



**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 : 06th September 2017

Time allowed THREE hours	Total marks : 180
ANSWER ALL QUESTIONS	Pass marks : 70%

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.

A graph paper, radar plotting sheet and data sheets D1, D2 & D3 are provided

- 1) A container vessel commenced her sea voyage from Iquique, Chile on 28th September at 1745 local time bound for Lyttelton, New Zealand. At the time of departure, the vessel's all navigational equipment and machineries were in good working order with compliance to international regulations. The vessel was capable of maintaining 17.50 knots service speed with a daily fuel consumption of 42 t. She was loaded to her maximum load line marks and her winter marks were immersed by an equivalent of 533 t at departure port, Iquique. Vessel's daily fresh water consumption was 11 t. Master was advised to proceed at her service speed between the following departure and landfall positions via the shortest route.

Departure position 20^o15.0'S, 070^o20.0'W
Landfall position 43^o63.0'S, 172^o49.0'E

- a) Calculate the minimum legal distance keeping in mind that the northern limit of the winter load line zone as 33^o S (20 marks)
- b) Calculate the ETA (local time) at the landfall position with reference to data sheets D1 and D2 (10 marks)

- 2)
- a) State the specific responsibilities of each of the following when operating together as a bridge team. (05 marks each)
- i. The master
 - ii. The pilot
 - iii. The OOW

- b) State the additional responsibilities of the OOW when the master is not present on the bridge during pilotage (with pilot onboard). (05 marks)
- c) With reference to master pilot information exchange, outline five items of information that;
- The master should give to the pilot immediately upon reaching the bridge. (05 marks)
 - The pilot should give to the master immediately upon reaching the bridge. (05 marks)

- 3) A ship steering a course of 270° (T) and running at a speed of 17.5 knots manages to obtain stellar sights spread over a period as mentioned below.

Ships time	Star	True Azimuth	True Altitude	Calculated Altitude
1842	A	085°	$40^{\circ}04.3'$	$39^{\circ}59.3'$
1850	B	042°	$40^{\circ}17.9'$	$40^{\circ}20.5'$
1858	C	343°	$29^{\circ}56.2'$	$30^{\circ}02.5'$
1906	D	116°	$37^{\circ}03.09'$	$37^{\circ}01.64'$

Find the vessel's most probable position at 1900 local time using DR position $33^{\circ}00.0'S$, $130^{\circ}18.0'W$.

(For plotting, use a scale of 1cm = 1Nm)

(30 marks)

- 4)
- List down the points that you plan to highlight to your navigators, as the master of the vessel who's preparing to conduct a bridge team meeting. (10 marks)
 - On a vessel that uses ECDIS for navigation, discuss the checks that you should perform as the master and functions you would advise your OOWs to make use of, on the ECDIS terminals prior to departure and during sea voyage. (10 marks)
 - State the factors that the master is required to consider regarding the composition of the bridge watch. (10 marks)
- 5) A vessel drawing a maximum draft of 11.1 m and with an air draft of 42.2 m is anchored outside Lyttelton, New Zealand awaiting suitable height tide to enter the harbour. The vessel has to pass under a fixed bridge shown having a charted height of 48.3 m with a minimum clearance of 4.0 m. There is also a shoal patch shown having a charted depth of 12.5 m very close to the bridge where the vessel is required to pass over with a minimum under keel clearance of 1.0 m. The vessel is expected to enter the harbour on 14th October during daylight using the first available tide.

Referring to data sheet D3 and the tidal graph, calculate the time window available for the vessel to transit the location of the bridge and the shoal patch considering vessel is at even keel and squat effect as negligible.

(30 marks)

- 6) Tropical revolving storms are common at certain times of the year in the South Pacific Ocean, especially to the North of New Zealand and off the East Coast of Australia.
- a) Sketch a plan view of a TRS in the Western South Pacific Ocean, indicating the likely track after recurving.

(10 marks)

- b) Compile a list of master's standing orders for preparing vessel to navigate safely in heavy weather. Consider safety of vessel in relation to navigation, stability, cargo, engine room, exposed decks and accommodation.

(20 marks)

DATA SHEET – D1

LEGAL TIME

Territory	Standard Time	Daylight Saving Time		
			Begins	Ends
Chagos Archipelago				
(i) Except Diego Garcia	–05	*		
(ii) Diego Garcia	–06	*		
Chatham Is.	–12½	–13½	First Sun in Oct	Sat before third Sun in March
Chile	+04	+03	27 Sept	13 March
China	–08	*		
Christmas I. (Indian Ocean)	–07	*		
Clipperton I.	+07	*		
Cocos Is.	–06½	*		
Colombia	+05	*		
Colón, Arch de	+06	*		
Comoros	–03	*		
Congo	–01	*		
Cook Is.	+10	*		
Corse (Corsica)	–01	–02	As for France	
Costa Rica	+06	*		
Croatia	–01	–02	Last Sun in March	Sat before last Sun in Oct
Crozet, Iles.	–05	*		
Cuba	+05	+04		
Cyprus				
(i) Except Ercan	–02	–03	Last Sun in March	Sat before last Sun in Oct
(ii) Ercan	–02	–03	Last Sun in March	Sat before last Sun in Oct
Czech Republic	–01	–02	Last Sun in March	Sat before last Sun in Oct
Denmark	–01	–02	Last Sun in March	Sat before last Sun in Oct
Djibouti	–03	*		
Dominican Republic	+04	*		
Easter I. (Isla de Pascua)	+06	+05	27 Sept	13 March
Ecuador	+05	*		
Egypt	–02	–03	30 April	30 Sept
El Salvador	+06	*		
Equatorial Guinea (incl. Pagalu (Annobon Is.) and Bioko (Macias Nguema Biyogo))	–01	*		
Eritrea	–03	*		
Estonia	–02	–03	Last Sun in March	Sat before last Sun in Oct
Ethiopia	–03	*		
Falkland Is.	+04	+03	Second Sun in Sept	Sat before third Sun in April
Fernando de Noronha, Arq de	+02	*		
Fiji Is.	–12	–13	1 Nov	27 Feb
Finland	–02	–03	Last Sun in March	Sat before last Sun in Oct
Føroyar (Faeroes)	00	–01	As for Denmark	

DATA SHEET – D2

Territory	LEGAL TIME			
	Standard Time	Daylight Saving Time		
			Begins	Ends
Lithuania, Republic of	-01	-02	Last Sun in March	Sat before last Sun in Oct
Lord Howe I.	-10½	-11	Last Sun in Oct	Sat before last Sun in March
Loyalty, Iles	-11	*		
Luxembourg	-01	-02	Last Sun in March	Sat before last Sun in Oct
Macau	-08	*		
Macedonia, Former Yugoslav Republic of	-01	-02	Last Sun in March	Sat before last Sun in Oct
Madagascar	-03	*		
Madeira, Arq. da	00	-01	Last Sun in March	Sat before last Sun in Oct
Malawi	-02	*		
Malaysia	-08	*		
Maldivé Is.	-05	*		
Mali	00	*		
Malta	-01	-02	Last Sun in March	Sat before last Sun in Oct
Mariana Is.	-10	*		
Marquises, Iles	+09½	*		
Marshall Is.				
(i) Except Ebon Atoll	-12	*		
(ii) Ebon Atoll	+12	*		
Mauritania	00	*		
Mauritius	-04	*		
Mexico				
(i) All states except (ii) and (iii)	+06	+05	First Sun in April	Sat before last Sun in Oct
(ii) Baja California Sur, Nayarit, Sinaloa, Sonora,	+07	+06	First Sun in April	Sat before last Sun in Oct
(iii) Baja California Norte	+08	+07	First Sun in April	Sat before last Sun in Oct
Midway Is.	+11	*		
Moldova, Republic of	-02	-03	Last Sun in March	Sat before last Sun in Oct
Monaco	-01	-02	Last Sun in March	Sat before last Sun in Oct
Mongolia	-08	-09	Last Sun in March	Sat before last Sun in Sept
Morocco	00	*		
Mozambique	-02	*		
Myanmar (Burma)	-06½	*		
Namibia	-01	-02	6 Sept	3 April
Nauru	-12	*		
Nederlandse Antillen	+04	*		
Nepal	-05¾	*		
Netherlands	-01	-02	Last Sun in March	Sat before last Sun in Oct
New Zealand	-12	-13	First Sun in Oct	Sat before third Sun in March
Nicaragua	+06	*		
Nicobar I.	-05½	*		

DATA SHEET – D3

NEW ZEALAND SOUTH ISLAND – LYTTTELTON

LAT 43°36'S LONG 172°43'E

TIME ZONE –1200

TIMES AND HEIGHTS OF HIGH AND LOW WATERS

SEPTEMBER				OCTOBER				NOVEMBER				DECEMBER			
Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m
1 0319 0927 SA 1544 2159	2.1 0.6 2.2 0.5	16 0247 0854 SU 1512 2130	2.4 0.2 2.5 0.2	1 0329 0941 M 1552 2203	2.1 0.6 2.1 0.5	16 0324 0940 TU 1550 2207	2.4 0.2 2.5 0.1	1 0415 1028 TH 1635 O 2248	2.1 0.5 2.1 0.5	16 0455 1112 F 1718 2332	2.5 0.3 2.4 0.3	1 0428 1040 SA 1649 O 2301	2.2 0.5 2.1 0.4	16 0527 1142 SU 1746 2357	2.5 0.4 2.3 0.4
2 0401 1011 SU 1625 2239	2.1 0.6 2.2 0.5	17 0342 0955 M 1608 ● 2227	2.5 0.1 2.6 0.1	2 0408 1022 TU 1630 2243	2.1 0.5 2.1 0.5	17 0419 1036 W 1644 ● 2302	2.5 0.1 2.5 0.1	2 0458 1108 F 1717 2331	2.1 0.5 2.1 0.5	17 0549 1203 SA 1809	2.5 0.3 2.4	2 0516 1127 SU 1737 2349	2.3 0.5 2.2 0.4	17 0616 1232 M 1835	2.4 0.5 2.2
3 0440 1052 W 1703 O 2318	2.1 0.5 2.2 0.6	18 0436 1052 TU 1703 2323	2.5 0.1 2.6 0.1	3 0447 1100 W 1709 O 2323	2.1 0.5 2.1 0.5	18 0514 1129 TH 1738 2355	2.5 0.2 2.5 0.2	3 0545 1152 SA 1802	2.2 0.5 2.1	18 0021 0641 SU 1254 1901	0.3 2.5 0.4 2.3	3 0606 1218 M 1829	2.4 0.5 2.2	18 0042 0702 TU 1321 1923	0.5 2.4 2.5 2.2
4 0519 1130 TU 1741 2357	2.1 0.5 2.1 0.6	19 0532 1146 W 1758	2.5 0.1 2.6	4 0528 1137 TH 1748	2.1 0.5 2.1	19 0610 1222 F 1831	2.5 0.2 2.4	4 0015 0632 SU 1238 1851	0.5 2.2 0.5 2.1	19 0109 0730 M 1346 1953	0.4 2.5 0.5 2.3	4 0037 0656 TU 1311 1924	0.4 2.4 0.4 2.2	19 0127 0746 W 1408 2012	0.5 2.3 0.6 2.1
5 0600 1207 W 1819	2.1 0.5 2.1	20 0018 0630 TH 1240 1852	0.1 2.5 0.1 2.5	5 0003 0613 F 1217 1829	0.5 2.1 0.5 2.1	20 0046 0704 SA 1315 1925	0.2 2.5 0.3 2.4	5 0100 0719 M 1329 1944	0.5 2.3 0.5 2.1	20 0157 0817 TU 1438 2044	0.5 2.4 0.5 2.2	5 0128 0746 W 1406 2020	0.4 2.4 0.4 2.2	20 0212 0830 TH 1453 2059	0.6 2.3 0.6 2.1
6 0036 0643 TH 1245 1859	0.6 2.1 0.6 2.1	21 0110 0727 F 1335 1949	0.2 2.5 0.2 2.4	6 0044 0659 SA 1300 1914	0.5 2.1 0.6 2.0	21 0136 0756 SU 1409 2020	0.3 2.5 0.4 2.3	6 0147 0807 TU 1422 2039	0.5 2.3 0.5 2.1	21 0245 0904 W 1528 2134	0.6 2.3 0.6 2.1	6 0221 0838 TH 1501 2115	0.3 2.4 0.4 2.2	21 0257 0916 F 1538 2144	0.6 2.2 0.6 2.1
7 0115 0727 F 1326 1942	0.6 2.1 0.6 2.0	22 0202 0822 SA 1431 2046	0.2 2.5 0.4 2.4	7 0126 0744 SU 1347 2004	0.5 2.2 0.6 2.0	22 0226 0846 M 1504 2114	0.4 2.4 0.5 2.2	7 0239 0856 W 1517 2133	0.5 2.3 0.5 2.1	22 0335 0953 TH 1618 2221	0.6 2.2 0.6 2.1	7 0317 0934 F 1556 2209	0.3 2.4 0.3 2.2	22 0342 1005 SA 1623 2228	0.7 2.1 0.6 2.0
8 0155 0812 SA 1410 2029	0.6 2.1 0.6 2.0	23 0255 0914 SU 1528 2142	0.3 2.4 0.5 2.3	8 0210 0830 M 1438 2057	0.6 2.2 0.6 2.0	23 0319 0937 TU 1559 2206	0.5 2.3 0.6 2.2	8 0334 0949 TH 1613 2226	0.4 2.3 0.4 2.1	23 0423 1045 F 1708 2308	0.7 2.2 0.6 2.0	8 0413 1034 SA 1654 2304	0.3 2.3 0.3 2.2	23 0428 1053 SU 1709 2311	0.7 2.1 0.6 2.0
9 0239 0856 SU 1458 2120	0.6 2.1 0.7 2.0	24 0351 1007 M 1626 2236	0.4 2.4 0.5 2.2	9 0300 0916 TU 1532 2150	0.6 2.2 0.6 2.0	24 0412 1029 W 1654 2256	0.6 2.3 0.6 2.1	9 0430 1048 F 1710 2320	0.4 2.3 0.4 2.2	24 0510 1136 SA 1756 2355	0.7 2.1 0.6 2.0	9 0510 1133 SU 1752	0.3 2.3 0.3	24 0512 1140 M 1754 2357	0.7 2.0 0.6 2.0
10 0326 0941 M 1550 2210	0.6 2.1 0.7 2.0	25 0447 1102 TU 1725 2328	0.5 2.3 0.6 2.2	10 0353 1006 W 1627 2243	0.6 2.2 0.6 2.1	25 0504 1123 TH 1749 2346	0.6 2.2 0.6 2.1	10 0526 1148 SA 1809	0.3 2.3 0.3	25 0556 1224 SU 1841	0.7 2.1 0.6	10 0001 0609 M 1230 1848	2.3 0.3 2.3 0.2	25 0559 1223 TU 1838	0.7 2.0 0.6
11 0418 1029 TU 1644 2301	0.6 2.2 0.7 2.1	26 0541 1158 W 1823	0.6 2.2 0.6	11 0449 1102 TH 1725 2336	0.5 2.2 0.5 2.1	26 0552 1217 F 1840	0.6 2.1 0.6	11 0017 0623 SU 1246 1906	2.2 0.3 2.3 0.2	26 0042 0644 M 1308 1923	2.0 0.7 2.0 0.6	11 0059 0711 TU 1325 1942	2.3 0.3 2.3 0.2	26 0044 0649 W 1307 1921	2.0 0.7 2.0 0.6
12 0511 1122 W 1742 2354	0.6 2.2 0.6 2.1	27 0021 0630 TH 1254 1916	2.1 0.6 2.2 0.6	12 0543 1202 F 1824	0.4 2.3 0.4	27 0037 0640 SA 1306 1925	2.0 0.6 2.1 0.6	12 0116 0723 M 1342 2000	2.3 0.3 2.4 0.2	27 0129 0733 TU 1351 2003	2.0 0.6 2.0 0.5	12 0156 0813 W 1420 2034	2.3 0.3 2.3 0.2	27 0132 0741 TH 1352 2004	2.1 0.7 2.1 0.5
13 0604 1219 TH 1840	0.5 2.3 0.5	28 0113 0719 F 1344 2002	2.1 0.6 2.2 0.6	13 0033 0639 SA 1301 1921	2.2 0.4 2.3 0.3	28 0126 0728 SU 1351 2006	2.0 0.6 2.1 0.5	13 0213 0826 TU 1438 2054	2.3 0.2 2.4 0.2	28 0213 0822 W 1434 2044	2.1 0.6 2.1 0.5	13 0251 0911 TH 1515 2127	2.4 0.3 2.3 0.3	28 0219 0832 F 1440 2050	2.1 0.6 2.1 0.5
14 0050 0657 F 1318 1938	2.2 0.4 2.4 0.4	29 0204 0807 SA 1429 2045	2.1 0.6 2.1 0.5	14 0132 0737 SU 1359 2017	2.3 0.3 2.4 0.2	29 0211 0817 M 1434 2045	2.0 0.6 2.1 0.5	14 0308 0925 W 1532 2148	2.4 0.2 2.4 0.2	29 0257 0909 TH 1517 2128	2.1 0.6 2.1 0.5	14 0344 1003 F 1608 2219	2.4 0.3 2.3 0.3	29 0307 0922 SA 1531 2140	2.2 0.6 2.1 0.5
15 0149 0754 SA 1415 2034	2.3 0.3 2.5 0.3	30 0248 0856 SU 1512 2124	2.1 0.6 2.1 0.5	15 0230 0839 M 1455 2112	2.3 0.2 2.5 0.1	30 0253 0904 TU 1514 2125	2.0 0.6 2.1 0.5	15 0402 1020 TH 1626 ● 2241	2.5 0.2 2.4 0.2	30 0341 0954 F 1602 2214	2.2 0.6 2.1 0.5	15 0436 1053 SA 1658 ● 2310	2.4 0.3 2.3 0.4	30 0357 1011 SU 1622 O 2232	2.3 0.5 2.2 0.4
				31 0334 0947 W 1555 2206	2.1 0.5 2.1 0.5									31 0448 1103 M 1713 2324	2.4 0.4 2.3 0.3

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

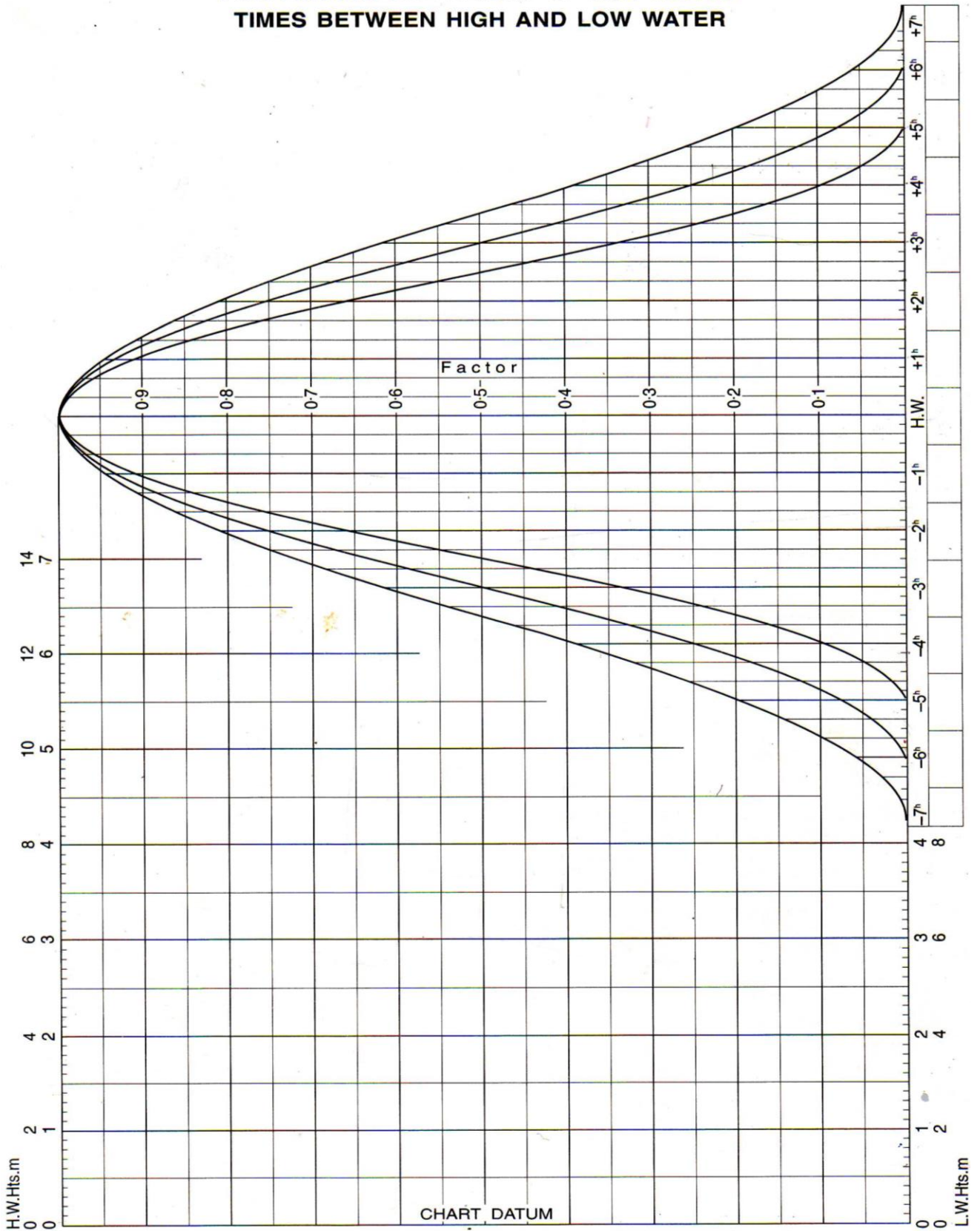


CHART DATUM

Answers

Answer – 1

- a) Total legal distance 6094Nm (6094.24Nm)
- b) ETA 13th October, 2200LT

Answer – 3

33°06.35'S, 130°17.80'W
(D'Lat = 6.35'S, Dep = 0.2'E)

Answer – 5

Min height of tide required to pass over shoal	= 0.6m
Time with 0.6m height of tide	= 0914Hrs
Max height of tide required to pass under bridge	= 2.1m
Time with 2.1m height of tide	= 1227Hrs
Available time window allowed)	= 0914 to 1227 (+ or – five minutes can be