NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2023

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. 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 22° 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.

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 39, 1987 February 12, 13, 14
5. Increments and Corrections 18^m & 19^m
6. Increments and Corrections 20^m & 21^m
7. Increments and Corrections 30^m & 31^m
8. Increments and Corrections 32^m & 33^m

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SECTION A PRACTICAL CHARTWORK

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

QUESTION 1

At 09:30 a GPS fix gave the following position of the vessel:
Lat. 34° 20'S Long. 018° 15'E.
Speed through the water is 15 knots.
Current is estimated to set 100° (T) at 2,0 knots.
The estimated leeway is 5° due to a NW'ly wind.
The magnetic variation is 23°W.

1.1 What is the compass course to steer to the next waypoint
Lat. 34° 01'S Long. 018° 15'E
entering the traffic zone approaching Table Bay? (13)

1.2 Lay off the courses on the chart from this last waypoint to the Pilot rendezvous position north of Green Point Lt. (Fl 10s. 20m 25M) (4)

1.3 What is the ETA at the Pilot rendezvous position if the average speed is 12 knots? (3)

[20]

QUESTION 2

A vessel at anchor off Smitswinkelbaai observes the horizontal sextant angles between

- Simonsberg ∆ 546 and Paulsberg ∆ 366 is 65°
- Cape Point Fl(2+1) 30s 87m 32M and Paulsberg ∆366 is 55°.

Plot the position of the vessel.

[20]

QUESTION 3

At 15:00 a vessel steering 092° (C) observed Cape Point light bearing 042° (C).

At 15:30 Cape Point light was bearing 352° (C).

The vessel maintained a speed of 8,0 knots, and the current was known to be setting 290° (T) at 1,8 knots.

What is the latitude and longitude position of the vessel at 15:30?

[16]

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QUESTION 4

If the height of a tower is 250 meters and the vertical sextant angle measured 2° 20', find the range of the tower in nautical miles.

[4]

QUESTION 5

5.1 A vessel with a draught of 8,3 m is anchored at a place where the height of tide is 4,5 m and a sounding obtained by hand lead line indicated 19,0 m depth mark.

Find the under keel clearance (UKC) when the height of low tide will be 0,7 m. (5)

5.2 Illustrate your calculation with a detailed sketch. (10)

[15]

QUESTION 6

The following questions relate to the Chart SAM 3002.

6.1 What is the warning about "Crayfish Trap Fishing" between Green Point and Cape Point given on the chart? (10)

6.2 What is the meaning of the abbreviation "Obsc" shown on the chart south of Slangkop? (3)

6.3 Describe the characteristics of Robben Island light. (6)

6.4 What is the scale of Chart SAN 3002? (2)

6.5 Which is the safe side to pass Whittle Rock in Valsbaai? (4)

[25]

100 marks

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SECTION B ASTRO-NAVIGATION

QUESTION 7

On 13 February 1987 in DR position 31° 06'S 013° 35'E, the lower limb of the sun was observed at meridian passage to the north of the observer at a sextant altitude of 72° 23,0'.

Index error was 1,2' OFF the arc.
Height of eye was 10,8 metres

7.1 Determine the following:

The GMT and zone time of meridian passage. (6)

7.2 What is the vessel's latitude at Meridian Passage? (14)

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

- the celestial equator;
- the sun's declination;
- the zenith position (Z);
- the position of the sun (X);
- the elevated pole (P). (5)

[25]

QUESTION 8

At 08:30 local ship's time on 12 February 1987, in DR position Lat. 27°S Long. 044° 20'E, the officer of the watch observed the sun bearing 083° (C) when the ship's head was 250° (C).

8.1 What was the true heading of the ship at that time? (20)

8.2 If the magnetic variation for this region was 19°E, what was the compass deviation? (5)

[25]

50 marks

Total: 150 marks

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