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

Trac

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	$Q = I t$	$E = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	$R \propto \frac{1}{A}$ $R \propto L$
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 carries 40 ma**

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

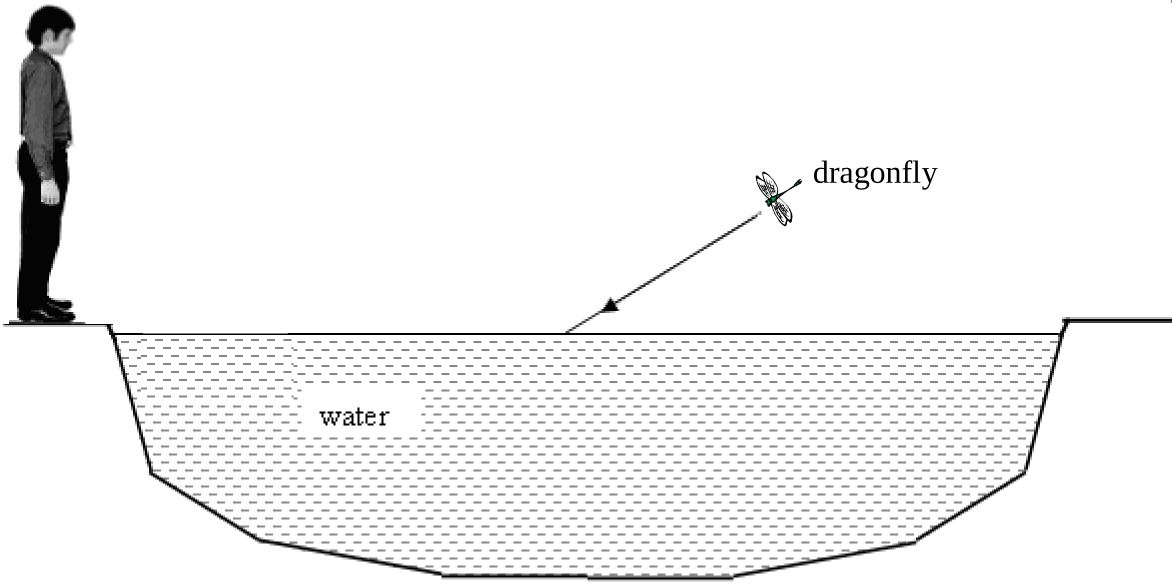


Figure 1

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)

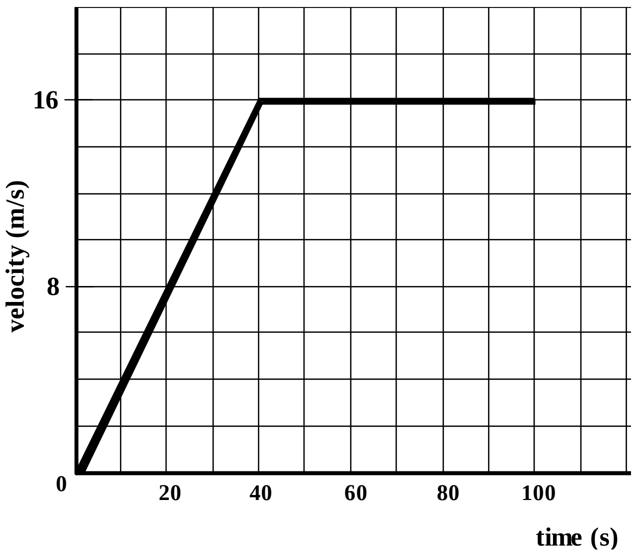
d. Underline the correct answer:

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 o Y has a resistance of 2 Ω.

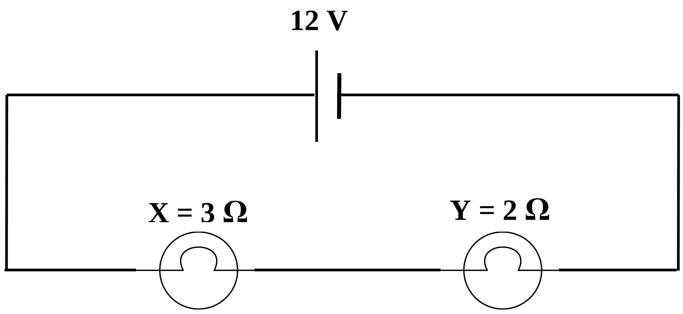


Figure 2

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**.

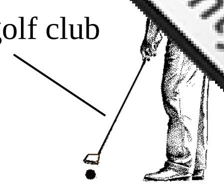
____ (1)

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,

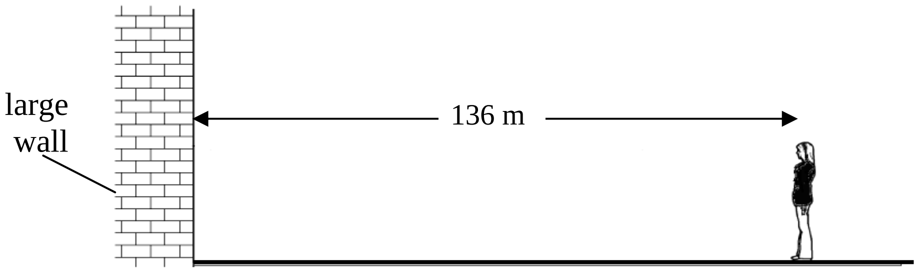
____ (2)

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. The first thermistor was discovered in 1833 by Michael Faraday. Early thermistors were difficult to produce and their use was limited. Commercial production of thermistors began in the 1930's.

a. Kim needs to find the **resistance** of a thermistor at a **temperature** of 60 ^{o}C. She uses the apparatus shown in Figure 3.

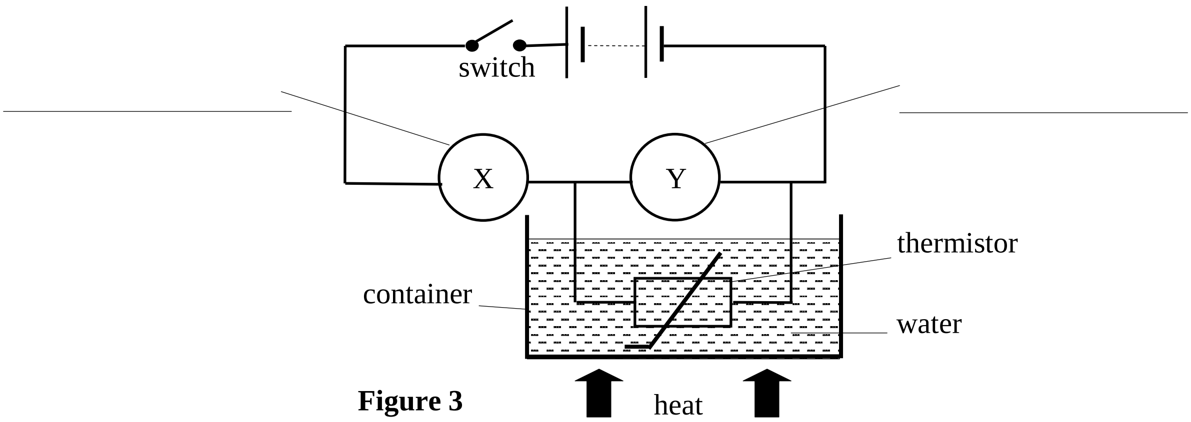


Figure 3

i. On the above diagram label the two measuring instruments **X** and **Y**. (2)

ii. Which other apparatus does Kim need to measure the temperature of the water?

____

(1)

iii. Describe how she carries out the experiment.

____

____

____

____

____

(5)

iv. Suggest **one** suitable precaution for this experiment.

____

(1)

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

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

i. Plot a graph of Resistance R (Ω) on *y-axis* against Temperature t (^{o}C) on *x-axis*. (5)

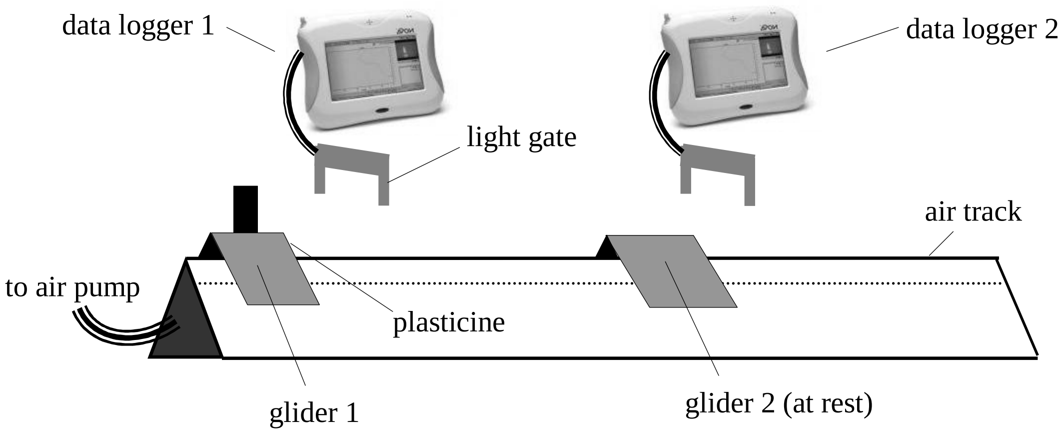
ii. Use the graph to find the resistance of the thermistor at a temperature of 45 ^{o}C.

____

(1)

7. The **Principle of conservation of momentum** can be used to calculate the v objects after they collide.

a. Adam investigates whether momentum is conserved when two gliders **stick together** afte colliding. He measures the mass of each glider using a top pan balance and then pushes glider 1 towards glider 2 which is initially **at rest**. He reads the velocities of the gliders from the data loggers.



He obtains the following results:

mass of glider 1 = 0.15 kg,	**mass** of glider 2 = 0.20 kg
velocity of glider 1 (before collision) = 1.05 m/s	
velocity of combined gliders (after collision) = 0.45 m/s	

i. Calculate the **total** momentum in kgm/s:

- **before** the two gliders collide,

____ (2)

- **after** the two gliders collide.

____ (2)

ii. Using your results, state whether momentum is conserved during the collision. Give a reason for your answer.

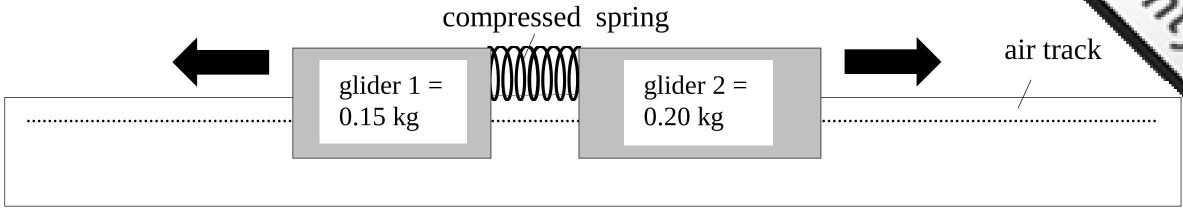
____

____ (2)

iii. Name an external force which should **not** be present in this experiment.

____ (1)

b. A spring is now **compressed** between the two gliders. The two gliders are **ini**
When the gliders are released, they move rapidly apart.



i. What is the total momentum **before** the gliders are released? Explain.

---

(2)

ii. What is the total momentum **after** the gliders are released? Explain.

---

(2)

iii. **Glider 1** moves to the left at a speed of 4 m/s. Calculate the speed of **glider 2**.

---

(2)

iv. The gliders experience an equal and opposite force because for every ____________

there is an equal and opposite ______________. (2)

8. An **optical fibre** is a solid rod of transparent material. It can be as fine as a strand of human hair and is designed to transmit light from one place to another.

a. Figure 4 shows a ray of light incident onto a curved solid glass shape, which shows how light can travel through an optical fibre.

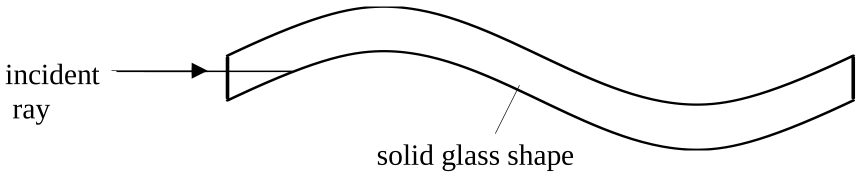


Figure 4

i. How does the speed of light change when the ray of light enters the glass shape?

---

(1)

ii. Complete the diagram to show the path taken by the ray of light. (2)

iii. Name this kind of reflection.

---

(1)

iv. State the **two** conditions necessary for this kind of reflection to occur.

____

____

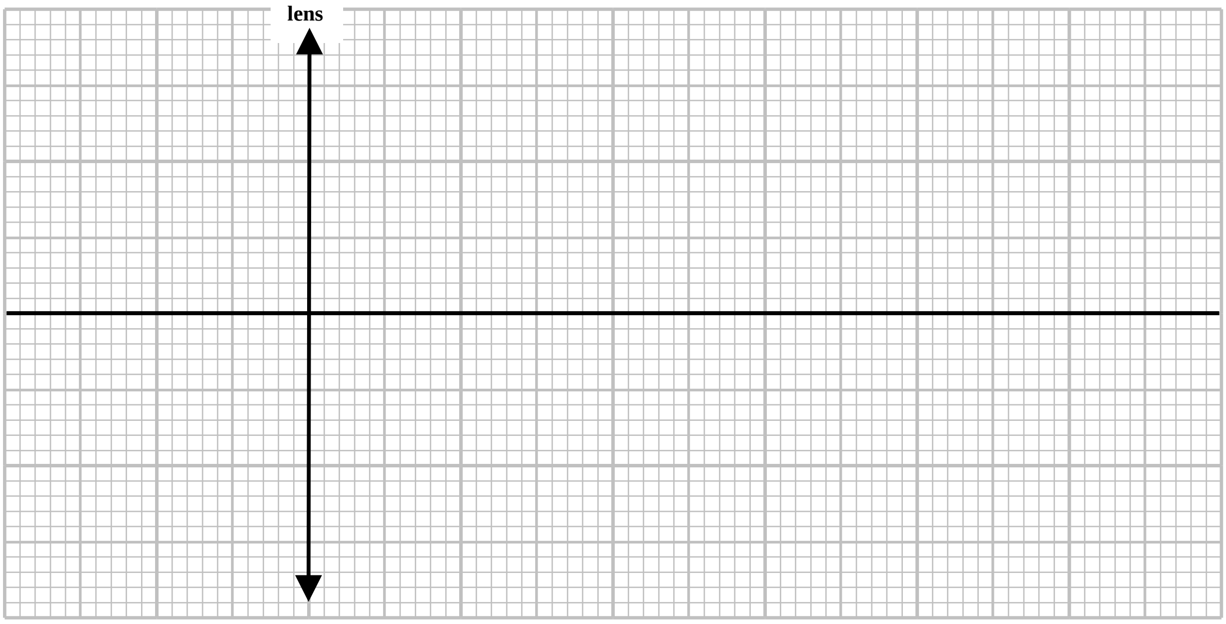
(2)

v. Name **one** application of this kind of reflection.

____

(1)

b) A convex lens has a focal length of 3 cm. An object of height 1 cm is placed 4 cm away from the centre of the lens. The resulting image of the object is formed 12 cm away from the lens.



i. Draw a ray diagram **to scale** to show how the image forms.

(4)

ii. Name **three** properties of the image.

____________________ ____________________ ____________________

(3)

iii. Calculate the magnification of the lens.

____

(1)