NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

NAUTICAL SCIENCE: PAPER I

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 6 pages and an Annexure Booklet of 5 pages (i–v). 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. Chronologically order/arrange and number the answers correctly according to the order/sequence and numbering system used in this question paper.
5. Clearly show ALL calculations and diagrams used in the determination of answers in answer book and/or chart accordingly.
6. The use of an approved scientific calculator (non-programmable and non-graphical) is permitted. Alphanumeric calculators and dictionaries are **NOT** permitted.
7. Use Magnetic Variation 25° W unless otherwise stated, and the attached Deviation Card – Annexure 1, throughout.
8. Round-off final courses and bearings to the nearest whole degree.
9. Express all times in hours, minutes, and seconds.
10. All work done on the chart must be done lightly, using a 2B pencil.
11. It is in your own interest to write legibly and to present your work neatly.

REQUIREMENTS

Drawing instruments
Chart SAN 3002

ANNEXURES

Annexure 1 – Deviation Card
Annexure 2 – Conversion of Arc to Time
Annexure 3 – Nautical Almanac – 2016 April 09, 10, 11
Annexure 4 – Increments and Corrections – Minutes 20 & 21
Annexure 5 – Graph Paper

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SECTION A PRACTICAL CHARTWORK

QUESTION 1

A vessel approaching Cape Town on a compass course 164° (C) established its 08:00 fixed via observation of Robben Island Lt. bearing 141° (C) at 11,7 miles. Using the Chart SAN 3002 provided, plot the position and determine the following:

1.1 The compass course to steer to the next alter course GPS position 033° 52, 55' S 018° 19,0' E given:

- speed through the water is 10 knots
- current is estimated to be setting 170° (T) at 2 knots
- estimated leeway from a Westerly wind is 7° (18)

1.2 From this last alter course position, show plot to arrive at the pilot rendezvous position - north of Green Point Lighthouse, disregarding the effects of current and wind. (2)

[20]

QUESTION 2

You are standing your day bridge watch in the vicinity south-west of Slangkoppunt Light on route toward Cape Point Light. The ship proceeds at an average speed of 8 knots. Execute the planned passage in accordance with appropriate plotting conventions and associated calculations.

1045 Fix 054° (T) Slangkoppunt Light @ 4,1 miles. Alter course to 150° (T) (3)

1100 Fix 034° 13.0' S 018° 16,55' E (2)

1130 Fix 045° (T) Bonteberg (⧋226). Commence a running fix (1)

1200 Fix 012° (T) Bonteberg (⧋226). Complete the running fix (5)

1230 Fix 067° (T) Cape Point Light, 030° (T) Paulsberg (⧋366) (2)

1256 Fix 034° (T) Cape Point Light @ 6,1 miles. Alter course to 080° (T) (3)

1322 Fix 000° (T) Cape Point Light @ 4,7 miles (2)

1346 Fix 034° 25,4' S 018° 33,6' E. (2)

[20]

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QUESTION 3

Your vessel is anchored in Simon's Bay. The following horizontal sextant angles were observed between:

- Simonsberg ⚬546 and Else Pk. ⚬303 is 75°
- Else Pk. ⚬303 and Kalkbaaiberg ⚬515 is 43°

3.1 Determine and plot the exact anchor position established by way of resultant ranges. (18)

3.2 State the established ship's position as a bearing and range in reference to Roman Rocks Light. (2)

[20]

QUESTION 4

With reference to Chart SAN 3002:

4.1 Describe the characteristics of Roman Rocks lighthouse. (5)

4.2 From the 'Tidal Streams' table, what is the direction and rate of the tidal stream outside Houtbaai in approximate position: 034° 04,5' S 018° 19,8' E three hours after HW Springs? (2)

4.3 What are the GPS co-ordinates for the top corner chart limits? (2)

4.4 The foghorn installed on Robben Island emits a group of 2 x blasts every 30 seconds. Deduct the specific duration of the said sound signal. (Answer SHORT or PROLONGED). (2)

4.5 Which chart-related hydrographic publication is listed first? (1)

4.6 What is the variation in the compass rose east of Table Mountain? (1)

4.7 What is the date of the latest edition of the chart? (1)

4.8 Would a vessel navigating in the immediate vicinity of Albatross Rocks (north-west of Cape Point Light) use Cape Point Light as an aid to navigation? (Answer YES or NO). (1)

4.9 What is the shallowest sounding in the immediate vicinity of Rocky Bank (south-east of Cape Point Light)? (1)

4.10 Describe the nature of the seabed symbolised by the abbreviation:

(a) 'S'

(b) 'Sh' (2 × 1 = 2)

4.11 What is the meaning of the chart symbol?



(a)



(b)

(2 × 1 = 2)

[20]

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QUESTION 5

5.1 A vessel is to pass with a UKC of 2,0 m over a sandbank for which the charted drying height is given as 0,9 m. Calculate the required height of tide to pass over the sandbank if the draught of the vessel is 11,8 m. (5)

5.2 By means of a simple illustrative sketch present the above given and calculated vessel and tidal data accordingly. (6 × 1 = 6)

5.3 The diagram below illustrates typical effects of celestial bodies on tidal levels. Identify the moon phases and associated tides experienced in phases 2, 3, and 4 accordingly. (6 × 1 = 6)

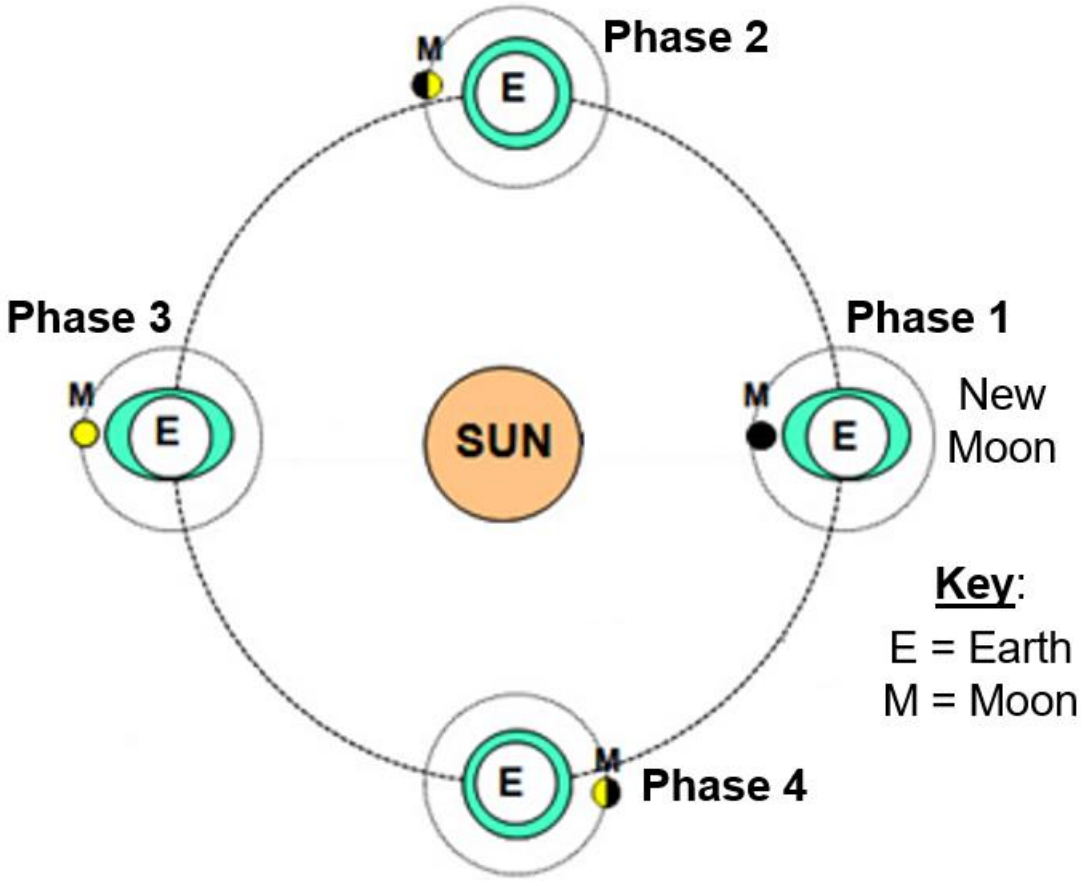


Diagram 1: Effects of Celestial Bodies on Tides

[<Adapted from: https://www.splashmaritime.com.au/Marops/data/text/Navtex/Navtide.htm>]

5.4 Decode the following tidal levels abbreviation:

(a) LAT

(b) MSL

(c) UKC (3 × 1 = 3)

[20]

100 marks

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SECTION B ASTRO-NAVIGATION

QUESTION 6

On 09 April 2016 the setting sun was observed bearing 281° (C). The vessel was in DR position 026° 00' N, 030° 00' W steering a compass course 274° (C). The magnetic variation obtained from the nautical chart was given as **11° W**. Given:

LIT = Longitude ÷ 15
d.Corrn = (Minutes of GMT ÷ 60) × d. Value
Amplitude = sin^{-1} [sin dec / cos lat]

6.1 Determine:

(a) GMT and ship's zone time of sunset at the assumed position, (6)

(b) Compass error of the vessel's compass at the time, (12)

(c) True course/heading (2)

6.2 By means of a rational horizon sketch on the plane of the celestial horizon, show, inter alia:

- 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). (5)

[25]

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QUESTION 7

On 10 April 2016 at 22:20 GMT in assumed position 025° 50,6' N 066° 08,6' W the Sun was observed to bear 279° (C) when the vessel was heading 145° (C). Given:

Nautical Almanac Formulation:

LIT = Longitude ÷ 15

Incr = Minutes and Seconds of GMT × 15

d.Corrn = (Minutes of GMT ÷ 60) × d. Value

$Z = \tan^{-1}((\sin(LHA) \div (\cos(L) \times \tan(d) - (\sin(L) \times \cos(LHA))$

Norie's Tables Formulation:

$A = \tan(L) \div \tan(LHA)$

$B = \tan(d) \div \sin(LHA)$

$C = A \pm B$

$Z = \tan^{-1}(1 \div (C \times \cos(L))$

7.1 What is the true heading of the vessel at the given time? (19)

7.2 If the magnetic variation of **14° W** is obtained from the nautical chart, what is the deviation of the compass for the given heading? (3)

7.3 Which hemisphere has the longest daytime during

(a) June solstice; and (1)

(b) December solstice? (1)

7.4 When do days and nights become almost equal in length?
(Answer: AT A SOLSTICE or THIS NEVER HAPPENS or AT AN EQUINOX) (1)

[25]

50 marks

Total: 150 marks

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