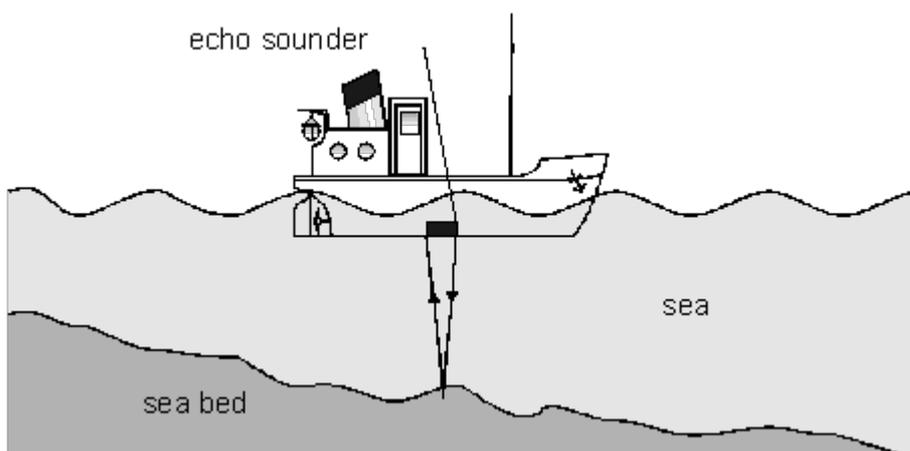


Q1. The diagram shows a boat using an echo sounder. It sends a pulse of sound waves which is reflected from the sea bottom. The reflected sound waves are detected by a sensitive microphone.



The time between sending and receiving the pulse is 0.005 s. The device calculates the depth of the sea, using the speed of sound in sea water, which is 1500 m/s.

(a) Calculate the depth of the sea. Show your working.

.....

2 marks

(b) The boat moves into very deep water. Explain why the reflected pulse is too weak to be detected.

.....

1 mark

(c) The boat's 'echo sounder' could **not** be used in an aeroplane to measure its height above the ground unless it had been modified.

Explain why the device will **not** give correct heights above the ground.

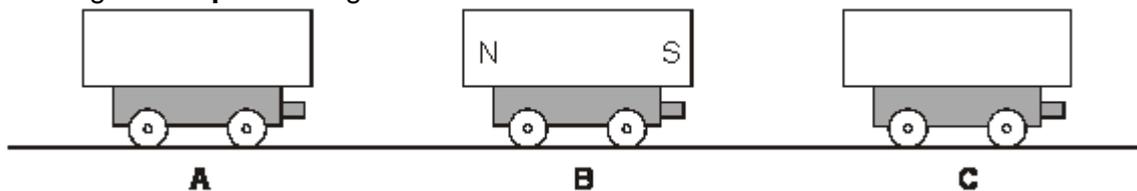
.....

1 mark
 Maximum 4 marks

Q2. The diagram below shows three trolleys. Peter put a bar magnet on each trolley.

(a) He pushed trolleys A, B and C together.

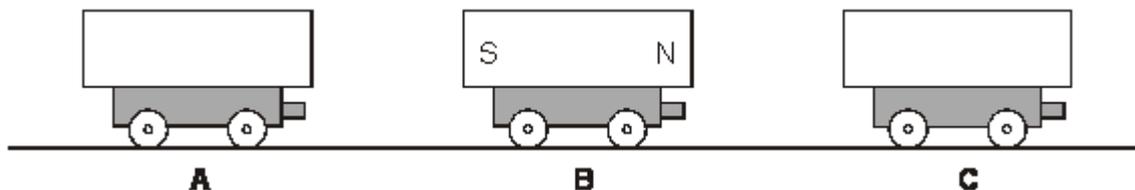
- Magnet B **attracted** magnet A.
- Magnet B **repelled** magnet C.



On the diagram above, label the north and south poles of magnets A and C. Use the letters N and S.

2 marks

(b) Peter turned trolley B around. Trolleys A and C were **not** turned around.



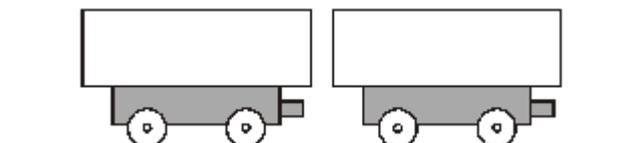
What would happen now when Peter pushed them all together? Use either **attract** or **repel** to complete each sentence below.

Magnet B would magnet A.

Magnet B would magnet C.

1 mark

(c) Peter held two trolleys close together and then let go.



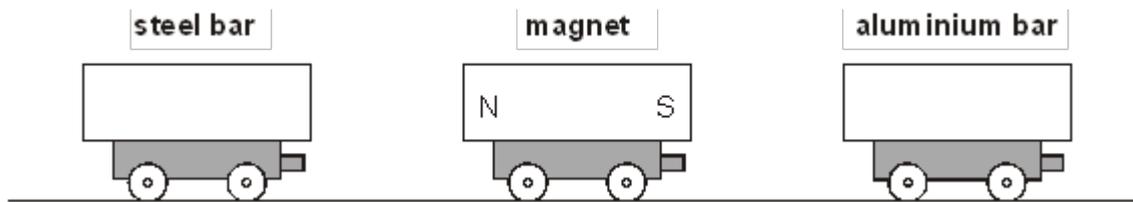
The magnets repelled each other.

Draw an arrow on both magnets to show which way they would move.

1 mark

(d) Peter took a magnet, a steel bar and an aluminium bar.

He put them on three trolleys as shown below.



(i) What happens to the steel bar as he moves it closer to the magnet?

.....

1 mark

(ii) What happens to the aluminium bar as he moves it closer to the magnet?

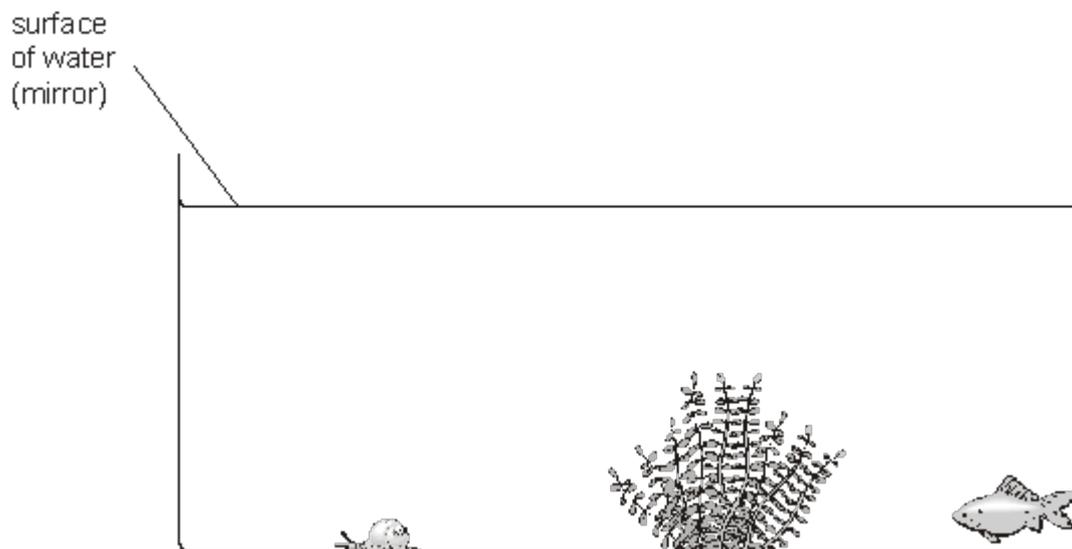
.....

1 mark
maximum 6 marks

Q3. (a) The diagram below shows a fish tank.

The surface of the water acts like a mirror.

The fish can see the snail reflected in the surface of the water.

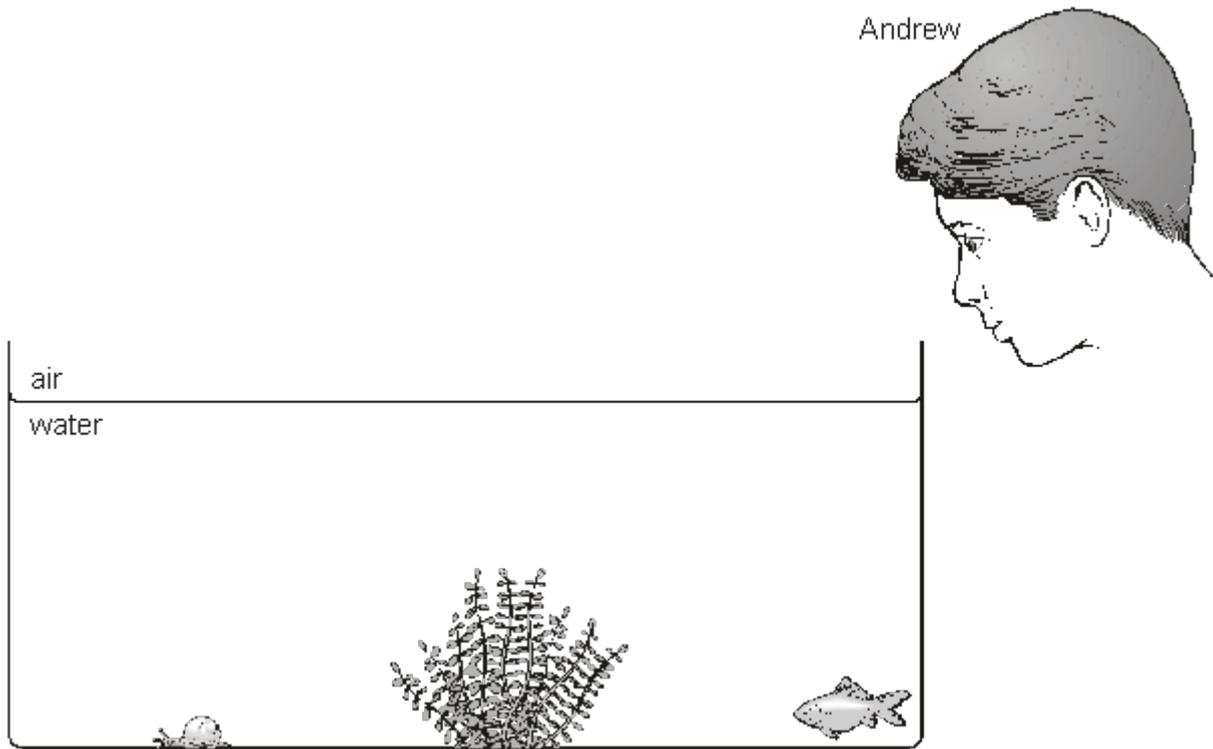


Draw a ray of light which passes from the snail, and reflects from the surface, to show how the fish can see the snail. Use a ruler.

Put arrows on the ray of light.

3 marks

(b) Andrew is looking at the snail.



When a ray of light passes from water to air it changes direction.

(i) Draw a ray of light from the snail to Andrew to show how Andrew can see the snail. Use a ruler.

Put arrows on the ray of light.

2 marks

(ii) What is the name given to this change in the direction of a ray of light?

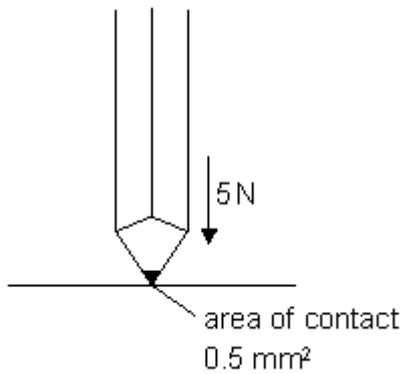
.....

1 mark
maximum 6 marks

Q4. Jenny is doing her homework.



(a) When Jenny writes, the pencil exerts a force of 5N on the paper.



not to scale

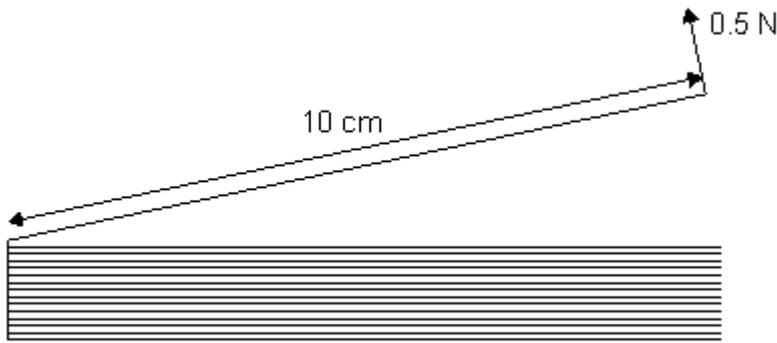
The area of the pencil in contact with the paper is 0.5 mm^2 .

Calculate the pressure of the pencil on the paper.
Give the unit.

.....
.....

2 marks

- (b) Jenny puts a book on her desk.
 She lifts the cover up with her finger, using a force of 0.5 N.
 The cover is 10 cm wide.



Calculate the turning moment on the cover of the book.
 Give the unit.

.....

2 marks

- (c) Jenny's book has an area of 200 cm^2 .
 It exerts a pressure of 0.05 N/cm^2 on the desk.

What is the weight of the book?
 Use the space below to show your working.

_____ N

2 marks
 maximum 6 marks

M1. (a) distance travelled by pulse = 7.5m
accept 'time to sea bed = 0.0025s' 1

depth of sea = 3.75m
*the unit is required for the mark consequential marking applies
accept half the distance travelled by the pulse accept the correct
answer with no working for both marks* 1

(b) any **one** from

- the energy spreads out
*accept 'it **or** the signal spreads out'*
- the energy is absorbed by the water
*accept 'it **or** the signal is absorbed by the water'
accept 'it is drowned out by noise'
accept 'the echo sounder **or** the signal made by
the echo sounder is **not** powerful enough'
do **not** accept 'the signal is not powerful enough'* 1

(c) because the speed of sound in air is different from that in water
*accept 'the speed of sound in air is less'
accept 'the speed of sound in air is 330m/s'* 1

[4]

M2. marks may be awarded for part (a) if the magnets are correctly
labelled in part (b) and no answer is given in part (a)

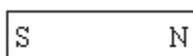
(a) • Magnet A



both poles are required for the mark

1 (L4)

• Magnet C



both poles are required for the mark

1 (L4)

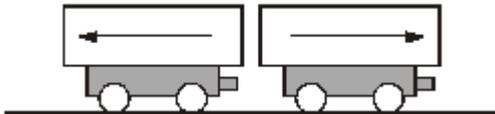
- (b)
- repel
 - attract

answers must be in the correct order

both answers are required for the mark

1 (L4)

- (c)
-



both arrows are required for the mark

1 (L4)

- (d)
- it is attracted

accept 'it gets faster'

1 (L4)

- nothing

accept 'it is not attracted or repelled'

accept 'it is not attracted'

accept 'it is not repelled'

'they stick together' is insufficient

*do **not** accept 'it repels'*

1 (L4)

[6]

M3.

- (a)
- a straight line from the snail to the surface and from the surface to the fish

the line must reach the fish within the tolerance

shown below the ray must be continuous

ignore an incident ray towards the snail

ignore rays refracted at the surface

1 (L5)

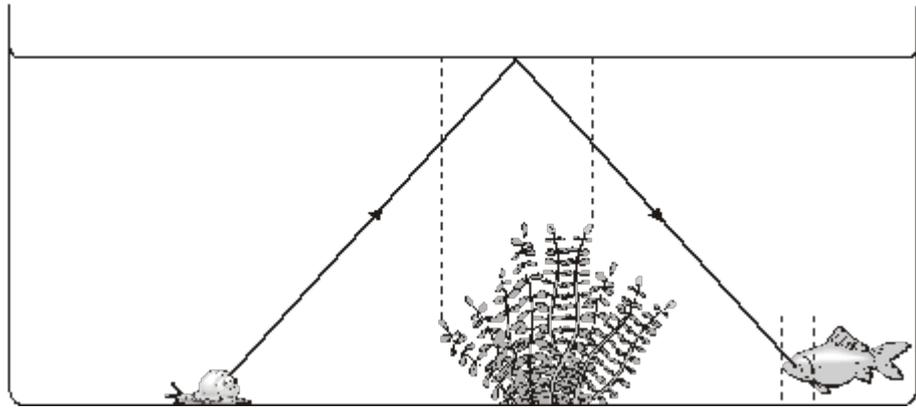
- the angle of incidence should be approximately equal to the angle of reflection

the line must reach the surface of the

water within the tolerance shown below

1 (L6)

- arrow pointing towards the fish **or** away from the snail
*accept a single arrow in the correct direction
on either the incident **or** the reflected ray
if two arrows are drawn, they must both be
in the correct direction*

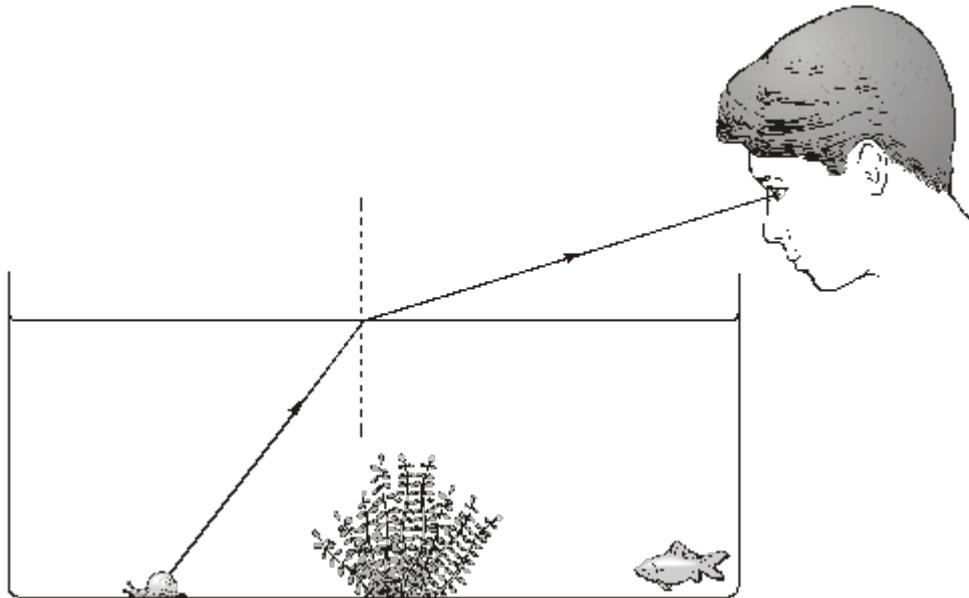


1 (L5)

- (b) (i)
- a ray from the snail to Andrew's eye bending at the surface
*both parts of the ray must be straight and
must slope upwards and to the right
the ray must be continuous
ignore any incident rays drawn towards the snail
the ray must bend further away from the normal
at the surface as it goes from water to air*

1 (L6)

- an arrow pointing towards Andrew on any part of the ray
*if two arrows are drawn, they must both be in the
correct direction*



1 (L6)

- (ii)
- refraction

1 (L6)

##

- (a) • 10

accept $\frac{5}{0.5}$ if the answer is not evaluated

1 (L7)

- N/mm²

accept, for two marks, '10 Pa'
'10' is insufficient
accept 'Nmm²'
do **not** accept 'n' for 'N'

1 (L7)

- (b) • 5

accept '10 × 0.5' if the answer is not evaluated

1 (L7)

- N cm

accept 'cm N'
do **not** accept 'n' for 'N'
accept, for two marks, '0.05 Nm'
'0.05' is insufficient

1 (L7)

- (c) • (weight = 200 × 0.05 =) 10

accept '(force = area × pressure =) 10'
accept, for one mark, '0.05 × 200' if not evaluated **or** evaluated incorrectly
award two marks for the correct numerical answer, whether or not correct working has been shown
if the answer is incorrect, award one mark for a rearranged equation showing explicitly how to calculate weight or force e.g. 'force **or** weight = area × pressure'

2 (L7)

[6]