EXAMINATION**

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)  
SUBJECT : NAVIGATION  
DATE : October 2020

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Time allowed **THREE hours** Total marks : 180

**ANSWER ALL QUESTIONS** Pass marks : 70%

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Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **not** allowed.

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- 1) Vessel on a passage from Cape Agulas ( $34^{\circ} 54.0'S$ ,  $020^{\circ} 01.0'E$ ) to Cape Leeuwin ( $34^{\circ} 26.0'S$ ,  $115^{\circ} 04.0'E$ ).

Due to a clause in the Charter party, the vessel has to limit her passage to  $40^{\circ}$  S latitude and the Master was instructed by charterers to maintain service speed of 12 kts during the passage.

- a) Draw a suitable sketch, derive your calculations and find total distance from Cape Agulas to Cape Leeuwin. (20 marks)
- b) If the vessel departs at 1000 hrs (UTC +1 hr) on 10<sup>th</sup> June, find the ETA at the Landfall position (UTC+8 hr). (10 marks)

- 2) A vessel is making good a course of  $120^{\circ}$  (T) at a speed of 12 knots. The DR position at 0630 hrs was  $32^{\circ} 14' S$ ,  $128^{\circ} 17' W$ . Four stars were observed at different times, which gave the following azimuths and intercepts:

No.1	Time	Star	Azimuth	Intercept
1	0618	A	$022^{\circ}$	2.2' away
2	0624	B	$127^{\circ}$	2.1' towards
3	0639	C	$185^{\circ}$	3.8' towards
4	0645	D	$333^{\circ}$	6.5' away

- a) Describe the criteria for selecting stars for observations. (10marks)

- b) If the same DR was used for all intercepts, find, by plotting, the vessel's most probable position at 0630 hrs. (20 marks)

- 3) A vessel with a draught of 9.4 m anchors off Prince Rupert, at 1030 hrs on the 6<sup>th</sup> June 2012 and has to cross a bar charted as 5.0 m with a clearance of 0.5 m beneath the keel.

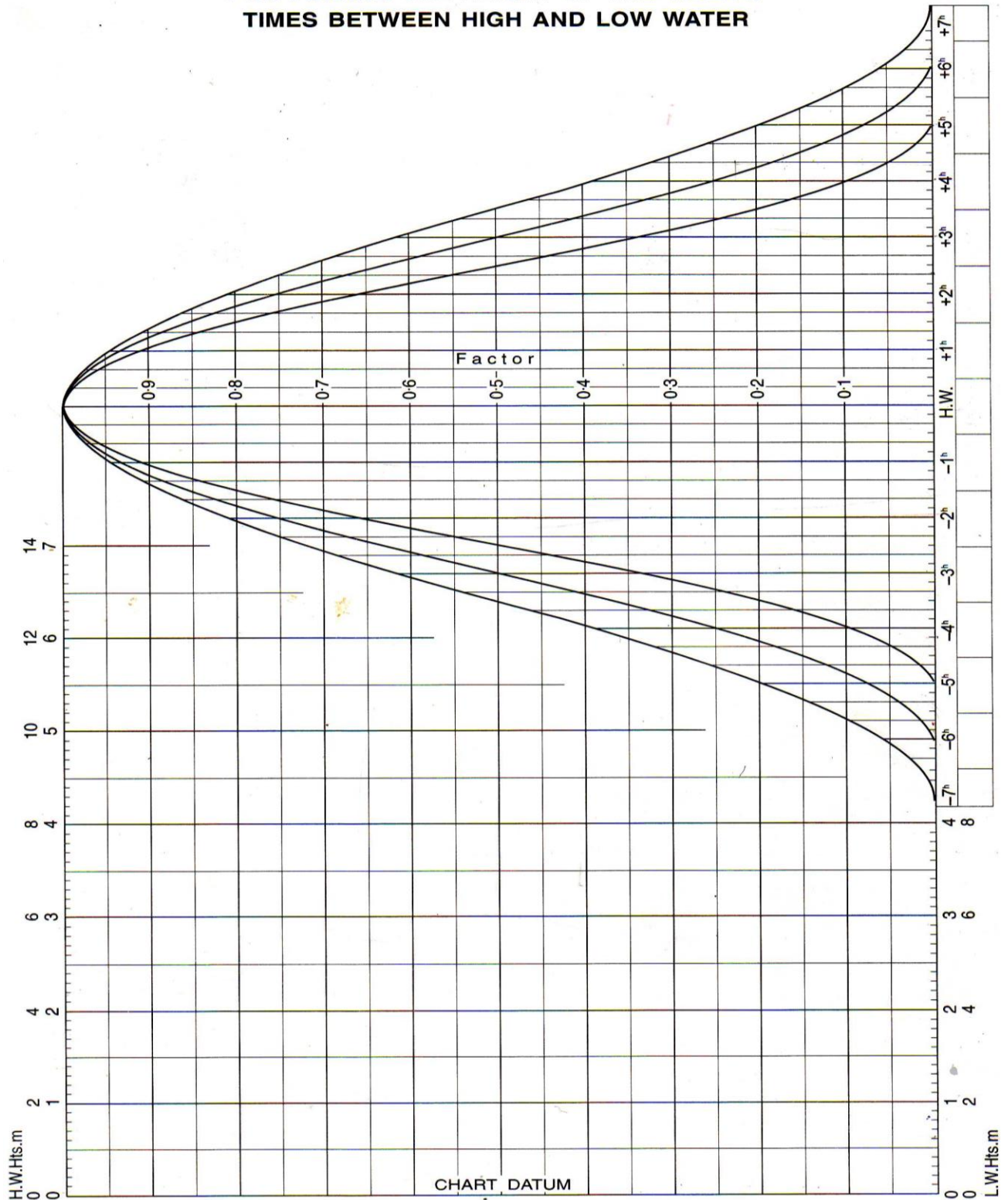
Extracts from tide tables  
6<sup>th</sup> June 2012

0550	7.5 m
1243	2.6 m
1834	7.4 m
0038	2.8 m

- a) Draw a systemic diagram (transverse cross section which illustrates the above heights) using above details. (10 marks)
- b) Using the Data Sheet I, calculate the time during **next rising tide** the vessel would be able to cross the bar keeping safe under keel clearance as above. (20 marks)
- 4) You are onboard an Ice class vessel on a passage from Hamburg, Germany to St. Petersburg, Russia in December where sea ice and ice accretion may be experienced.
- a) Explain the preparations that you do onboard to ensure the vessel's readiness for the above sea passage. (12 marks)
- b) List the sources from which a master may gain information about ice conditions in the Baltic sea. (06 marks)
- c) Briefly discuss the operational problems that may encounter while navigating in ice regions. (12 marks)
- 5) Answer the following questions with regards to safety onboard and watch keeping:
- a) Describe the meaning of "Sole look out" and list the factors to be taken in to account by a Master in deciding the Sole look out on the bridge. (06 marks)
- b) What is "Blind pilotage" and describe the precautions required during blind pilotage with suitable diagrams to enrich your explanation. (15 marks)
- c) State the appropriate bridge manning levels in the following situations:
- Navigation during night hours in open sea passage
  - Arrival to port with Pilot on board
  - Approaching a high traffic density area for anchoring during restricted visibility.
- (03 marks each)

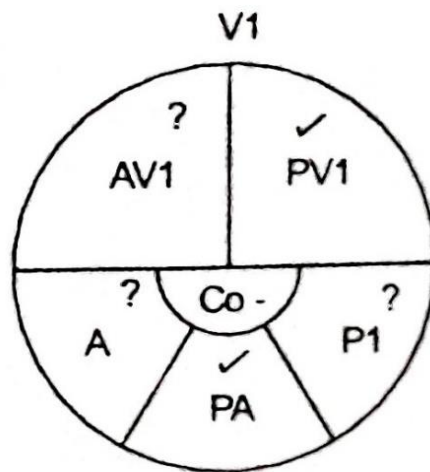
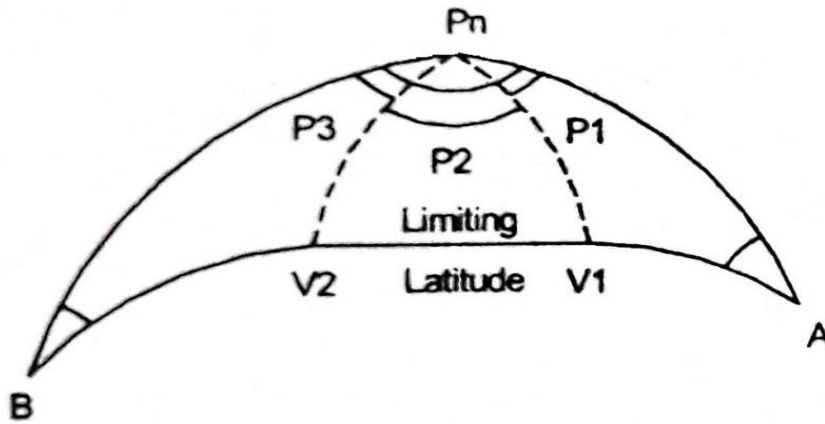
- 6) Your vessel on a passage between New Jersey, USA to Antwerp, Belgium and may encounter tropical revolving storms (TRS) as per weather forecast.
- a) Describe the warning signs of an approaching tropical revolving storm and modern day TRS Forecast systems available for Bridge officers.  
(10 marks)
  - b) Sketch a plan view of a TRS, in the Northern hemisphere, indicating ALL the relevant features.  
(8 marks)
  - c) Explain your actions with suitable sketches, if you observed that your vessel is in following sectors of a TRS in the Northern Hemisphere.
    - i. Navigable Semicircle
    - ii. Dangerous Semicircle
    - iii. Path of the TRS  
(12 marks)

FOR FINDING THE HEIGHT OF THE TIDE AT  
TIMES BETWEEN HIGH AND LOW WATER



**Answer sheet for questions.**

1). a).



Considering PAV1 triangle using Napier rule;

For distance :  $\cos AV1 = \sin \text{lat } A / \sin \text{lat } V1$

For course :  $\sin A = \cos \text{lat } V1 / \cos \text{lat } A$

For d'long :  $\cos P1 = \tan \text{lat } A / \tan \text{lat } V1$

Same way considering PBV2 triangle distance, course and d'long to be derived.

V1 to V2 distance using plane sailing.

AV1 Distance = **1626.8 nm** Course **069 04.3 '**

BV2 Distance = **1703.8 nm** Course **068 14.7'**

Cos P1 = **33 45.5'E** Cos P3 = **35 12.7' W**

V1 to V2 distance = **1198.7 nm**

Total Distance = AV1 + V1V2 + V2B = **1626.8 + 1198.7 + 1703.8 = 4529.3**

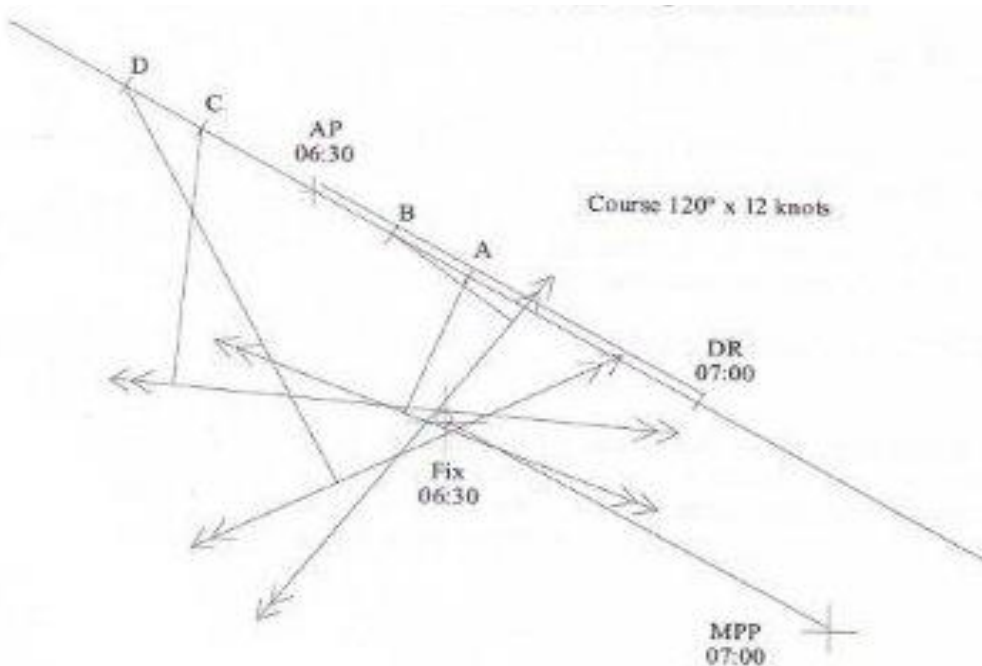
b). Departure time : 10 00 UTC on 10<sup>th</sup> June and  
Time taken  $4529.3 / 12 = 15$  days 17 hrs 26 min  
ETA = 03 26 UTC on 26<sup>th</sup> June / **10 26 LT on 26<sup>th</sup> June**

2

b).

As the position is required for 0630:

1. Star A	0618 to 0630	12 minutes	run on	2.4'
2. Star B	0624 to 0630	6 minutes	run on	1.2'
3. Star C	0639 to 0630	9 minutes	run back	1.8'
4. Star D	0645 to 0630	15minutes	run back	3.0'



d' lat = 3.3'S, dep = 1.8' E

DR Lat= 32° 14.0' S

d'lat= 0° 03.3' S

Fix Lat= 32° 17.3' S

$$\text{dep} = d' \text{ long} \times \text{Cos} (m' \text{ lat})$$

$$d' \text{ long} = \text{dep} / \text{Cos} (m' \text{ lat})$$

$$d' \text{ long} = 1.8' / \text{Cos} 32.3^\circ$$

$$= 2.1'' \text{ E}$$

$$\text{DRLong} = 128^\circ 17.0' \text{ W}$$

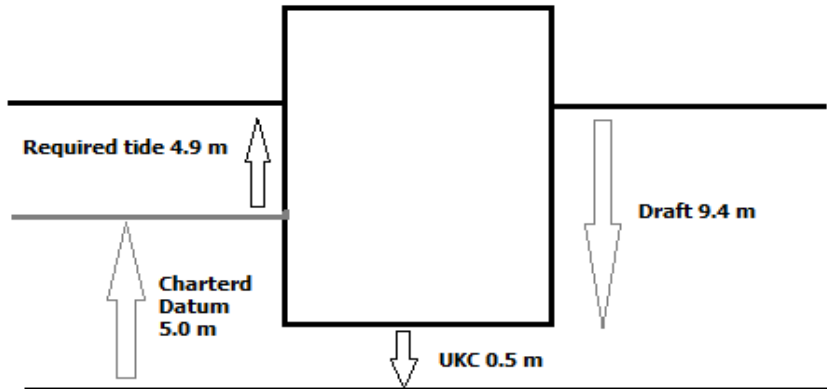
$$d' \text{ long} = 0^\circ 02.1' \text{ E}$$

$$\text{FixLong} = 128^\circ 14.9' \text{ W}$$

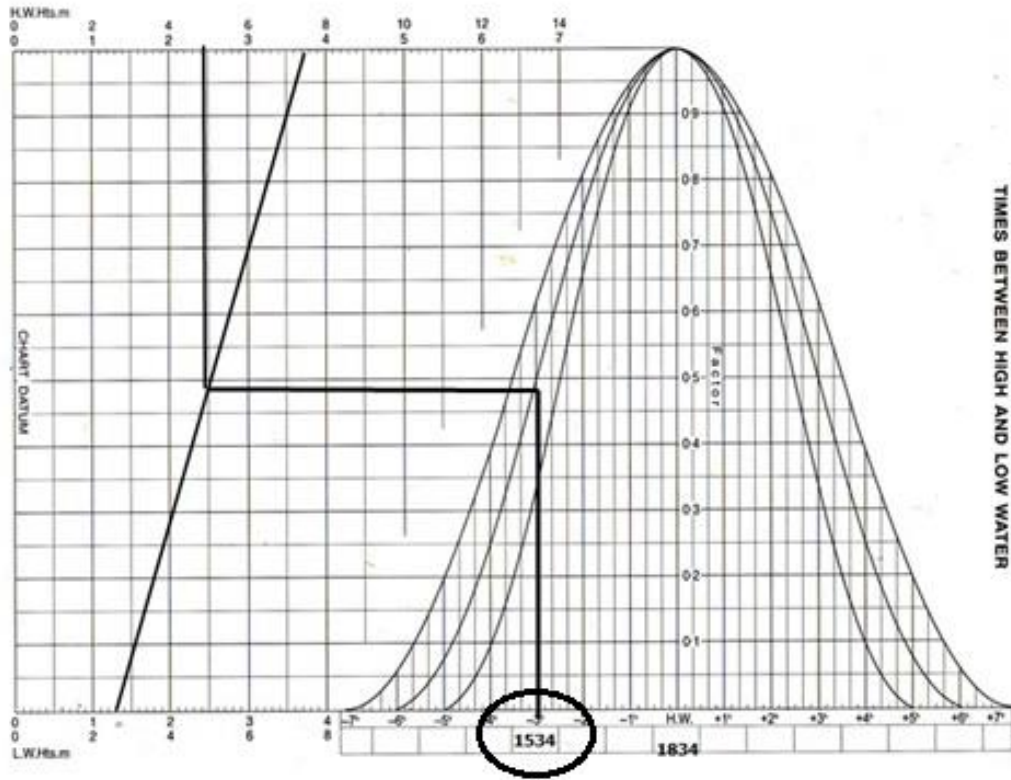
Vessel's Most Probable Position at 1830 = 32° 17.3' S 128° 14.9' W

3)

a).



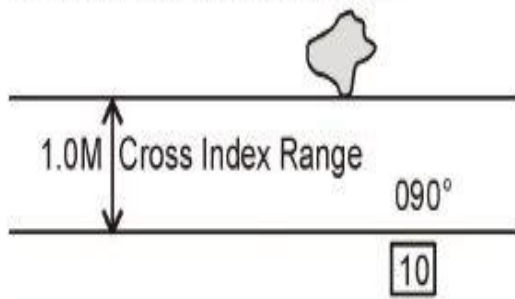
b).



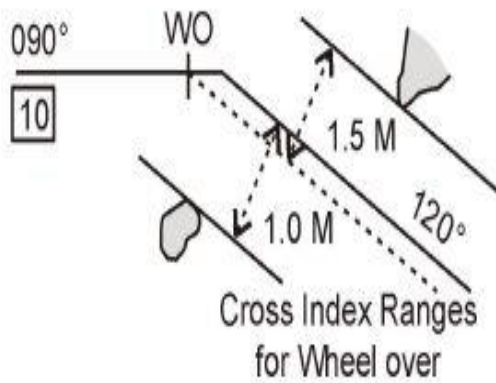
FOR FINDING THE HEIGHT OF THE TIDE AT TIMES BETWEEN HIGH AND LOW WATER



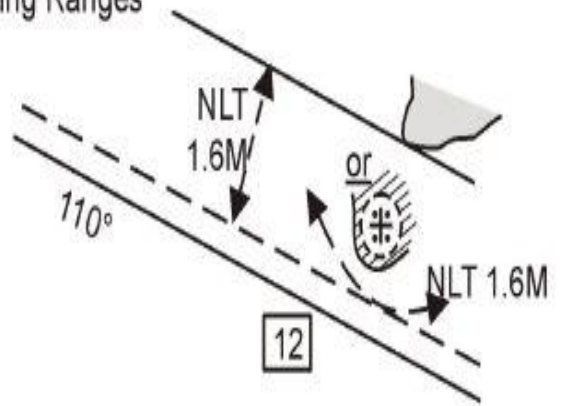
a. Parallel Index Line / Range



c. Wheel over Ranges



b. Clearing Ranges



d. Dead Ranges

