READING PASSAGE 1

You should spend about 20 minutes on **Questions 1-13**, which are based on Reading Passage 1 on pages 2 and 3

Steam across the water

A look at the early history of boats powered by steam

During the 1600s, very early in the development of steam engines, inventive spirits like the Frenchman Denis Papin dreamed of – and experimented with – boats driven by steam, rather than by the wind or human effort, but many decades passed before those visions became reality.

Englishman Jonathan Hulls took out patents on a steamboat in 1736, but it was to be driven by a Newcomen engine, which was heavy and therefore inefficient, and would never be a success. In 1763, William Henry, an American. put a Watt steam engine in a boat, but it sank. Nearly 20 years later, in the 1780s, a steam-powered paddle-wheeler managed to last fifteen minutes against the current on the River Saone in France, but lacked the endurance for longer trips. Developments elsewhere included a boat driven by a steam-powered water-jet and able to do six kilometres per hour. However, all these steamboats were either too slow or too expensive to run. For example, American John Fitch successfully trialled his first steamboat in 1787, but although he tried a number of designs and solved many technical challenges – one of his boats could even travel at 13 km/h – he could never convince sceptics that steamboats would pay.

The 19th century came before real success could be claimed. In Scotland in 1802, Lord Dundas launched the steamboat *Charlotte Dundas*, which was driven by a paddle wheel and had an improved engine designed by William Symington. Barges, some weighing as much as 70 tonnes. were towed by this steamboat 30 kilometres along the Forth and Clyde Canal to Glasgow, Scotland's second city. Soon after, success came to American Robert Fulton, whose countrymen called him 'the father of the steamboat'. Inspired by news of the *Charlotte Dundas*, Fulton ran steamboat trials on the River Seine, in an attempt to attract French support for his submarine *Nautilus*. He later imported a Boulton-Watt steam engine and built a boat to use it in. In 1807, the *Clermont* began a scheduled passenger steamboat service between New York and Albany, 250 kilometres up the Hudson River, taking 30 hours for the trip. Within few years, steamers were running on the St Lawrence River in Canada and would soon appear on other rivers and lakes, including the Mississippi River, a most famous venue for the paddle-wheelers.

Back in Scotland, Fulton's ideas inspired Henry Bell, who launched his *Comet* in 1812 on the Clyde between Glasgow and Greenock. Inside a decade, dozens of steamboats were to be seen on the rivers, lochs and canals of Scotland, carrying cargo and occasionally passengers. The age of steamboats had come.

Once steamboats were carrying passengers and industrial goods along the inland waterways and sheltered coastlines of Europe, North America and elsewhere, the challenge became to send steamboats onto the open ocean, such as across the Atlantic

Ocean, between Europe and the US. Travelling under steam power alone would require engines to use less coal so the ship could stay at sea for several weeks. In order to provide a reliable service, it was also necessary to replace paddle wheels as a source of power with something less affected by the rolling of the ship.

Without waiting for such breakthroughs, crossings under a combination of steam and sail got underway in 1819 with the American ship *Savannah*. A regular service took another two decades and introduced the famous name of Cunard. Securing the British government contract for the mail service across the Atlantic, Samuel Cunard established a shipping line in 1840, soon carrying passengers as well, and offering guaranteed sailing dates. Cunard's first ships used a sail-steam combination, but the era of the passenger liner, using steam alone, was getting close.

When it came to building the ships, the versatile British engineer Isambard Kingdom Brunel set the pace. Brunel, brilliant and daring, had already built the Great Western Railway. He created ever bigger ships – ~~faster,~~ more luxurious and comfortable for passengers. The *Great Western*, launched in 1838, was 70 metres long and crossed from Bristol to New York in just fifteen days. The largest paddle steamer ever built was Brunel's *Great Eastern*. Ultimately too expensive to run as a passenger ship, it was leased to lay the first submarine telegraph cable from Europe to America. His 1853 Great Britain, nearly 100 metres long and luxuriously appointed, was the first ocean-going steamship made of iron, and the first to use the underwater screw propeller for powering movement in place of paddle wheels. The idea of the screw had been around since the experiments of the American John Stevens in ~~1803,~~ but only in 1838 did a large steamer use one, the riverboat *Archimedes* built by Francis Pettit Smith. Later ships had twin screws for reliability.

In many modem ships, steam turbines have replaced engines with pistons, with fuel oil instead of coal to fire the boilers. Diesel engines keep others moving. The largest ships afloat now would dwarf Brunel's *Great Eastern* (launched in 1860); the Atlantic can be crossed in only four days. But in whatever form, the ever-evolving descendants of the original visions of Denis Papin and Robert Fulton continue to travel the seas in vast numbers.

Questions 1 – 6

Complete the table below.

Choose **ONE WORD ONLY** from the passage for each answer.

Write your answers in boxes 1-6 on your answer sheet.

Date	Event
1600s	• Early inventors like Papin started to develop boats that relied on steam instead of manpower or wind.
1730s	• The engine of Jonathan Hulls' steamboat was **1** …**inefficient**… due to its weight. **=heavy**
1780s	• A French paddle steamer did not have the **2** …**endurance**… to keep going for more than a quarter of an hour. **=lacked** • John Fitch overcame a number of **3** …**technical**… problems with his steamboat designs. **=challenges**
Early 1800s	• The Charlotte Dundas pulled barges to Glasgow. • In France, Fulton used a steamboat to try to raise interest in a **4** …**submarine**… . **=in an attempt** **=attract support** • Passengers in the US began to be carried regularly by a steamboat called the **5** …**Claremont**… **=scheduled**
1812 onwards	• In Scotland, steamboats transported some passengers, but mostly **6** …**cargo**……..

Questions 7 – 13

Do the following statements agree with the information given in Reading Passage 1?

In boxes 7-13 on your answer sheet, write

TRUE	*if the statement agrees with the information*
FALSE	*if the statement contradicts the information*
NOT GIVEN	*if there is no information on this*

=use less coal

7 For steamboats to cross the Atlantic Ocean, engines which used fuel economically were needed. **TRUE**

=reliable

8 Using paddle wheels guaranteed reliability on ocean crossings. **FALSE**

9 The Savannah was much faster than a regular paddle steamer. **NOT GIVEN**

10 Brunel preferred designing railways to steamships. **NOT GIVEN**

1 iron

11 The Great Britain had more than one innovative feature. **TRUE** **2 underwater screw propeller**

12 The design of the riverboat Archimedes was widely admired. **NOT GIVEN**

13 Modern ships that cross the Atlantic use the same energy source as the early steamships. **FALSE**