**Q1.**

The diagram shows an adult and a child pushing a loaded shopping trolley.



(a)     (i)      What is the *total force* on the trolley due to the adult and child?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Which **one** of the terms in the box means the same as *total force*?

         Draw a ring around your answer.

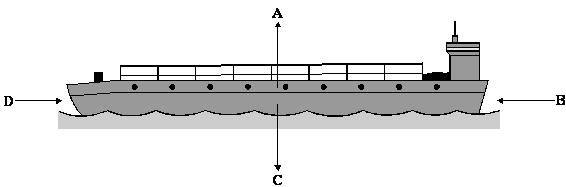
|  |
| --- |
| **answer force**          **mean force**        **resultant force** |

**(1)**

**(Total 2 marks)**

**Q2.**

Four of the forces that act on this container ship are shown in the diagram as **A, B, C** and **D**.



Complete each sentence by choosing the correct letters, **A, B, C** or **D**.

The first one has been done for you.

At the start, the ship is not moving because forces **B** and **D** are balanced.

The ship begins to move forward when forces \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ are unbalanced.

When the ship is moving at a steady speed, forces \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ are balanced.

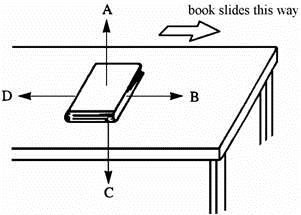
The ship stops at a port. All of the containers are taken off and this changes

force \_\_\_\_\_\_\_ .

**(Total 3 marks)**

**Q3.**

When you slide a book across a table, there is a force of friction between the book and the table.



(a)     Which arrow shows the force of friction that acts on the book? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The force of friction will slow the book down.  
Write down **one** other effect that the force of friction will have on the book.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

**(Total 2 marks)**

**Q4.**

(a)     The diagram shows the horizontal forces acting on a swimmer.



(i)      The swimmer is moving at constant speed.  
Force **T** is 120 N.

What is the size of force **D**?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

**(1)**

(ii)     By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Initial resultant force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

**(1)**

(iii)    Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

**(Total 5 marks)**

Mark schemes

**Q1.**

(a)     (i)      50 (N)

*ignore any units*

**1**

(ii)     resultant force

**1**

(iii)     4000

*accept their (a)(i) × 80 correctly calculated for* ***2*** *marks*

*allow* ***1*** *mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80*

*ignore any units*

**2**

(b)     (i)      joule

**1**

(ii)     heat

**1**

**[6]**

**Q2.**

**B** and **D** (either order)

**1**

**B** and **D** (either order)

*accept* ***A*** *and* ***C***

**1**

**A** or **C**

**1**

**[3]**

**Q3.**

(a)     D

*for 1 mark*

**1**

(b)           wear it away **or** make it warmer

*for 1 mark do not accept ‘stops it’*

**1**

**[2]**

**Q4.**

(a)     (i)     120

**1**

(ii)     20

*accept 140–their (a)(i) provided answer is not negative*

**1**

(iii)    as speed increases

**1**

drag force / water resistance / friction / **D** increases

**1**

(until) **D** = 140 N or (until) **D** = **T**

*forces balance is insufficient*

**1**

(b)     (i)      (average) speed (of swimmer)

**1**

(ii)     any **two** from:

•    more data

*accept results for data*

*do* ***not*** *accept more accurate data*

•    force may vary (a lot) / change

•    give more reliable average

*ignore references to anomalies*

*ignore accurate / precise*

**2**

(iii)    examples of acceptable responses:

•    most / some females produce smaller forces

*do* ***not*** *accept all females produce smaller forces*

•    most / some males produce larger forces

*do* ***not*** *accept all males produce larger forces*

•    some females swim as fast as males but use a smaller force

•    most of the faster swimmers are male

*do* ***not*** *accept all males swim faster*

•    most of the slower swimmers are female

*do* ***not*** *accept all females swim slower*

•    range of the (average) speed of males is smaller than the  
     range of the (average) speed of females

•    range of the (average) force of the males is greater than the  
     range of the (average) force of the females

**1**

(iv)     exert maximum (hand) force (throughout the swim / stroke)

*accept (any method to) increase (hand) force*

*practise more is insufficient*

**1**

**[10]**