NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

NAUTICAL SCIENCE: PAPER I

MARKING GUIDELINES

Time: 3 hours 150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

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SECTION A PRACTICAL CHARTWORK

QUESTION 1

(Answer booklet)

1.1

	Course	Robben Island Lt.
Compass:	164° (C)	141° (C)
Deviation:	1° E ✓	1° E ✓
Magnetic:	165° (M)	142° (M)
Variation	25° W	25° W
True:	140° (T) ✓	117° (T) ✓

Distance (current) = 3 kn × 0,5 Hr = 1,5 M

Distance (ship) = 10 kn × 0,5 Hr = 5,0 M -or-
= 10 kn × 1 Hr = 10,0 M

Speed over-the-ground (SOG) = 5,8 M ÷ 0,5 Hr = 11,6 kn -or-
7,4 M ÷ 1,0 Hr = 7,4 kn

ETA @ 2nd position = 11,6 M ÷ 11,6 kn) = 1,0 Hr = 0900

Triangle at initial position:	**½ hour triangle**	**1 hour triangle**	**Other option**
Course to make good:	140° (T)	140° (T)	140° (T)
Course to counter current:	135° (T)	135° (T)	
Leeway:	7° (W'ly wind)	7° (W'ly wind)	7° (W'ly wind)
Course to steer:	142° (T)	142° (T)	
Variation:	25° W	25° W	
Magnetic:	167° M	167° M	
Deviation:	2° E	2° E	
Compass Course:	165° C	165° C	

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1.1 & 1.2 **Criterion**	**Possible Score**	**Rating**
1st position fix (Rbn. Is. bearing: 117° (T) ✓ range: 11,7 ✓ time: 0800)	2	
2nd position fix Lat: 033° 52.55' S Long: 018° 19.0' E time: 0900	2	
Course to make good vector/line: 140° (T) ✓	1	
Course to make good label: 140° (T) Speed label 10	---	---
0830 DR: 5 Miles (at estimated average speed 10 kn)	---	---
Current vector set/direction: 170° (T) ✓	1	
Current vector set/direction symbol: 170° (T) 	1	
Current vector rate/magnitude measurement 0,5 or 1,0 miles	1	
Current vector set/direction label: 170° (T)	---	---
Current drift/rate label: 2 Kn 2	---	---
Course to counter current vector/line: 135° (T)	1	
Course to pilot station vector/line: 090° (T) ✓	1	
Course to pilot station label: 090° (T) Speed label 10	---	---
3rd location: Arrival at pilot station	1	
Total	**11 / 11**	**/ 11**
0 = Poor (zero / totally inappropriate / inaccurate attempt) **1 = Good** (attempt mostly correct/accurate)		

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QUESTION 2

(Answer booklet)

1200 DR distance (at estimated average speed of 8 kn: 8 × 0,5 = 4 M) ✓

(Chartwork)

Criterion	Possible Score	Rating
1045 Fix 054° (T) Slangkoppunt Light Range: 4.1 M Alter course to 150° (T)	3	
1100 Fix 034° 13.0' S 018° 16.5' E	2	
1130 Fix 045° (T) Bonteberg (running fix commences)	1	
1200 Fix 012° (T) Bonteberg	1	
1200 DR plot: 4 Miles	1	
Transfer of 1st LOP to DR termination point ✓	1	
Transferred LOP symbol: 	1	
1230 Fix 067° (T) Cape Point Light 030° (T) Paulsberg	2	
1256 Fix 034° (T) Cape Point Light Range: 6.1 M. Alter course to 080° (T)	3	
1322 Fix 000° (T) Cape Point Light Range: 4.7 M	2	
1346 Fix 034° 25.4' S 018° 33.6' E	2	
Total	**19** **19**	**19**
0 = **Poor** (zero / totally inappropriate / inaccurate attempt) **1** = **Good** (attempt mostly correct/accurate)		

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QUESTION 3

3.1 (Answer booklet)

Base Line Simonsberg / Else Pk:	178°/358°
Base Angle:	90° – 75° = 15° (toward obs.)
Bearing (of Else Pk) from Simonsberg:	358° + 15° = 013°
Bearing (of Simonsberg) from Else Pk:	178° – 15° = 163°
Base Line Else Pk / Kalkbaaiberg:	185°/005°
Base Angle:	90° – 43° = 47° (toward obs.)
Bearing (of Kalkbaaiberg) from Else Pk:	005° + 47° = 052°
Bearing (of Else Pk) from Kalkbaaiberg:	185° – 47° = 138°

3.2 Anchor position: Roman Rocks Lt. Bearing = 209° (T) Range = 1,5 M

(Chartwork)

3.1 **Criterion**		**Possible Score**	**Rating**
1st Triangle construct:	base line ✓ side 1 toward observer's side of base line ✓ side 2 toward observer's side of base line ✓	3	
2nd Triangle construct:	base line ✓ side 1 toward observer's side of base line ✓ side 2 toward observer's side of base line ✓	3	
Position plot:	range (product of HSA triangle) ✓ range (product of HSA triangle) ✓	2	
Total		**8**	**8**
0 = Poor (zero / totally inappropriate / inaccurate attempt) **1 = Good** (attempt mostly correct/accurate)			

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QUESTION 4

4.1 Roman Rocks lighthouse: **Fl. 6s 17m 20M**

- Colour of light: white;
- Class of light: flashing;
- Period/frequency is 6 seconds;
- Elevation of lighthouse is 17 metres above Height Datum/MSL;
- Nominal luminous range of the light is 20 nautical M;

4.2 Tidal stream: Direction **266°** (T)
Speed/rate/drift = **0,3** knots

4.3 **Top** corner chart limits co-ordinates: 033° 43' 09" S ✓ 018° 25' 12" E ✓

4.4 PROLONGED

4.5 Notices to Mariners

4.6 Variation 25° 27' W (2019 edition)

4.7 26 – 11 – 2019

4.8 NO

4.9 22 m

4.10 (a) 'S' = sand

(b) 'Sh' = shells

4.11 (a) major (navigation) light

(b) chimney

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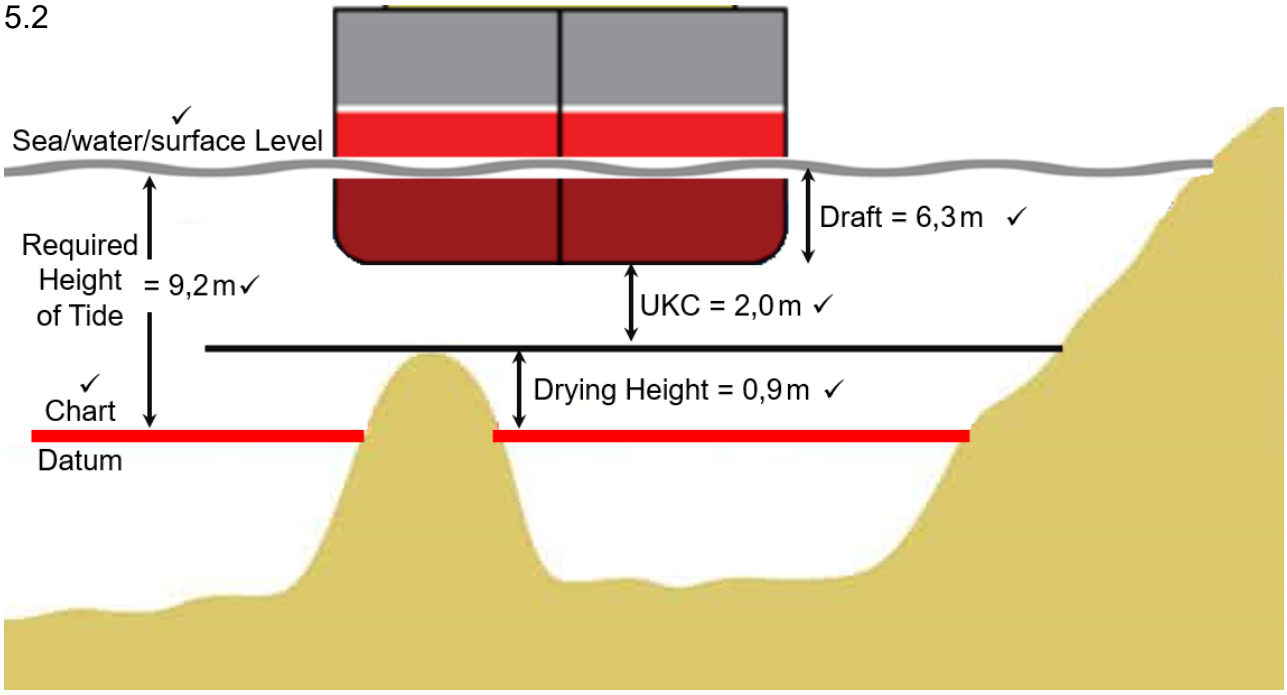
QUESTION 5 TIDES

5.1 HoT (predicted) = UKC + d + Dry Ht ✓
= 2,0 ✓ + 6,3 ✓ + 0,9 ✓
= 9.2 m ✓

-OR-

Draught	=	6,30 m
Clearance	=	2,00 m
Drying Height	=	0,90 m
Height of tide	=	9,20 m

5.2



5.3 Phase 2 first quarter ✓
neap tides ✓

Phase 3 full moon ✓
spring tide ✓

Phase 4 last/third quarter ✓
neap tides ✓

5.4 (a) LAT = lowest astronomical tide ✓

(b) MSL = mean sea level ✓

(c) UKC = under keel clearance / depth below keel ✓

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SECTION B ASTRO-NAVIGATION

QUESTION 6

6.1 (a)

	Option 1		**Option 2**	
LMT Sunset (20° N)	18 17 00		(30° N) 18 24 00	
Lat Corr'n (6° 00')	00 04 12	+	(4° 00') 00 02 48	-
LMT Sunset (26° 00' N)	18 21 12		18 21 12	
LIT (30° 00' **W**)	02 00 00	+	02 00 00	+
GMT	20 21 12		20 21 12	
~~Zone (30° 00' **W**)~~	~~02 00 00~~	-	02 00 00	-
~~Ship's Zone Time~~	~~18 21 12~~		18 21 12	

(b) Dec @ 2000 on 09 Apr = N 07° 57.9' *(↑ Trend: **Increasing**)*
d Corr^{n} **('d' = 0.9')** = **+** 0.3' *(d Corr^{n} = 0.9' × Min 21' of GMT ÷ 60)*
Dec @ 2021 on 09 Apr = **N 07° 58.2'**

Amp = Sin^{-1} (Sin Dec/Cos Lat)
= Sin^{-1} (sin 07° 58.2' /cos 26° 00')
= 0.1542673534
= 8,874…°
Thus Amp = **W 09°N**

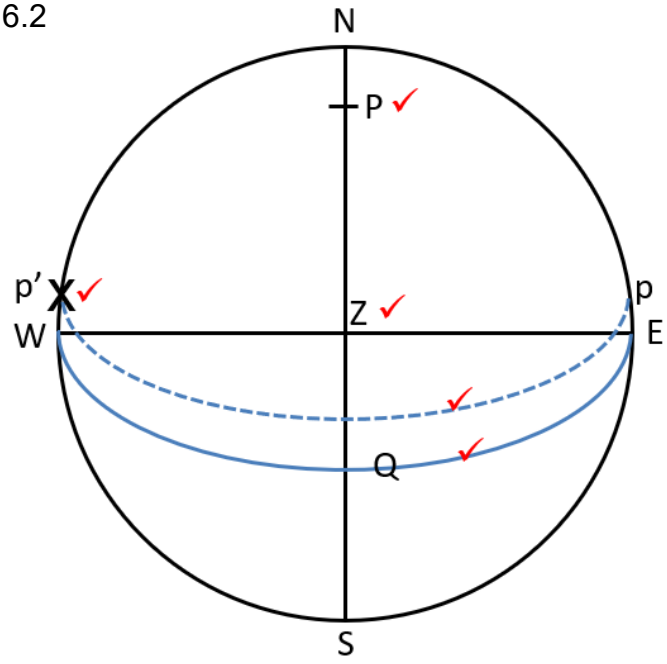
True Brg = 270° + 09°
= 279° (T)

True brg = 279° (T)
Comp brg = 281° (C)
Comp error = 2° W

(c) Compass Heading = 274° (C)
Error = 2° W
True course = 272° (T)

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6.2



- celestial horizon (NESW)
- observer's meridian (NZS)
- zenith position (Z)
- elevated pole (P)
- equinoctial/celestial equator (WQE)
- path of heavenly body/parallel of declination (pXp')
- position of heavenly body - sun (X)

QUESTION 7

7.1 ***Almanac Daily Page: 2016 April 09, 10, 11 (SAT, SUN, MON)***

GHA (22:00)	149° 43,7'	
Incr.(20' 00")	005° 00,0' +	*(Incr. = Mins & Secs of GMT **x** 15)*
GHA (22:20)	154° 43,7'	
Long. (066° 08,6' W)	066° 08,6' W –	
LHA	**088° 35,1'**	

Dec @ 22:00	N 8° 21,9'	*(↑ Trend: **Increasing**)*
'**d**' Corr^{n} (20')	**+** 0,3'	*(d Corr^{n} = 0.9' × Minute 20' of GMT ÷ 60)*
Dec @ 2020	N 8° 22,2'	

$$Z = \text{Tan}^{-1}\left(\frac{\text{Sin} - \text{LHA}}{\text{Cos} \pm \text{Lat} \times \text{Tan} \pm \text{Dec} - \text{Sin} \pm \text{Lat} \times \text{Cos} - \text{LHA}}\right)$$

$$= \text{Tan}^{-1}\left(\frac{\text{Sin} - 88° 35,1'}{\text{Cos} +25° 50,6' \times \text{Tan} +8° 22,2' - \text{Sin} +25° 50,6' \times \text{Cos} - 88° 35,1'}\right)$$

= – 83, 061°

= N 83° W

Z_T = 360° – 83°

= 277° (T)

-OR-

A = 0.0119 S

B = 0.1471 N

C = 0.1352 N

Z = *tan^{-1} (1* ÷ (0.1352 × *cos (*25° 50,6'*))*

= 83,062°

= N 83° W

= 277° (T)

True Azimuth = 277° (T)

Obs. Comp. Brg. = 279° (C)

Comp. Error = 2° **W**

Compass Heading = 145° (C)

Compass Error = 2° (W) *(Error West = Subtract)*

True Heading = **143° (T)**

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7.2 Compass Error = Variation ± Deviation **– OR –** **T** 143°
Comp Error – Variation = Deviation **V** 14° W
2° W + 14° E = **M** 157°
12° E = **D** 12° E
12° E = **C** 145°

7.3 (a) Northern hemisphere

(b) Southern hemisphere

7.4 AT AN EQUINOX

Total: 150 marks

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MARKSHEET **Exam Number: _____**

SECTION A PRACTICAL CHARTWORK

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(Chartwork)

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Current vector set/direction symbol: 170° (T) 	1	
Current vector rate/magnitude measurement 0,5 or 1,0 miles	1	
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(Chartwork)

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QUESTION 3

3.1 (Chartwork)

Criterion		Possible Score	Rating
1st Triangle construct:	base line	3	
	side 1 toward observer's side of base line		
	side 2 toward observer's side of base line		
2nd Triangle construct:	base line	3	
	side 1 toward observer's side of base line		
	side 2 toward observer's side of base line		
Position plot:	range (product of HSA triangle)	2	
	range (product of HSA triangle)		
Total		**8**	**8**
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