DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2012

Track

FORM 4 **PHYSICS** **TIME: 1h 30min**

Name: _____ **Class: _____**

Answer ALL questions in the spaces provided on the Exam Paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity, g = 10 m/s^2.

Forces & Motion	$W = mg$	
	$v = u + at$	$s = ut + \frac{1}{2} a t^2$
	$s = \frac{(u+v)}{2} t$	$v^2 = u^2 + 2as$
	$F = ma$	Momentum (p) = mv
	Average speed = $\frac{\text{Total distance}}{\text{Total time}}$	
Electricity	$Q = I t$	$E = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	$R \alpha \frac{1}{A}$ $R \alpha L$
Waves	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{\text{image distance}}{\text{object distance}}$	$m = \frac{\text{height of image}}{\text{height of object}}$

Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Maximum mark	**8**	**8**	**8**	**8**	**8**	**15**	**15**	**15**	**85**
Actual mark									

	Total Theory	**Total Practical**	**Final Mark**
Actual Mark			
Maximum Mark	**85**	**15**	**100**

SECTION A **This section carrie**

1. Liam sees a dragonfly **reflected** in the water.

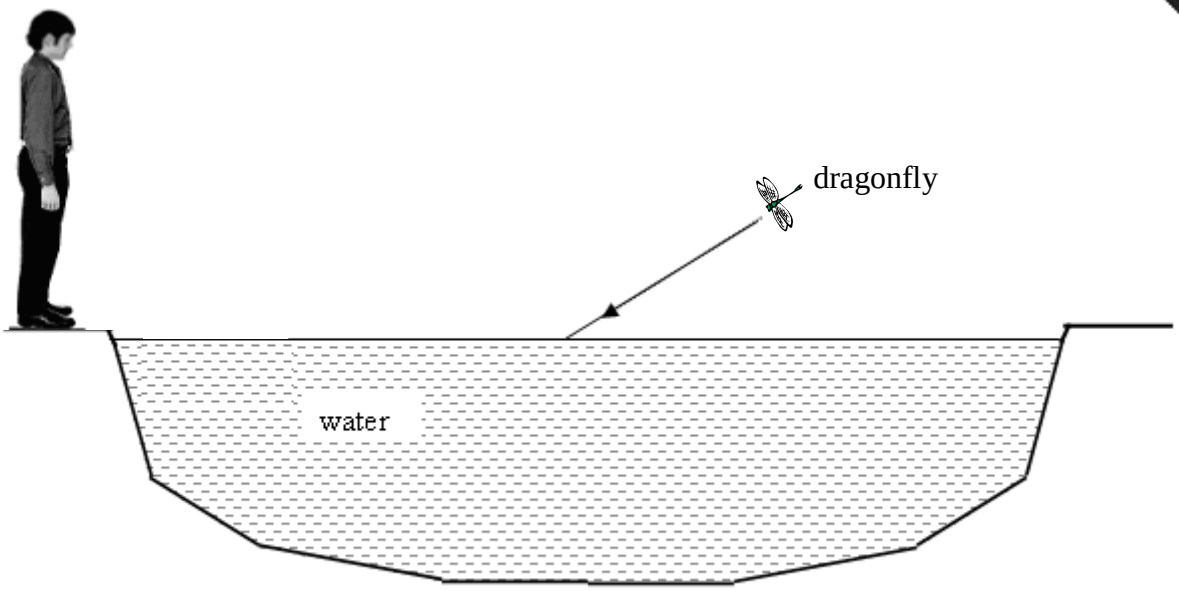


Figure 1

a. Draw on Figure 1:

i. the normal at the water surface, (1)
ii. the ray which is **reflected** towards Liam's eyes. (1)

b. Label the angles of incidence (**i**) and reflection (**r**). (2)

c. Mark with an '**I**', the position where the image of the dragonfly appears to be. (1)

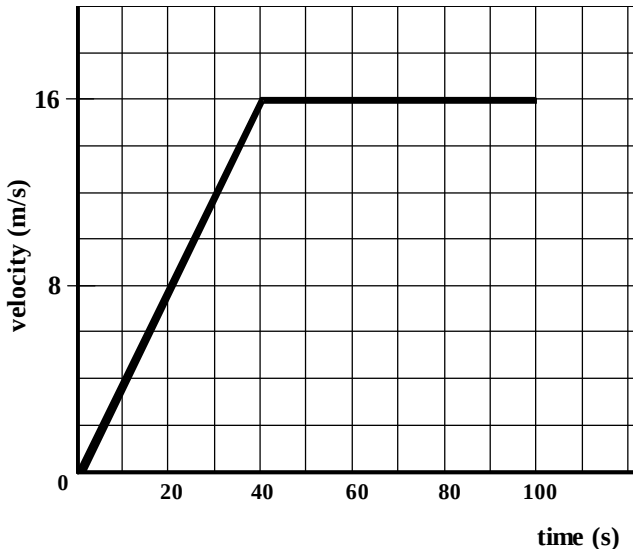
d. Underline the correct answer:

i. The angle of incidence is (equal to, greater than) the angle of reflection. (1)

ii. The image of the dragonfly is (real, virtual). (1)

iii. This means that such an image (can, cannot) be formed on a screen. (1)

2. The velocity-time graph below describes the motion of a horse racing along a stra



Use the velocity-time graph to answer the following questions:

a. What is the **maximum velocity** reached by the horse?

_____

(1)

b. How long does it take the horse to reach this maximum velocity?

_____

(1)

c. Calculate the **acceleration** of the horse.

_____

_____

(2)

d. The horse crosses the finishing line exactly after 100 seconds. Show that the racing track is 1280 m long.

_____

_____

_____

(3)

e. When the horse stops unexpectedly, the jockey continues to move forward. Which of the three laws of motion explains this?

_____

(1)

3. Two filament lamps are connected as shown in Figure 2. **X** has a resistance of 3 Ω and **Y** has a resistance of 2 Ω.

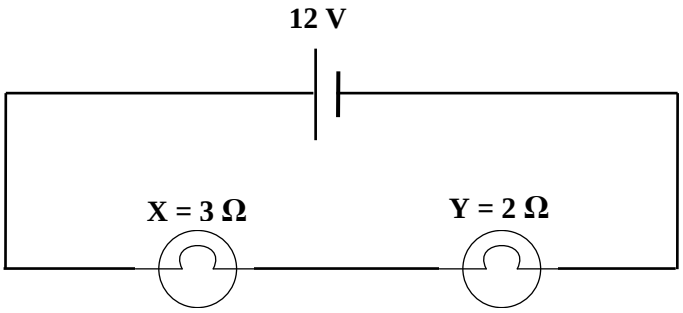


Figure 2

a. The two filament lamps are connected in _____. When one lamp fails, the other lamp turns off, because the circuit is now _____. (2)

b. Calculate:

i. the **total resistance** of the circuit,

_____

(1)

ii. the **current** flowing through the circuit,

_____

(1)

iii. the **voltage** across filament lamp **X**.

_____

(1)

c. i. In the space below, draw a circuit showing two filament lamps connected in such a way that if one of them fails, the other would still light up.

(2)

ii. The two filament lamps in the circuit you have drawn are now connected in _____. (1)

4. A golfer hits a **stationary** ball of mass 0.045 kg, with an average force of 1440 N.

a. The velocity of the ball before it is hit by the golf club is _____ m/s. (1)

b. Calculate the **acceleration** of the ball caused by this force.

(2)

c. The velocity of the ball leaving the golf club is 80 m/s. Calculate:

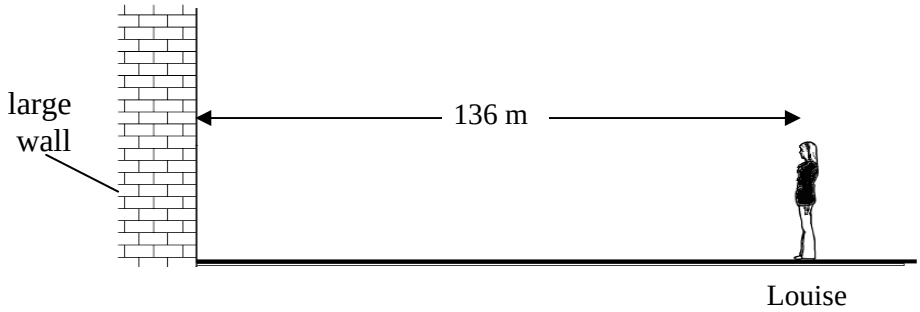
i. the **momentum** of the ball as it leaves the golf club,

(2)

ii. the **time** the golf club is in contact with the ball.

(3)

5. Louise stands 136 m in front of a large wall. She claps and hears an echo.



a. Underline the correct answer:

i. Sound travels by means of (transverse, longitudinal) waves. (1)

ii. The air particles vibrate (parallel, perpendicular) to the direction of the wave. (1)

iii. The speed of sound (depends, does not depend) on how loud the sound is. (1)

iv. An echo is heard when the sound is (reflected, refracted). (1)

b. The speed of sound in air is 340 m/s. How long does it take for Louise to hear the echo?

(2)

c. How far away from the wall does she need to stay to hear the echo after 1 second?

(2)

SECTION B **This section carries**

6. A thermistor is a temperature-dependent resistor. The first thermistor was used in 1833 by Michael Faraday.

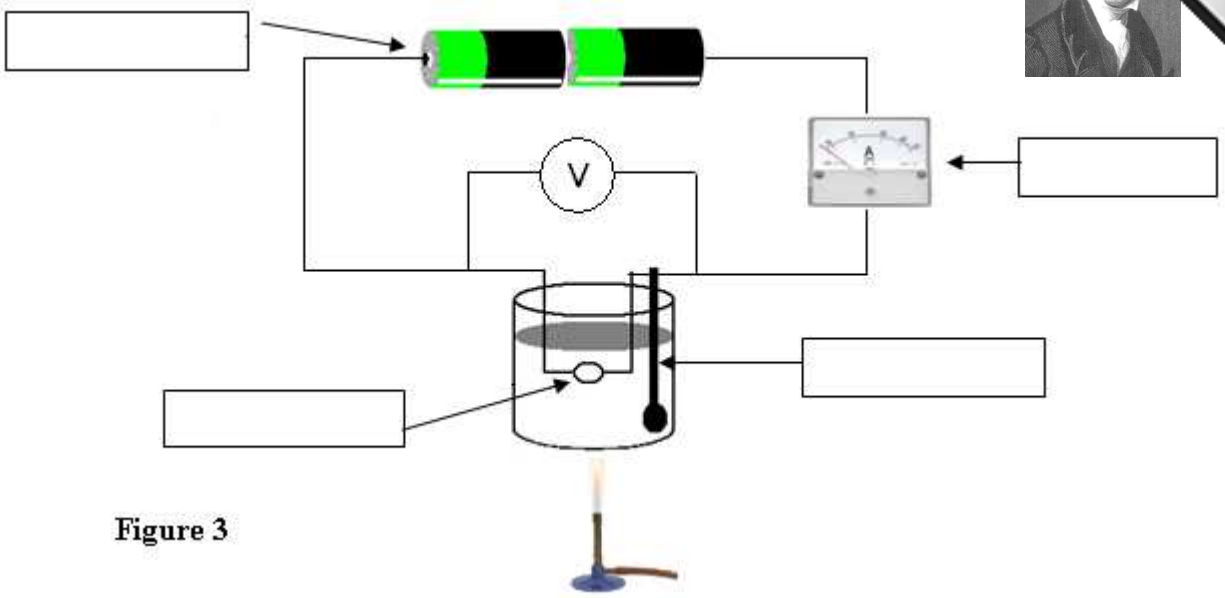


Figure 3

a. Kim calculates the **resistance** of a thermistor at a **temperature** of 60°C**.** She uses the apparatus shown in Figure 3.

i. Label the apparatus in the spaces provided. (4)

ii. Complete the following sentence:

When the thermistor is heated, its resistance _____ and a larger current flows. (1)

iii. Which measuring instrument in the above diagram is used to measure the voltage across the thermistor? _____ (1)

iv. Write down the numbers **1** to **3** next to each of the statements below to describe how Kim performs the experiment.

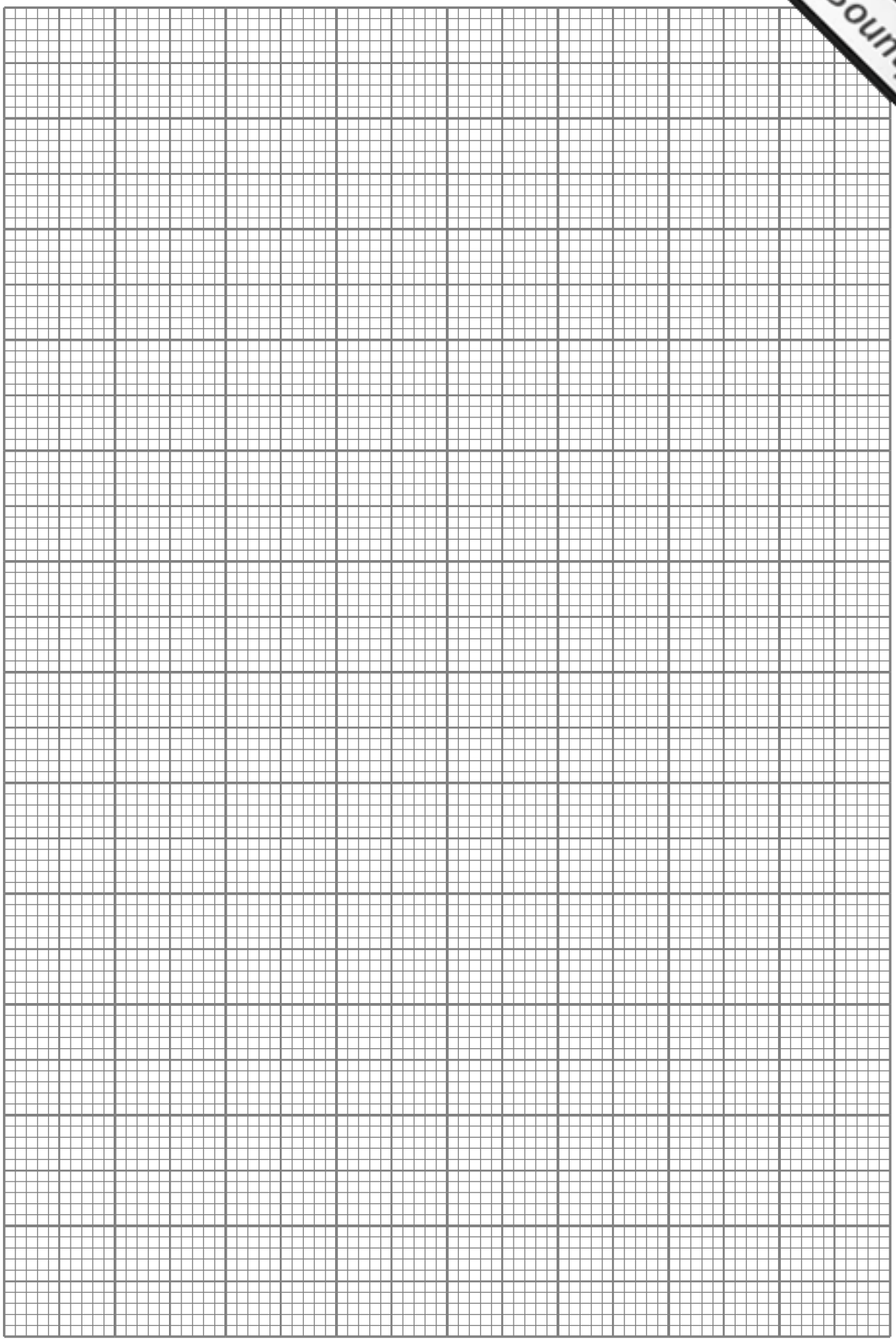
When the water reaches 60°C, the current and voltage are noted.	
The Bunsen Burner was lit and water was heated.	
The equation V= IR was used to measure the resistance of the thermistor.	

(3)

b. Kim repeats the procedure at different temperatures and obtains the readings shown below.

Resistance (Ω)	1900	1200	800	540	360	250	180
Temperature (°C)	10	20	30	40	50	60	70

Plot a graph of Resistance (Ω) on *y-axis* against Temperature (°C) on *x-axis*. Draw a **curve** that passes through all the points. (6)



7. An **optical fibre** is a solid rod of transparent material. It can be as fine as a stra[illegible] hair and is designed to transmit light from one place to another.

a. Figure 4 shows a ray of light incident onto an optic fibre.

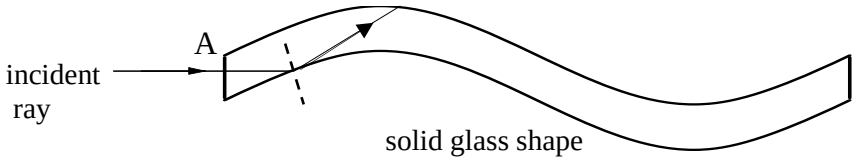


Figure 4

i. How does the speed of light change as the ray of light passes from air to glass?

_____

(1)

ii. In Figure 4 above, draw the path taken by the ray of light inside the optical fibre.

(2)

iii. What is the name given to this type of reflection? _____

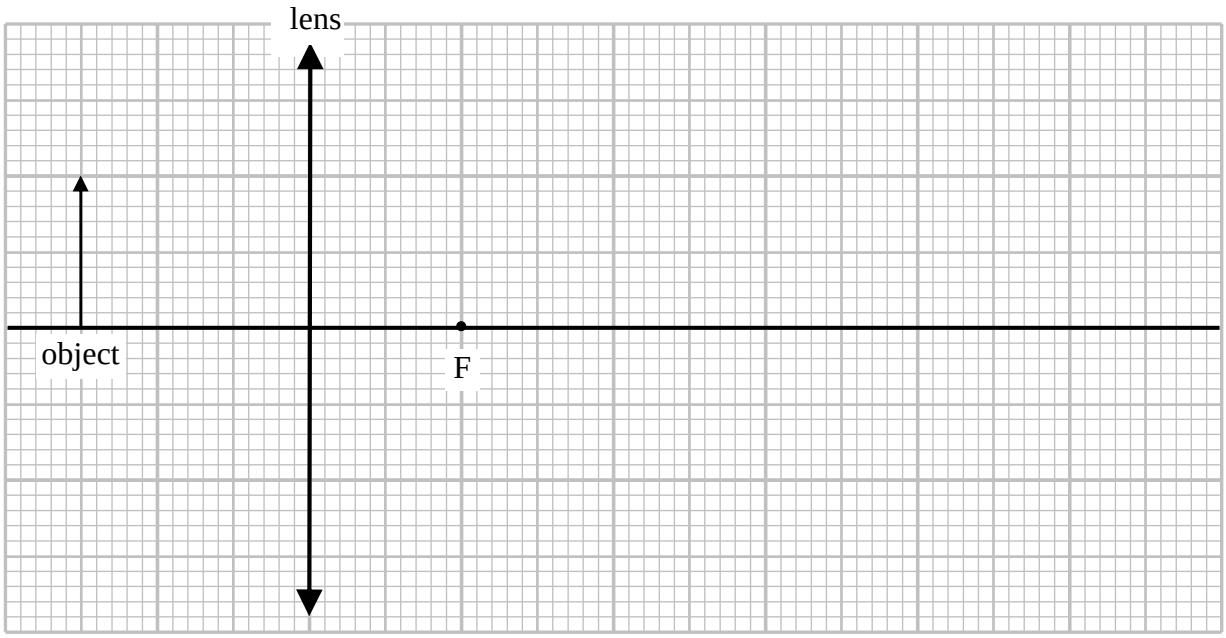
(1)

iv. Name **one** use of this type of reflection.

_____

(1)

b) A convex lens has a focal length of 2 cm. An object of height 2 cm is placed 3 cm away from the centre of the lens.



i. Draw two rays from the top of the object to show how the image forms. (3)

ii. Draw the image and label it as '**I**'. (1)

iii. Measure the height of the image. (1)

iv. Underline the correct answer in each of the following. Is the image formed

Real or Virtual? Inverted or Upright? Magnified or Diminished?

(3)

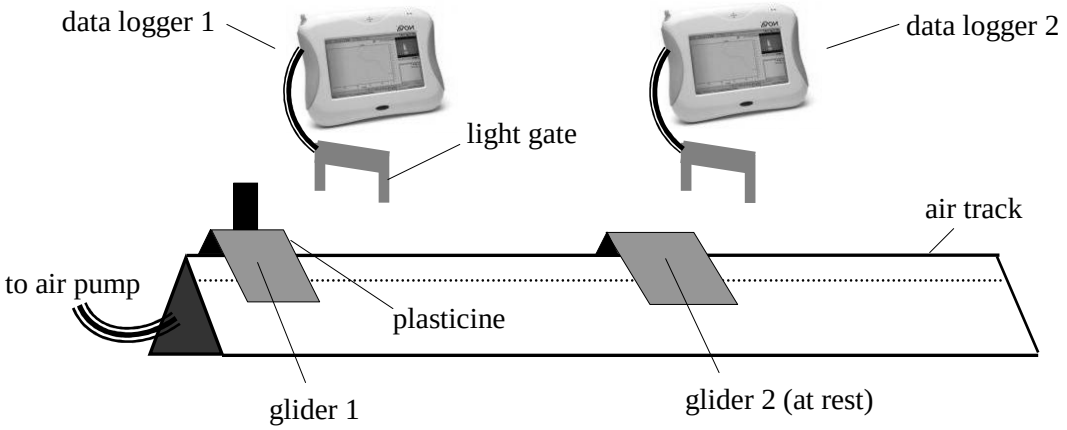
v. Calculate the magnification of the lens.

_____

(2)

8. The **Principle of conservation of momentum** can be used to calculate the [illegible] of objects after they collide.

a. Adam investigates the conservation of momentum when two gliders collide. He measures the mass of each glider using a top pan balance and then pushes glider 1 towards glider 2 which is **at rest**. He reads the velocities of the gliders from the data loggers.



He obtains the following results:

mass of glider 1 = 0.1 kg, **mass** of glider 2 = 0.2 kg
velocity of glider 1 (before collision) = 1.2 m/s

i. Calculate the momentum in kgm/s, **before** collision, of:

- glider 1,

_____

(2)

- glider 2.

_____

(1)

ii. Hence calculate the total momentum of both gliders before collision.

_____

(1)

iii. After collision gliders 1 and 2 **stick together.** What is their total momentum after collision?

_____

(1)

iv. Calculate the velocity of the gliders after collision.

_____

_____

(3)

b. Modern cars are built with a number of safety features.

i. Give **one** example of a safety feature used in cars.

_____

(1)

ii. Explain how the safety feature you have indicated helps passengers in case of an accident.

_____

_____

(2)

c. A ball of mass 0.80 kg is moving with an initial velocity of 10 m/s. The ball is stopped by the goalkeeper in 0.01s.

i. Use the formula $F = \frac{mv - mu}{t}$ to calculate the force applied by the goalkeeper.

_____

_____

(3)

ii. The goalkeeper repeats his actions but takes longer to stop the ball. Will his force increase, decrease or remain the same?

_____

(1)