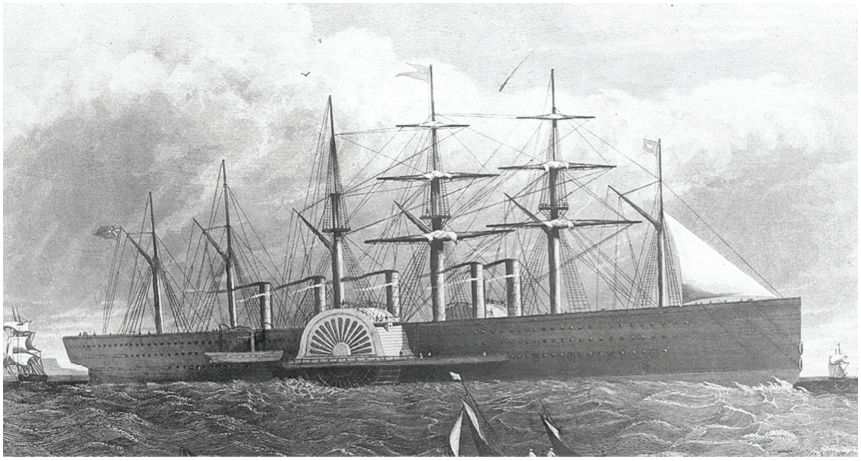
ST PAUL'S
GIRLS' SCHOOL

Name: _____ Group: _____

Comprehension Paper – Ships and shipping

1 hour 15 minutes



This paper is all about ships and shipping. You will consider major developments and changes within this area, and also examine the odd disaster. It also looks at the way in which people on boats have communicated with each other and those on the shore. As an island country, Britain has long had an extraordinary reputation for its navy and huge technological advances in shipbuilding. Over the course of the nineteenth century two important changes took place. The use of sail was gradually replaced by steam power; and iron and steel were used increasingly, instead of wood, in the construction of ships. The SS Great Britain was a revolutionary steam ship designed by the famous engineer Isambard Kingdom Brunel launched at Bristol on 19th July 1843. She was the largest ship afloat and the first modern iron hulled ocean going propeller-driven ship.

There are three sections, all of which must be attempted. You should answer the questions in this booklet. You will need the separate Answer Sheet A for Section A and the supplementary booklet for Section B.

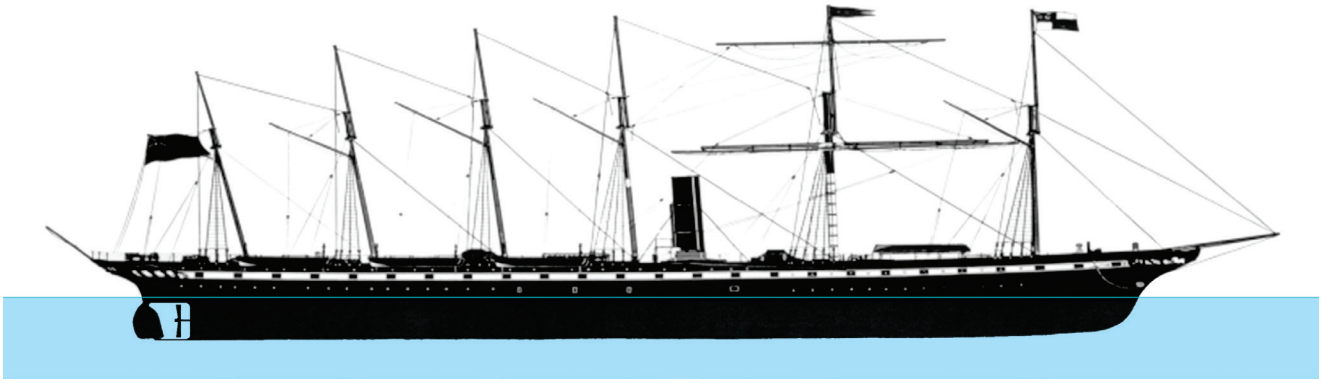
You should spend about **25 minutes** on each section. You will be told when to move on by the invigilator and **you must do so**. **It does not matter if you do not finish every section; it matters more that you have had a go at each one. If you finish a section early you may move on to later sections. You may go back to other questions at the end.**

Write all your answers, including any working out or rough work, in the booklet. If you want to highlight any details please do so.

You will need a pencil, a pen, a ruler and a rubber. You can write in either pencil or pen.

Section A

The SS Great Britain



Read the text below then answer the questions which follow:

The engine room of the SS Great Britain would have been an awe-inspiring sight - loud, filthy and monstrous. It was dominated by the three storey high steam engine of 340 tons which produced 1,000 horsepower.

Here is a description of how the ship's engine drove the screw propeller to make the ship move through the water

The boiler turned the salt water into steam which is then pushed through a pipe into the **cylinder engines**, pushing its pistons up. The four cylinder engines were set low in the hull and arranged in a V-formation at thirty three degrees to the vertical. They pushed the **connecting rods** upwards which were attached to the **crankshaft** via an eccentric wheel. The crankshaft turned a driving wheel situated between the cylinder engines. The **driving wheel** used a broad **chain** to turn the smaller **gear wheel** situated below it. As the gear wheel revolved, the propeller shaft also turned along with the attached propeller. As the engine turned the crankshaft at 18 rpm, the propeller shaft, with the screw propeller, turned at 53 rpm propelling the ship at 12 knots.

A reconstruction of the original SS Great Britain screw propeller

Questions

Use Answer Sheet A which shows Fig. 1 and Fig. 2 for these questions.

1a Name the parts of the engine labelled on the cross section diagram in Fig. 1 using the words in bold text in the passage on the previous page. One has been done for you. [5]

b Fig. 2 shows the engine in side view. Which part (labelled A, B, C, D or E) shows [3]

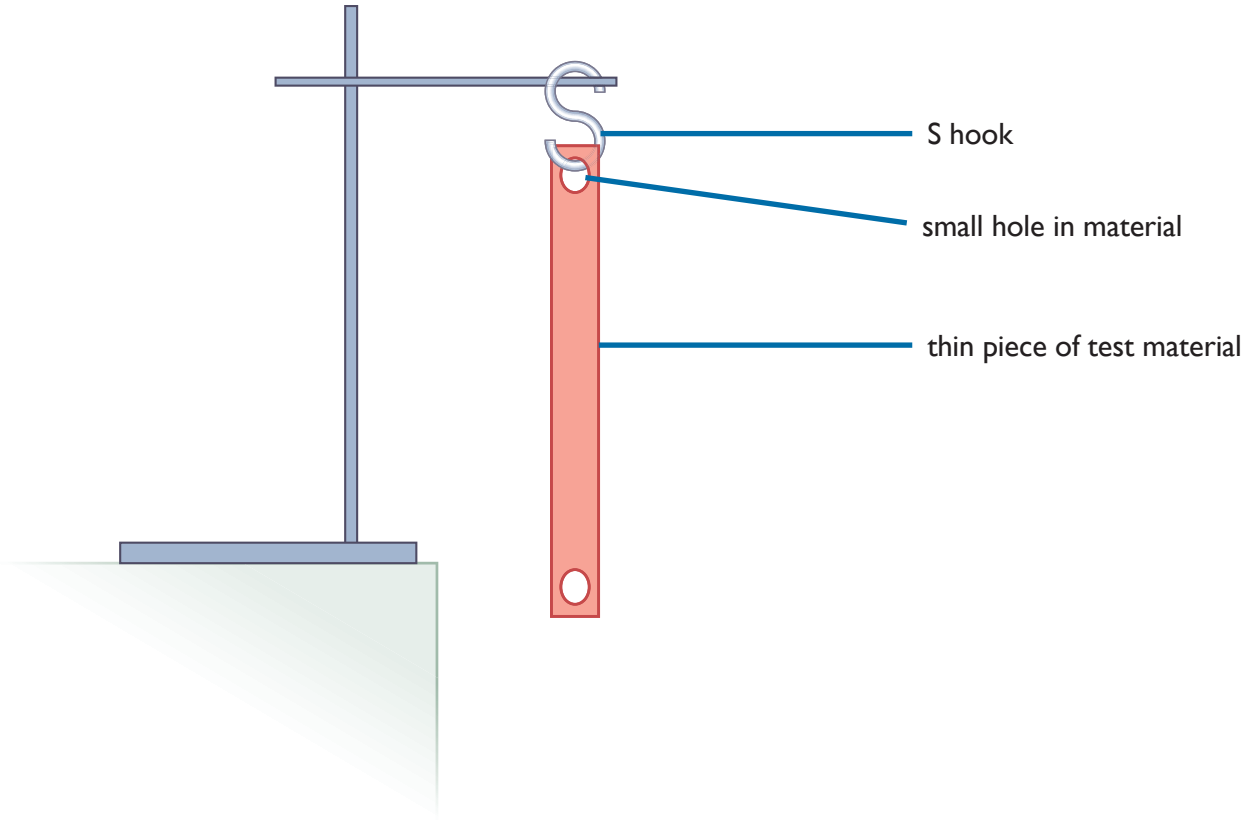
i The chain _____

ii The connecting rod _____

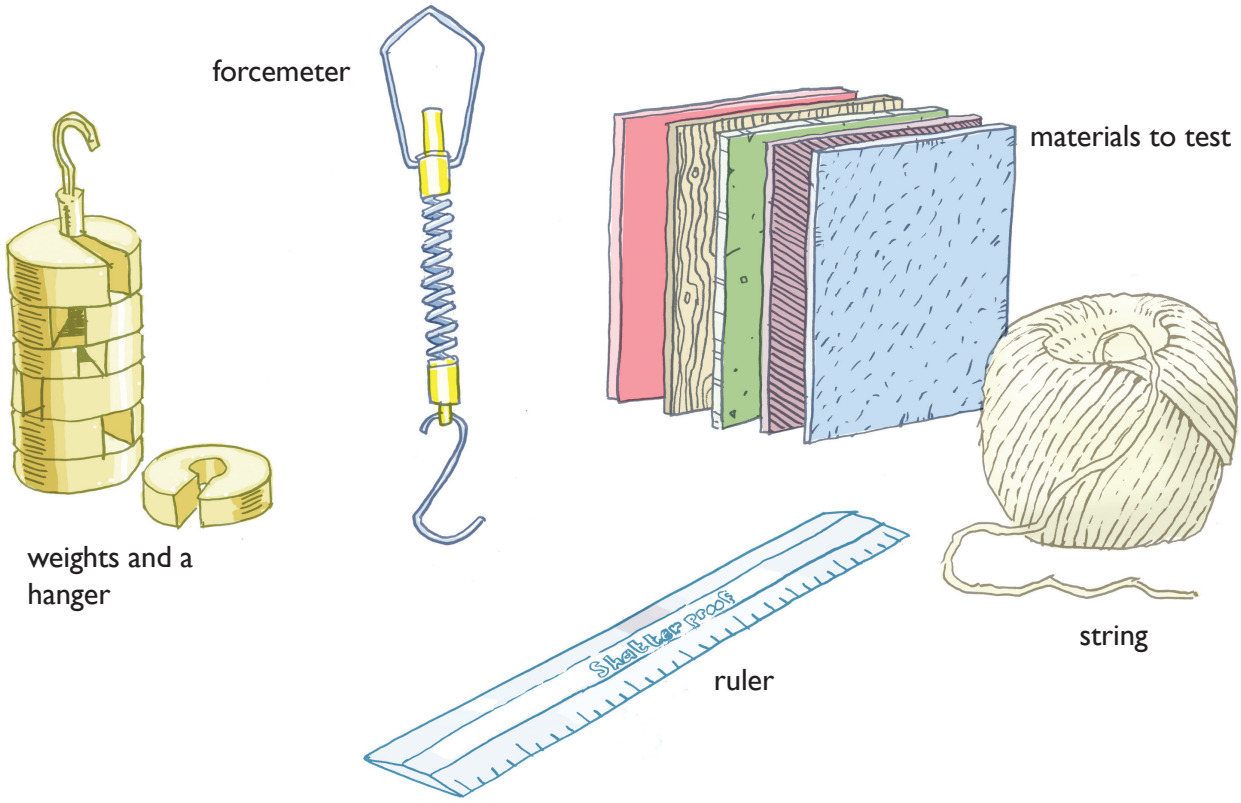
iii The crankshaft _____

c On Fig. 2 indicate the position of the propeller shaft using a new label line [1]

2 Brunel chose iron as the material for the hull of the SS Great Britain rather than wood because of its strength. The hull of a ship needs to be strong in tension which means being stretched without breaking. The diagram shows how to set up apparatus to test the tensile strength of a material.



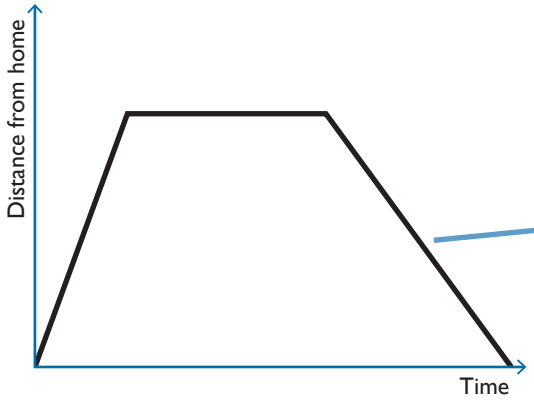
Design an experiment to investigate the tensile strength of different materials using the apparatus shown in the diagram on the previous page. You can use some or all of the items shown below as well.



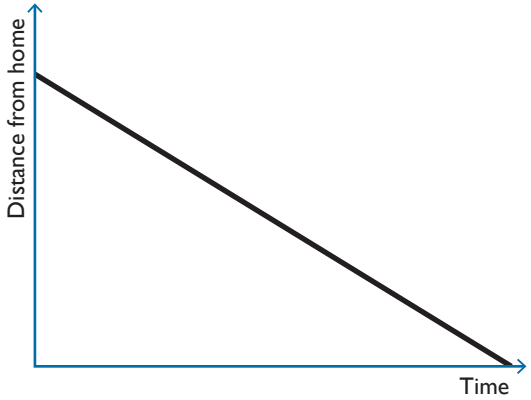
- Describe step by step how you will carry out your experiment. Make sure you include details of any measurements you will make and how this will be done.
- You should describe how you will make the experiment a fair test to collect reliable results and explain why this is necessary. [6]

3 Distance time graphs can be used to represent a journey in a visual form. They show the distance from the starting point and the time taken to complete each part of a journey.

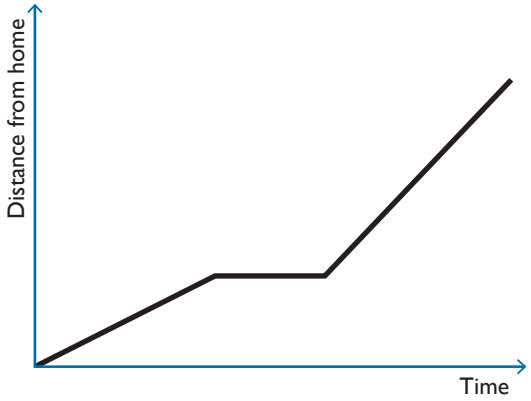
a Match up the distance time graphs to the descriptions by drawing a line to connect them. The first one has been done for you. [2]



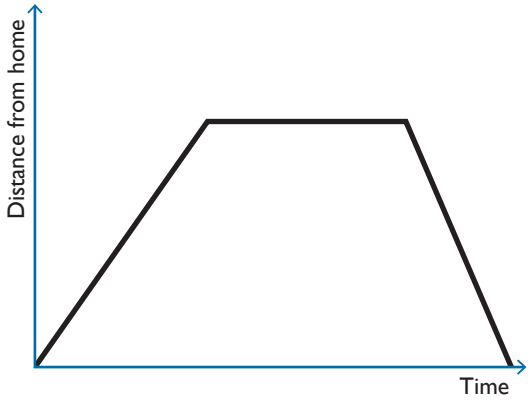
Tom ran from home to the bus stop and waited. He had missed the bus so he walked home.



Tom walked slowly along the road, stopped to look at his watch then started running.

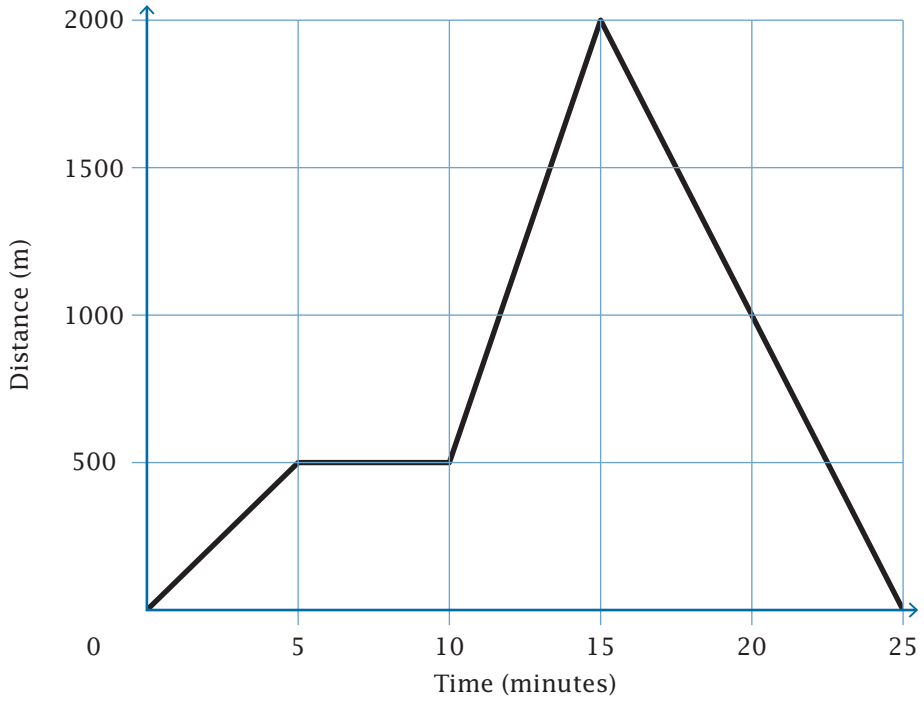


Tom walked to the shop, bought a newspaper, then ran all the way home.



After the party, Tom walked slowly all the way home.

b The graph below shows a bicycle journey made by Sam one Sunday morning.



Describe the journey **in as much detail as you can** using the information in the graph. [5]

c Here is an extract from the captain's diary which describes the progress made by the SS Great Britain during a return crossing between Liverpool and New York in 1845. Use this to plot a distance time graph on the graph paper provided. Use the calendar and the blank space to help you work out the points to plot. [8]

The graph paper for this question can be found on Answer Sheet A.

25th July 9am:
Left Liverpool at 9am under steam at a good speed.

31st July 9am:
Maintaining a steady speed. Travelled 950 miles so far.

2nd August 9am:
Full steam ahead! Have travelled 850 miles since my last entry already.

6th August 10am:
Arrived in New York an hour ago having covered a satisfying 1700 miles in four days.

25th August 10pm:
Tomorrow we embark on the return journey very early at morning dawn. The forecast is for inclement conditions at sea so we will set off slowly and cautiously.

1st September 6am:
Slow progress since we left New York but all is well on board. We are just 500 miles away from that fair city but the winds have dropped at last and the sea is calm now.

9th September 5am: *Conditions indeed improved enabling us to cruise steadily across almost 3000 miles since my last entry. I expect we should be docking in Liverpool at day break in just about an hour's time.*

July 1845						
S	M	Tu	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August 1845						
S	M	Tu	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September 1845						
S	M	Tu	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Section B

The Titanic

This set of questions is about one of the most famous shipping disasters, the sinking of the *Titanic*, a ship said to be "unsinkable". Read the text below and answer the questions which follow:

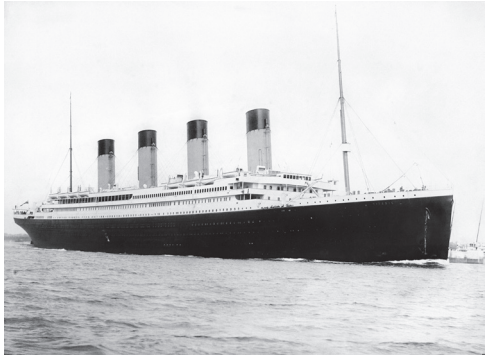
As you know, the development of iron steamships is particularly associated with the engineer, Isambard Kingdom Brunel in Bristol but large scale shipbuilding also developed in Belfast where Harland and Wolff specialised in building trans-Atlantic liners. The most famous ship built by this company was the *Titanic*. It was an extraordinary ship. It was more than three football pitches long, weighed 46,000 tons and was taller than a 17-storey building. It had four cream and black funnels. Its hull was made from sixteen watertight compartments, which its owners claimed made it 'practically unsinkable'. It was also widely tipped to be able to beat the transatlantic speed record. There were several different classes of ticket, ranging from first class tickets which cost £870 (about £27,000 in today's money) to £3 third class tickets, which would be about £95 in today's money.

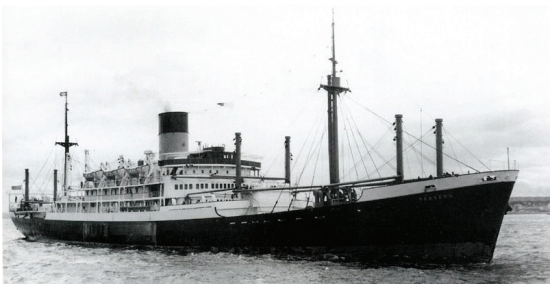
Four days into its maiden voyage on 14 April 1912 the *Titanic* moved into the freezing waters in the middle of the Atlantic. Just before midnight, one of the lookouts spotted the outline of an iceberg 'dead ahead'. Despite desperately turning to avoid it and putting the engines in full reverse, the *Titanic* struck the iceberg at speed and was holed below the waterline. Five of the watertight compartments had been gashed open and water flooded in. The ship could only stay afloat with four compartments filled with water and, less than three hours later, *Titanic* sank beneath the waves. The order went out for women and children to get into the lifeboats first, but of the 2206 people on board, only 704 were rescued.

Questions

1 Which image do you think is the *Titanic*? Tick the correct box [1]

A ☐ B ☐ C ☐





2 Study the casualty figures below and answer the questions which follow:

FIRST CLASS

	On board	Rescued	% Rescued
Men	173	58	34
Women	144	139	97
Children	5	5	100
TOTAL	**322**	**202**	**63**

SECOND CLASS

	On board	Rescued	% Rescued
Men	160	13	8
Women	93	78	84
Children	24	24	100
TOTAL	**277**	**115**	**42**

THIRD CLASS

	On board	Rescued	% Rescued
Men	454	55	12
Women	179	98	55
Children	76	23	30
TOTAL	**709**	**176**	**25**

TOTAL PASSENGERS AND CREW

	On board	Rescued	% Rescued
Men	1662	315	19
Women	439	338	77
Children	105	51	49
TOTAL	**2206**	**704**	**32**

a What percentage of women were rescued? [1]

b What was the percentage point difference between the number of children rescued in second and third classes? [1]

c Do you think the order for women and children to get onto the lifeboats first was followed? Explain your answer carefully. [5]

d Does the evidence of these charts shed light on attitudes to richer and poorer people in the early twentieth century? Explain your answer. [5]

Who was to blame?

Study the five text boxes in the supplementary booklet which each consider who might have been to blame for the *Titanic* disaster and answer the questions which follow.

3. Study the evidence and then consider the statements below and decide if they are true (T), false (F) or you can't tell (C). Circle your answer. [6]

a Captain Smith wanted to set a transatlantic speed record on his last ever trip. T F C

b The wreck of the *Titanic* was discovered in 1958. T F C

c There were not enough lifeboats for 1028 passengers. T F C

d The radio operators on the Californian were woken at midnight. T F C

e The rivets on the *Titanic* were made of iron. T F C

f The top speed of the *Titanic* was 20 knots an hour. T F C

4. Read the following which is from an interview with Captain Smith. This is what he said in 1910.

When someone asks me to describe my career at sea, I just say – uneventful. Of course there have been winter gales, storms and fog, but in all my years, I have never been in an accident. I've only seen one ship in trouble in all my years at sea. I've never seen a wreck, have never been wrecked, and I have never been in a situation that threatened to end in disaster.

Does this piece of evidence add to the argument that Captain Smith was to blame for the *Titanic* disaster? Or is it irrelevant? Explain your answer carefully. [5]

5. Who do you think was most to blame for the sinking of the *Titanic*? Explain your answer carefully. [6]

Section C

Semaphore signalling

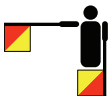
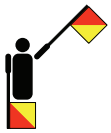
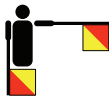
This method of signalling is an old favourite of the Navy because it is the fastest way of sending messages by flags and is even faster than flashing light. It can be used only in the daytime and at distances of less than 2 miles. It is even more secure than light signalling because there is less chance of interception by an enemy.

The NATO sending speed for Naval Communicators is 15 words per minute but it is rarely used as a means of official communication. Semaphore is most often used while taking on supplies at sea or as an unofficial method to converse with another ship.

Semaphore requires little equipment - just hand flags either 15 or 18 inches square. Letters and numerals are formed by placing two flags at certain angles to each other. Each flag is held so that the stick is a continuation of the signaller's forearm. The arms need to be kept stiff.

Questions

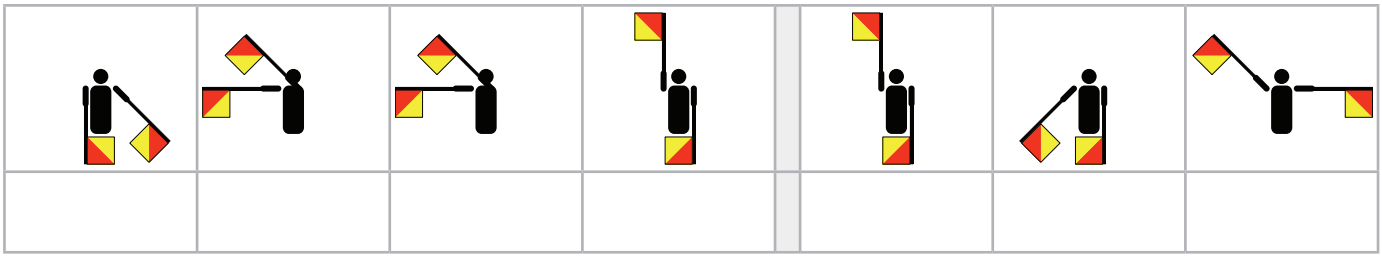
1 The first seven letters of the alphabet are produced below. How would you describe each **asterisked** position in order to help you learn the signals? [6]

Signal	Letter	Position of left hand, position of right hand **from the point of view of the observer**
	A	
	B	*
	C	
	D	
	E	*
	F	
	G	*

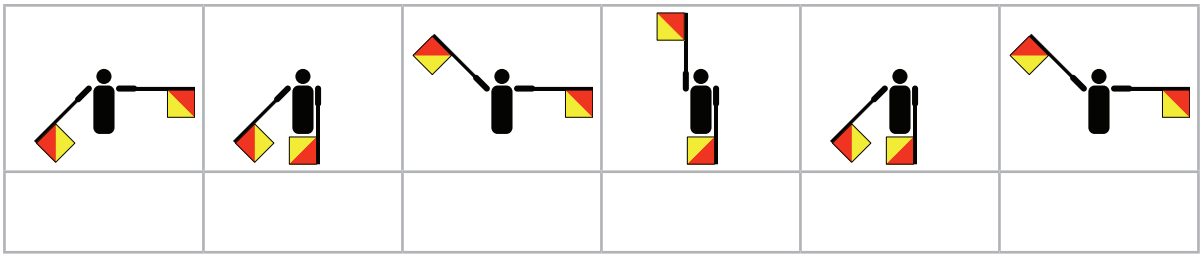
2 Here are some messages that the boats might have sent to each other. What do you think they are saying?

Clue 1: Not all of these words contain only letters A – G! You will need to deduce the others.
Clue 2: Think about what messages boats typically might send to each other! [8]

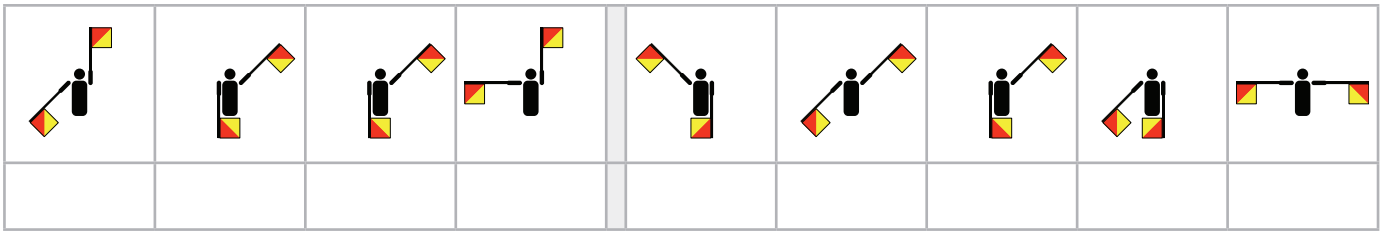
a



b



c

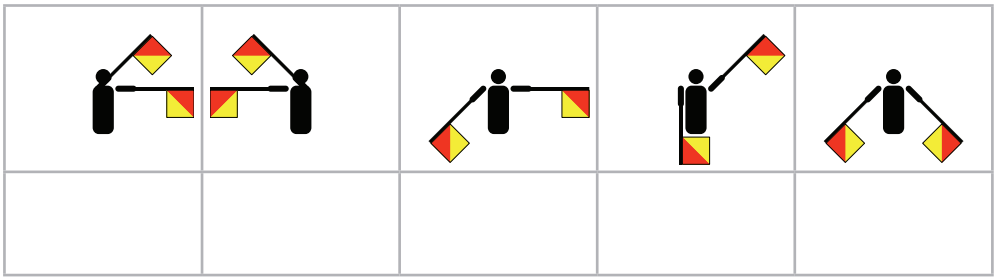


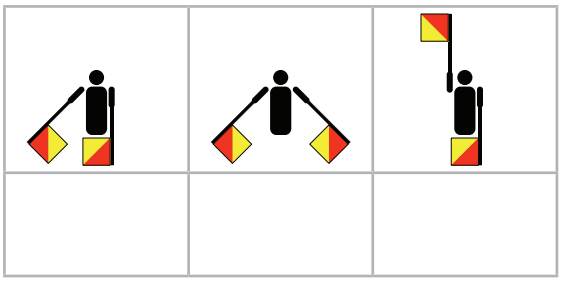
3 Looking back at the new letters you have worked out, can you think of up to three more rules about how semaphore signals are created? [4]

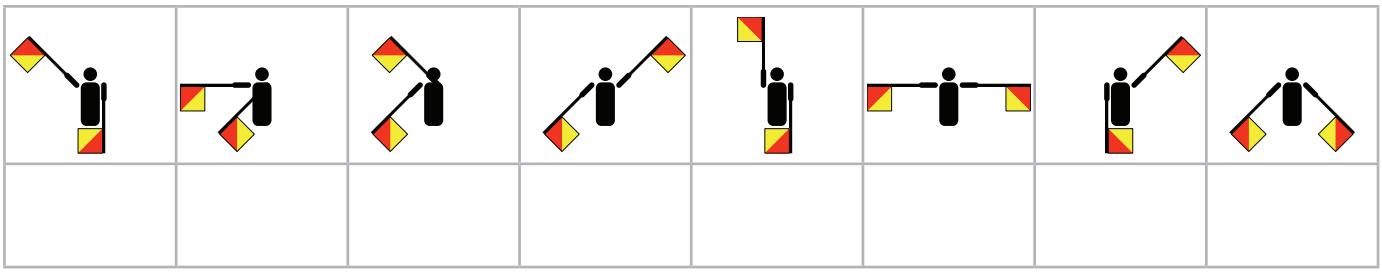
b Why do you think the flags are coloured with a red triangle and a yellow triangle? [2]

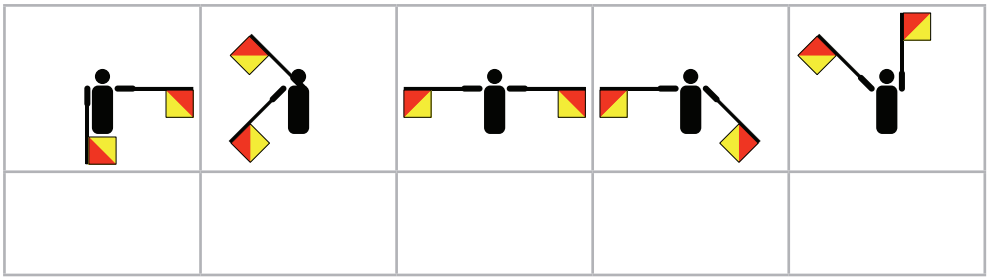
c What might have been some of the issues **apart from the ones mentioned in the opening paragraph** which made semaphore less useful? [4]

4a Now see if you can translate this final message! [3]









b Explain below how you reached your conclusions. [3]

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Comprehension Paper - Answer Sheet A

Please answer question 1a and question 3c from Section A on this answer sheet.

Fig 1 Engine of SS Great Britain in cross section

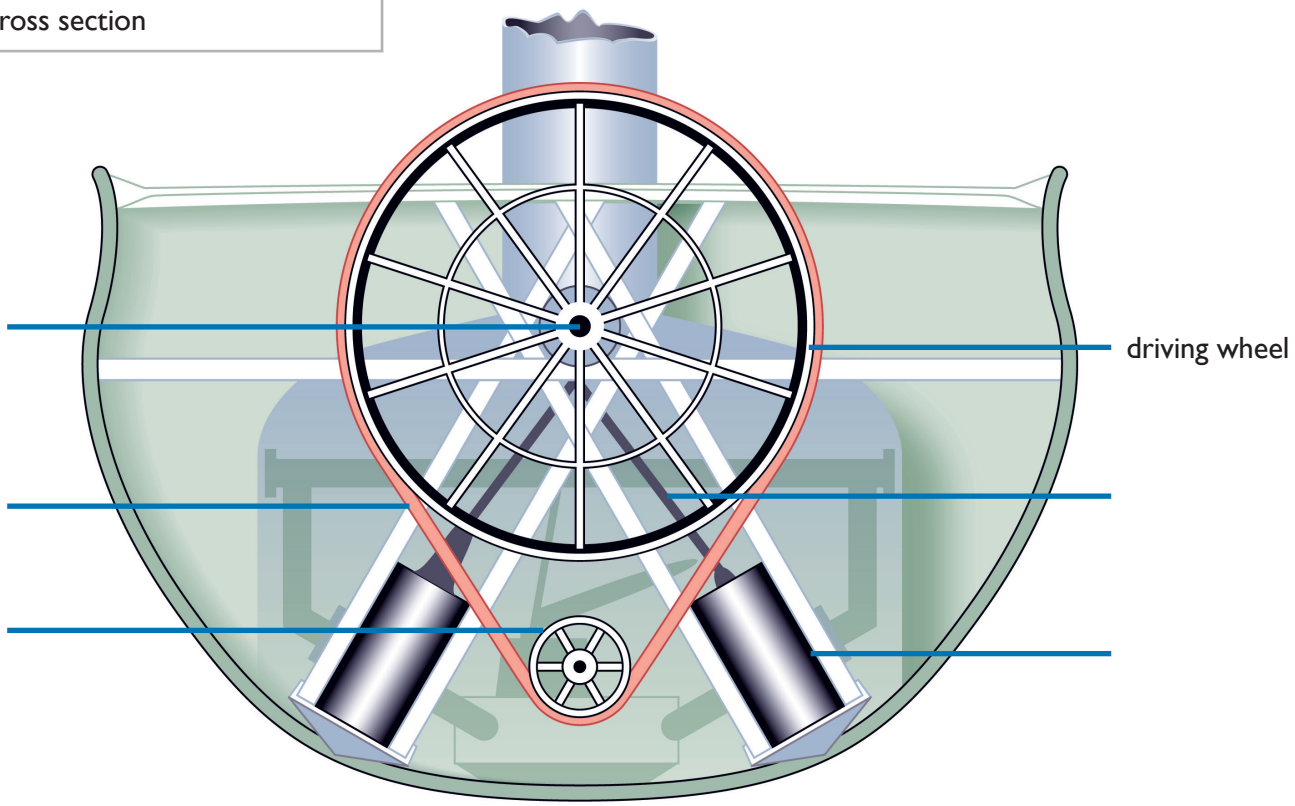
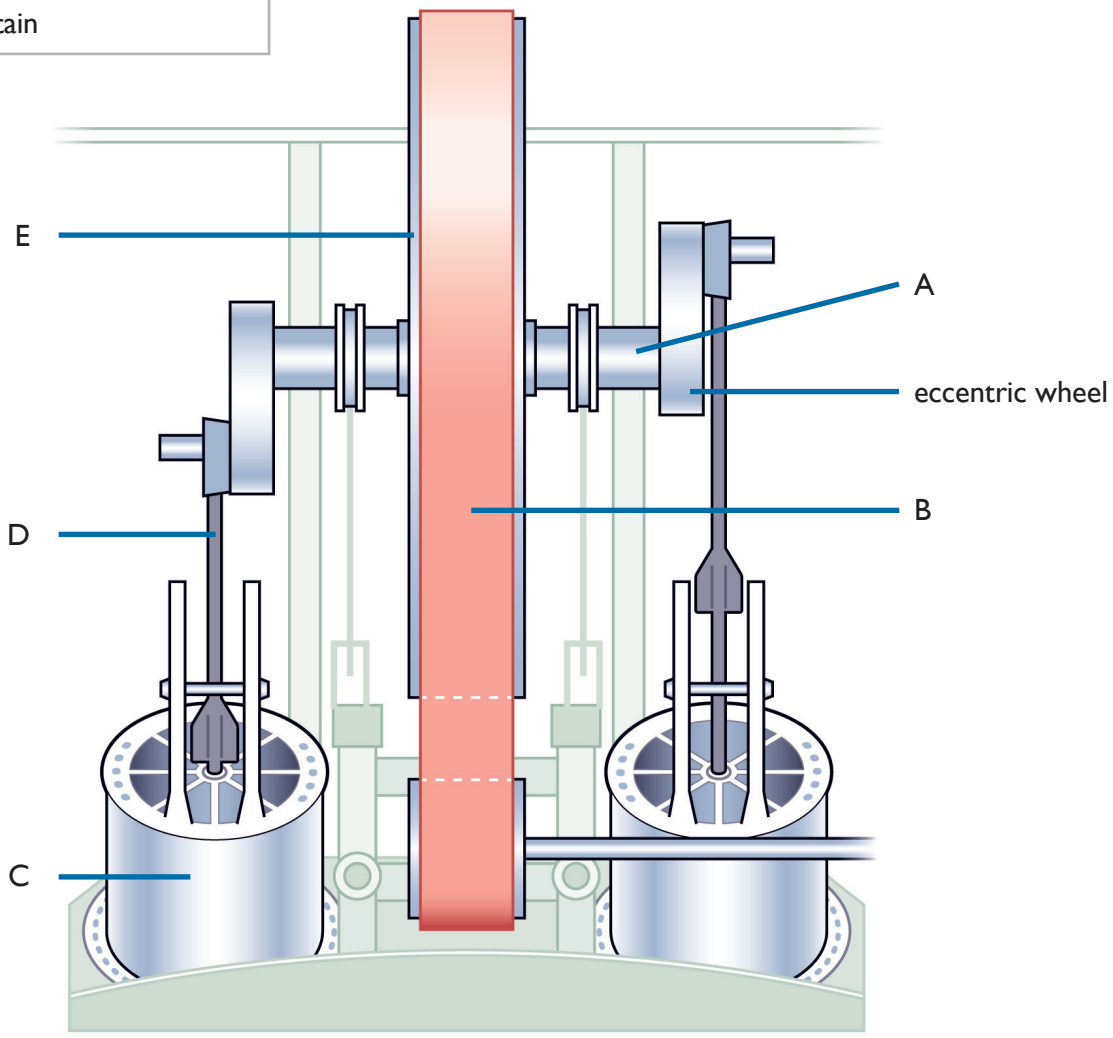
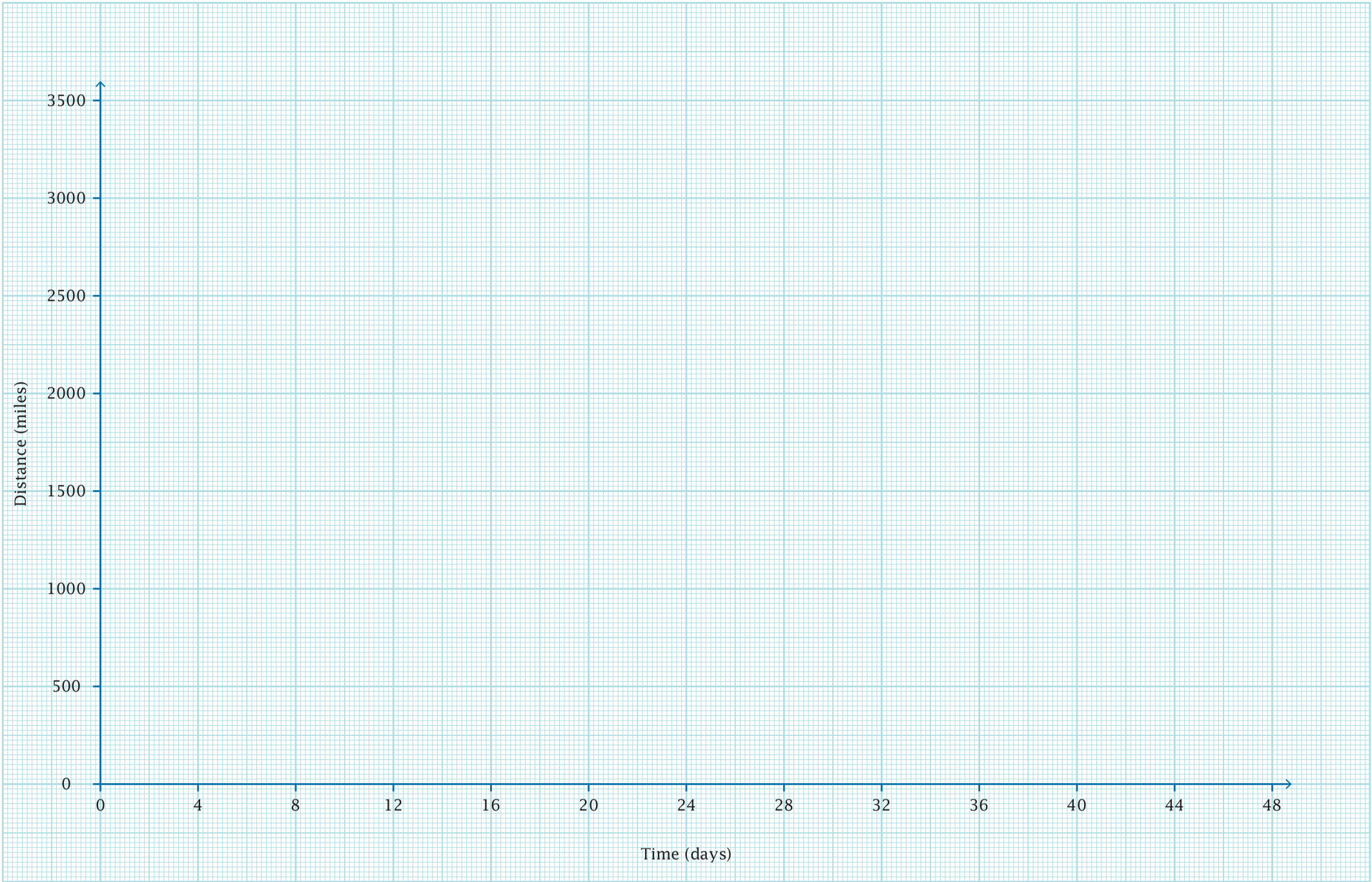


Fig 2 Side view of the engine of SS Great Britain




3500
3000
2500
2000
1500
1000
500
0
Distance (miles)
0
4
8
12
16
20
24
28
32
36
40
44
48
Time (days)

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Comprehension Paper - supplementary booklet

You will need the information in this booklet to help you with Section B.

Read the text boxes carefully. You can highlight, underline or make notes in this booklet.

Section B

The Titanic

Was it Captain Smith's fault?

Captain Smith was due to retire after the *Titanic*'s maiden voyage. Did he want to set a transatlantic speed record on his last ever trip? He ignored at least seven warnings from other ships nearby and the *Titanic* was travelling at 20 knots per hour – close to top speed – when it struck the iceberg. If the ship had been going slower, could it have turned out of the iceberg's way in time? Perhaps Captain Smith thought an iceberg couldn't sink a modern ship. He once said, "I can't imagine anything causing a modern ship to sink. Ship building has gone beyond that".

Was it Harland and Wolff's fault?

The *Titanic* was built at the Harland and Wolff shipyard in Belfast, Northern Ireland. About three million rivets were used to hold the ship together. When the wreck of the *Titanic* was finally discovered in 1985, some of the rivets were brought to the surface and analysed. The investigations showed that the rivets were made from poor-quality iron. When the ship struck the iceberg, the heads of rivets snapped off and sections of the ship were torn wide open. If the rivets had been made of more expensive, higher-quality iron, perhaps the hole in the *Titanic*'s side would have been smaller – and maybe the ship wouldn't have been sunk at all. Further test showed that the cheap rivets became brittle in extremely low temperatures – just like on the night of 14 April 1912.

Was it Thomas Andrew's fault?

Thomas Andrews was the naval architect who designed the *Titanic*. The shop was thought to be unsinkable by many because of the 16 watertight compartments that Thomas had designed in the hull. However, the compartments didn't reach as high as they should have done. Andrews had reduced their height to make more space for first-class cabins. If just two of the watertight compartments had reached all the way to the top, there is a chance that the *Titanic* wouldn't have sunk.

Was it Walter Lord's fault?

Walter Lord was the captain of a ship called the Californian which was only 19 miles away from the *Titanic* when it struck the iceberg. Despite being aware of icebergs in the area, Lord allowed his radio operator to go to bed at around 11.15pm. At around midnight, members of the Californian's crew saw rockets being fired into the sky on the horizon. They woke up Captain Lord and told him, but he decided not to sail towards the fireworks; he decided it was just another ship having a cocktail party! Should Lord have made the Californian race towards the scene? Should he at least have insisted that the radio be turned on so they could have heard the *Titanic*'s SOS signals? How many more people would have survived if the Californian had been there to pull them from the icy waters?

Was it Bruce Ismay's fault?

Bruce Ismay was the man in charge of the White Star Line – the owners of the *Titanic*. He was also one of the first class passengers on board the ship and managed to secure a place on one of the lifeboats before it went down. Ismay was eager to prove the *Titanic* was not only the biggest and most luxurious ocean liner, but also the fastest. Did he put pressure on Captain Smith to maintain top speed despite sailing through icebergs? Was he hoping that the Titianic would make a record crossing? One witness claimed she heard Ismay and Smith arguing on the evening of 13 April – was it over the speed? Also, was Ismay responsible for more deaths than there should have been? The original design for the *Titanic* equipped it with 32 lifeboats – enough for everyone on board. The finished ship only had 20 – enough for just 1178 of the 2206 people on board. The White Star Line decided to remove some the lifeboats to make room for more first-class cabins.