2 A ship floats on the sea.

upthrust

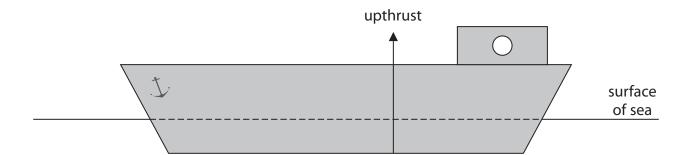surface of sea

(a) The ship floats because of the forces acting on it.

(i) The upward force acting on the ship is called upthrust.

This force is shown on the diagram.

Draw another labelled arrow on the diagram to show the other vertical force acting on the ship.

(2)

(ii) Forces are vector quantities.

State what is meant by the term **vector quantity**.

(2)

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(iii) Give another example of a vector quantity.

(1)

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(b) The upthrust force acting on the ship is proportional to the pressure difference between the bottom of the ship and the surface of the sea.

The pressure acting on the ship at the surface of the sea is 100 kPa.

(i) State the formula linking pressure difference, height, density and gravitational field strength (*g*).

(1)

(ii) The bottom of the ship is 15.8 m below the surface of the sea.

Show that the pressure acting on the bottom of the ship is approximately 260 kPa.

[density of seawater = 1030 kg/m³]

(3)

(iii) Explain why the bottom of the ship is deeper below the surface of the sea when the ship is fully loaded with cargo.

(2)

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(Total for Question 2 = 11 marks)