NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2022

# NAUTICAL SCIENCE: PAPER I

Time: 3 hours 150 marks

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## PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 4 pages and an Annexure Booklet of 7 pages (i–vii). Please check that your question paper is complete.
2. Answer **ALL** the questions in Sections A and B.
3. Begin the answer to each new question on a new page.
4. The use of scientific calculators is permitted.
5. Alphanumeric calculators and dictionaries are **NOT** permitted.
6. Nautical tables may be used.
7. Use Magnetic Variation 24° W unless otherwise stated, and the Deviation Card, Annexure 1, throughout.
8. It is in your own interest to write legibly and to present your work neatly.

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## REQUIREMENTS

Drawing instruments
Chart SAN 3002

## ANNEXURES

1. Examination Notes and Deviation Card
2. Altitude Correction Tables
3. Conversion of Arc to Time
4. Nautical Almanac – page 163, 1987 August 17, 18, 19
5. Increments and corrections pages xxix, increments for $54^m$ to $55^m$
6. Increments and corrections pages xxx, increments for $56^m$ to $57^m$
7. Tide Tables – Mossel Bay 2007 October, November, December

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## SECTION A PRACTICAL CHARTWORK

**Note:** Marks include all work done on the Chart 3002 provided.

### QUESTION 1

Prepare a passage plan for a voyage from Kaap Hangklip to Cape Town. The following way points are given:

| | | |
|---|---|---|
| WP 1 | 34° 30,2'S | 018° 50,0'E |
| WP 2 | 34° 23,3'S | 018° 19,0'E |
| WP 3 | 34° 10,0'S | 018° 15,0'E |
| WP 4 | 34° 01,0'S | 018° 15,0'E |
| WP 5 | 33° 52,4'S | 018° 21,0'E |
| WP 6 | 33° 52,4'S | 018° 24,0'E |

1.1 Lay off the courses on Chart 3002. (10)

1.2 Draw up a table with the following headings:
- Course
- Distance between WPs
- Distance to go to the last WP (6)

1.3 What will the ETA at WP 6 be if the vessel arrived at WP 2 at 05:30 with estimated speed 12 knots? (4)
**[20]**

### QUESTION 2

A vessel on passage to Simon's Bay plotted position at 13:00 Kaap Hanglip Lt. bearing 045° (T) × 3,0 miles.
The vessel is required to pass 1 mile off Whittle Rock Racon Buoy.
The current is setting at 240° (T) at 3 knots, and the vessel speed is 12 knots.

2.1 Find the compass course to steer to pass 1 mile off Whittle Rock Racon Buoy. (16)

2.2 At what time will the buoy be abeam? (4)
**[20]**

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## QUESTION 3

Cape Point Lt. observed bearing 260° (C) when the ship's heading was 210° (C). At the same time the vertical sextant angle of the lighthouse was observed to be 0° 13,5'.

Sextant index error is 1,2' on the arc.
State of the tide is estimated to be 1,0 m below MHWS.

Plot the position on the chart and state the Latitude and Longitude coordinates of this position.

**[20]**

## QUESTION 4

A vessel is taking on fuel, stores and fresh water at Mossel Bay. She is expected to depart during the afternoon of Friday, 9 November 2007. The shallowest chart depth in the port is 4,20 m.

4.1 From the Tide Table provided, what is the height and time of high tide on the afternoon of 9 November 2007? (5)

4.2 Calculate the maximum draft the vessel may load to in order to sail with an UKC of 2,0 m. (6)

4.3 From the Tide Table, what is the phase of the Moon on 10 November? (4)

4.4 What is the range and duration of rising tide on the morning of 9 November? (5)

**[20]**

## QUESTION 5

5.1 On the Chart 3002 provided, choose a suitable anchorage position in Table Bay for a vessel carrying hazardous cargo and having a draught 13,5 m.

Mark the position on the chart and state the position on your answer book with reference to the bearing and range to the Breakwater Lt. Fl. G. 2s. (4)

5.2 What colour light will Milnerton Lt. flash from this anchorage position (5.1)? (1)

5.3 What is the variation to apply to the True Bearing in the year 2012 indicated in the compass rose south of Table Bay on the Chart 3002? (5)

5.4 What do the Cardinal marks indicate on the buoy south of Robben Island (VQ6 + L Fl. 10s)? (3)

5.5 Describe the characteristics of Green Pt Lt. Hse. (7)

**[20]**

**100 marks**

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## SECTION B ASTRO-NAVIGATION

### QUESTION 6

On 19 August 1987 a vessel in DR position 28° 00'S, 010° 11'E, the sextant altitude of the Sun's lower limb was observed to be 35° 23,7' when the chronometer read $08^h\ 54^m\ 20^s$.

Chronometer error: 45 seconds slow on GMT;
Index error of the sextant: 1,0' on the arc;
Observer's height of eye: 6,2 metres.

6.1 Determine the position line on which the ship was situated using the intercept method. (20)

6.2 Plot the DR position, azimuth and the position line schematically in your answer book. (5)
**[25]**

### QUESTION 7

On 19 August 1987 your vessel is steering 304° (C) in DR position 27° 30'S, 010° 15'E. The sun was observed to rise bearing 086° (C). The magnetic variation is 24°W.

7.1 Calculate the GMT and Zone Time of sunrise on 19 August. (10)

7.2 Determine the compass error and the true course of the vessel. (10)

7.3 Show by means of a sketch on the plane of the celestial horizon the following:

7.3.1 The declination (X); (1)

7.3.2 The celestial equator (Q); (1)

7.3.3 The zenith position (Z); (1)

7.3.4 The elevated pole (P); (1)

7.3.5 The amplitude of the Sun (Ø°) (1)
**[25]**

**50 marks**

**Total: 150 marks**

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