St Mary's School
CAMBRIDGE

Lower Sixth Physics

Sample Entrance Examination

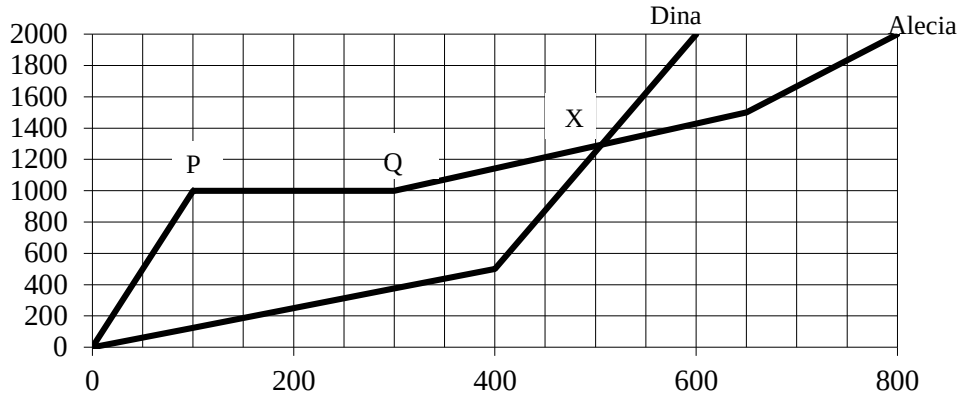
Time allowed: 60 minutes

Name: _____

INSTRUCTIONS :

- **Answer all questions**
- **Calculators allowed**
- **Dictionaries or reference materials are forbidden**

1. The graph below shows the distance travelled (m) against time (s) for Alecia and Dina who are riding their bikes to school .



(a) How far is it to school?

.....[1]

(b) Who sets off at the faster speed?

.....[1]

(c) Explain what has happened at the section marked PQ.

.....[1]

(d) Work out Dina's speed for the first 400 seconds.

.....

.....[2]

(e) What happens at point X?

.....[1]

(f) Who arrives at school first?

.....[1]

(g) What is Alecia's average speed for the whole journey?

.....

.....[2]

TOTAL / 9

2. The table shows power ratings and heat losses for three types of light bulb.

bulb	energy efficient	standard	fluorescent strip
power rating (W)	20	100	20
power lost as heat (W)	1	80	8
efficiency (%)			

(a) Use the equation:

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100$$

to calculate the efficiency of each bulb. Write your answers in the table.

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.....[6]

(b) (i) Which type of bulb is the least efficient ?

.....[1]

(ii) Where does the wasted energy go ?

.....[1]

(c) Give **two** reasons why energy efficient bulbs are considered to be better for the environment than standard bulbs.

.....

.....[2]

TOTAL / 10

3. The diagram below shows a skydiver during three stages of the parachute jump. Stage 1 and 2 shows the skydiver during free fall long after the skydiver has left the plane. Stage 3 shows the skydiver after the parachute has been open for some time.

Stage 1 Stage 2 Stage 3

In Stage 1 the skydiver is travelling at a constant speed.

(a) State the name for this steady speed.

.....[1]

(b) State the names of the forces on the skydiver in stage 1.

.....

.....[2]

In Stage 2 the skydiver increases his speed by tilting downwards.

(c) Explain how tilting downwards has altered the forces acting on the skydiver.

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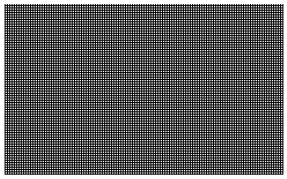
.....[3]

(d) The table below shows readings from the parachutist's altimeter (an instrument for measuring the height above the ground) during the descent. The altimeter was later found to be inaccurate at times. At 15 seconds into the jump the parachutist tilts downwards.

TIME (SECS)	HEIGHT (METRES)
0	2000
5	1860
10	1600
15	1300
20	770
25	580
30	500
35	420
40	450
45	300
50	250
55	200
60	175

(Continued...)

(i) Construct a graph of the information. [4]



(ii) Use the graph to determine the average speed between 10-15 seconds.

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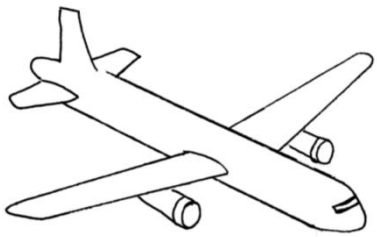
.....[2]

TOTAL / 12

4. A jet aircraft is taking off from an international airport. Its mass, including passengers and fuel is 150,000 kg. Its take-off speed is 100 ms^{-1}. The maximum thrust of its engines is 500,000 N.



(a) Using the equation Kinetic Energy (joules) = ½ mv^2 ,calculate the kinetic energy at the moment of take-off.

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.....[2]

(b) Name the two main forces acting on the plane at take-off.

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.....[2]

(c) We can assume there are no forces of resistance and the engines maintain maximum thrust.
Using the equation Work done (joules) = force × distance, calculate the minimum length of runway needed for
take-off.

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.....[3]

TOTAL / 7

5. Alice pulls per brother Simon on a sledge. She pulls with a force of 100 N and the friction force between sledge and ground is 20 N.

(a) What is the resultant force on the sledge?

.....[1]

(b) How much work does she do in pulling the sledge 20m?

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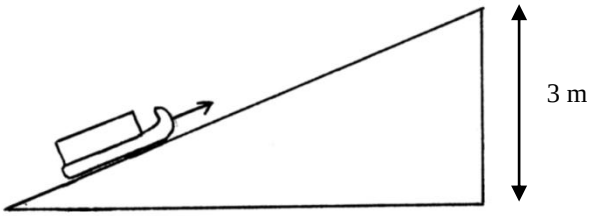
.....[3]



(c) Alice pulls the sledge up a hill of vertical height 3m.

(i) If the sledge and Simon together weigh 100 N, use the equation:

Potential Energy (joule) = force × vertical height
to calculate their potential energy at the top of the hill.

.....[1]

(ii) Alice lets go of the sledge. Explain what happens in terms of the energy changes.

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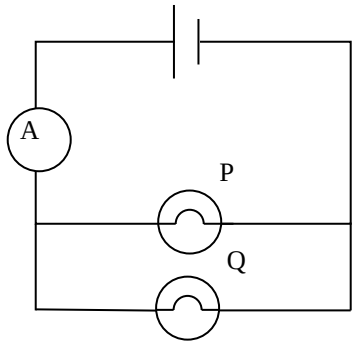
.....[2]

TOTAL / 7

6. (a) In the circuit below, lamps P and Q are identical. The reading on the ammeter is 3A. The cell shown is of emf. 6V.



Calculate the current that passes through lamp P.

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.....[2]

(b)If a voltmeter was connected across lamp P, what would it read ?

.....[1]

(c)Calculate the resistance of lamp P.

.....

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.....[3]

TOTAL / 6

7. (a) A musical instrument produces a sound wave with a frequency of 1000 Hz. The sound wave has a wavelength of 0.34 m in air. Calculate the speed of the sound wave in air.

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.....[2]

(b) In water the speed of sound is different. The speed of a sound wave in water is 1300 m/s. The sound
wave has a frequency of 1000Hz. Calculate the wavelength of this sound wave.

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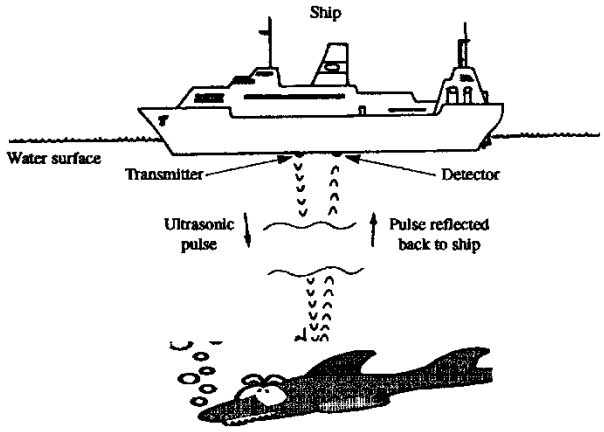
.....[2]

The diagram shows a ship using an Echo locator (SONAR) to find a shoal of fish. The pulsed wave is transmitted from the ship, which is then reflected off the top of the shoal and is then picked up by the receiver.



(c) The time taken to receive the echo is 0.2s after transmission. Calculate how deep the ship has to lower its fishing nets to catch the top of the shoal.

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.....[4]

(d) Define the term 'ultrasound wave'

.....[1]

(e) Give one other use of ultrasound waves (apart from echo location)

.....[1]

TOTAL / 10