NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2021

NAUTICAL SCIENCE: PAPER I

Time: 3 hours 150 marks

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 Variation 17° W and the attached Deviation Card.
8. It is in your own interest to write legibly and to present your work neatly.

REQUIREMENTS

Drawing instruments
Graph paper
Chart SAN 3002

ANNEXURES

1. Examination Notes and Deviation Card
2. Predicted Hourly Heights in Metres – Walvis Bay – November 2001
3. Altitude Correction Tables 10° – 90° – Sun, Stars, Planets
4. Nautical Almanac – 1997 July 30, 31, Aug 1 (Wed., Thurs., Fri.)
5. Conversion of Arc to Time
6. Increments and corrections, page xxiv, increments for 44 and 45 minutes
7. Increments and corrections, page xxx, increments for 56 and 57 minutes

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SECTION A PRACTICAL CHART WORK

QUESTION 1

At 11h00 the following fix was obtained:

115º (T) Robben Island light by 10 miles.
Your speed through the water was 8 knots.
The current was estimated to be setting 050° (T) at 2 knots.
The leeway was estimated as 3° due to a south westerly wind.

1.1 Determine the compass course to steer to your next alter course position (WP1), 041º (T) Robben Island light by 4,7 miles. (15)

1.2 Lay off the course on the chart to a position WP2 180º (T) north breakwater light (Fl.G.2s 5M) 1,3 miles. (5)

1.3 What is your estimated time of arrival at the position WP2? The effect of the current after the alter course position is negligible and can be disregarded. (5)
[25]

QUESTION 2

Your vessel is lying approximately 3 miles due west of Chapman's Peak (.592).
Two horizontal sextant angles were taken as follows:

Between Karbonkelberg (.652) and Chapman's Peak (.592) – 65º.
Between Chapman's Peak (.592) and Slangkop light – 72º.

Determine your position in terms of latitude and longitude.

[20]

QUESTION 3

At 15h00 your vessel was steering 132º (C). At that time a compass bearing was taken of Cape Point light which was 089° (C).

At 16h00 a second bearing was taken of Cape Point light which was 349° (C).

The engine speed was 10 knots and the current was estimated to be setting 040° (T) at 2 knots. Leeway was estimated as 3° in a south-westerly wind.

3.1 Plot the vessel's position at 16:00. (15)

3.2 What is the true bearing and range of Cape Point Lt. at 16:00? (5)
[20]

QUESTION 4

Your vessel is due to sail from Walvis Bay on the rising tide during the afternoon of 6 November 2001. In order to leave the port of Walvis Bay, your vessel must cross a sandbank with a charted depth of 7,3 metres beneath the keel. The draught of your vessel is 7,1 metres and you require a minimum of 1,5 metres under keel clearance.

When is the earliest you will be able to cross the sandbar? **[15]**

QUESTION 5

5.1 What are the characteristics of the following lights?

5.1.1 Lighthouse 1: Fl.(3+2). 20 s. 79m 24M FR 65m 10M (10)

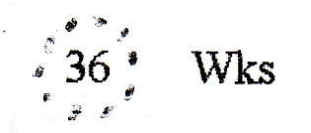
5.1.2 Lighthouse 2: LFl.R. 6M (4)

5.2 Whittle Rock Cardinal Buoy, False Bay

5.2.1 What is the audio or fog signal of this buoy? (1)

5.2.2 Your vessel is navigating in thick fog steering North in the vicinity of Whittle Rock. Directly ahead, you hear the fog signal of Whittle Rock Buoy. Which direction would you alter course to avoid the buoy? (3)

5.3 What is the meaning of the following chart symbol?



(2)
[20]

100 marks

SECTION B ASTRO-NAVIGATION

QUESTION 6

What is the zone time of sunset on 30 July 1997 in position 26º 30'S 140º 08' W?

[10]

QUESTION 7

What is the Local Hour Angle and the Declination of the sun on 31 July 1997 at 16h45E in position 38º 20' S 079º 20' E?

[12]

QUESTION 8

On 1 August 1997 in DR position 35º 40' S 042º 28' W, the lower limb of the sun was observed at meridian passage, to the north of the observer, with a sextant altitude of 36º 21,2'.

Index error of the sextant	3,2' off the arc
Height of eye	9 metres

8.1 Determine:

8.1.1 the GMT and zone time of meridian passage of the sun. (6)

8.1.2 the latitude of the observer at meridian passage. (12)

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

8.2.1 the observer's zenith position (Z) (1)

8.2.2 the elevated pole (P) (1)

8.2.3 the celestial equator (1)

8.2.4 the declination of the sun (1)

8.2.5 the position of the sun (X) (1)

[23]

QUESTION 9

9.1 In the Southern hemisphere, during which months of the year do

9.1.1 the longest day; and (1)

9.1.2 the longest night occur? (1)

9.2 What three errors of the sextant altitude of the sun are corrected by the Total Correction? (3)

[5]

50 marks

Total: 150 marks