DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2013

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

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, to be 10 m/s^2.

Forces & Motion	$W = mg$	$F = ma$
	$v = u + at$	$s = ut + \frac{1}{2} a t^2$
	$s = \frac{(u+v)}{2} t$	$v^2 = u^2 + 2as$
	Average speed = $\frac{\text{Total distance}}{\text{Total time}}$	Momentum (p) = mv
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	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{\text{image distance}}{\text{object distance}}$	$m = \frac{\text{height of image}}{\text{height of object}}$
	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\eta = \frac{\text{speed of light (air)}}{\text{speed of light (medium)}}$

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 c arks**

1. A guitar string vibrates with a frequency of 250 Hz.

a. Complete:

i. 250 Hz = 250 vibrations every _____. (1)

ii. We hear sounds with a frequency between _____ Hz and _____ Hz. (1)

b. Calculate the:

i. **periodic time** of the sound waves produced,

_____

(1)

ii. **wavelength** of the sound waves, given that the speed of sound is 340 m/s.

_____

(2)

c. Underline the correct answer:

i. Sound waves are (transverse, longitudinal). (1)

ii. As the string is plucked harder, the sound waves produced have a greater (amplitude, frequency). (1)

iii. Sound waves **cannot** travel through a (metal, vacuum). (1)

2. Ryan **drops** a metal key and a feather from a height of 4 m.

a. The **initial velocity** of the key and the feather is _____. (1)

b. The key falls with an **acceleration** of _____ m/s^2. (1)

c. The feather takes longer to fall because of a force called _____. (1)

d. Calculate the:

i. **time** the key takes to fall,

_____

_____

(2)

ii. **velocity** of the key just before it hits the ground.

_____

_____

(3)

3. Three **identical** filament lamps L_1, L_2 and L_3 are connected as shown in Figu

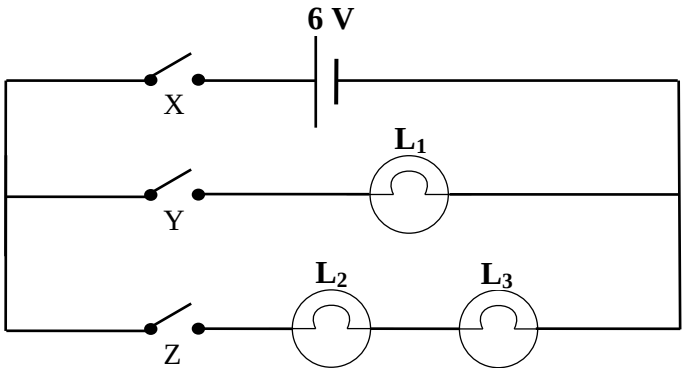


Figure 1

a. i. **L_1** and **L_2** are connected in _____. (1)

ii. **L_2** and **L_3** are connected in _____. (1)

b. State which switch or switches need to be closed (switched on), so that **only**:

i. **L_1** lights up,

_____

(1)

ii. **L_2** and **L_3** light up.

_____

(1)

c. With all switches closed, calculate the:

i. **voltage** across **L_2**,

_____

(1)

ii. **charge** present in **L_1** given that a current of 2 A flows for 30 seconds.

_____

_____

(2)

d. Explain why **L_1** will light brighter than **L_2**.

_____

_____

(1)

4. In the 1430s, Johann Gutenberg invented the periscope. It made use of mirrors and enabled people to see over a crowd. The periscopes that are used in submarines make use of prisms instead of mirrors.

Johann Gute

a. Figure 2 shows a ray of light incident onto a glass prism.

i. Given that the critical angle of glass is 42^0, which one of the rays A, B, C or D, shows the correct path followed by the light? _____ (1)

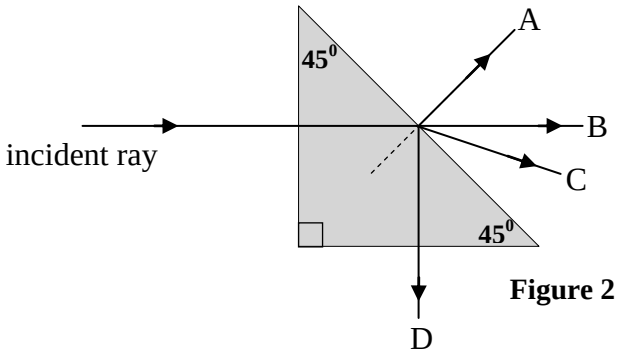
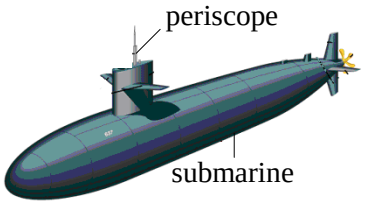


Figure 2



ii. Explain why the ray of light takes the path you have chosen.

_____

_____

(2)

iii. The refractive index of glass is 1.5. Calculate the speed of light inside the glass prism, given that through air it travels at a speed of 3×10^8 m/s (300 000 000 m/s).

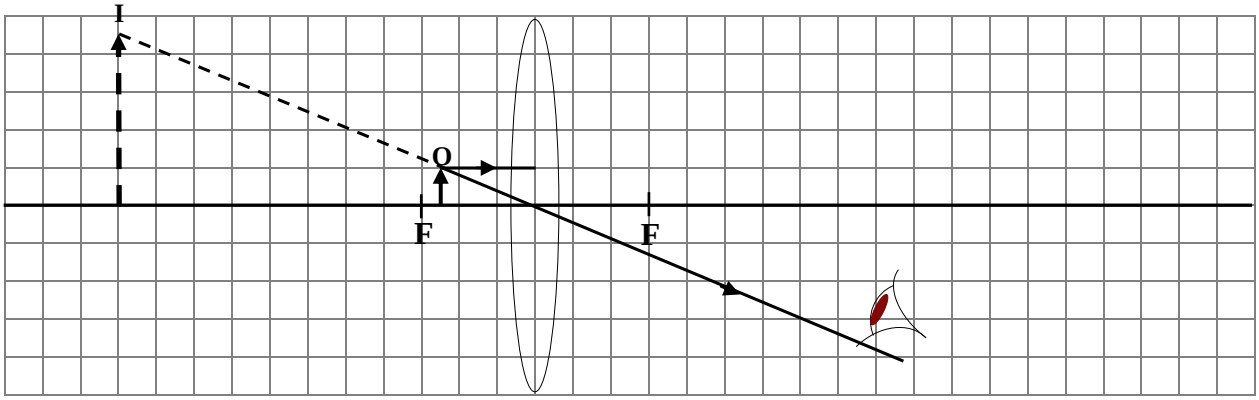
_____

_____

(2)

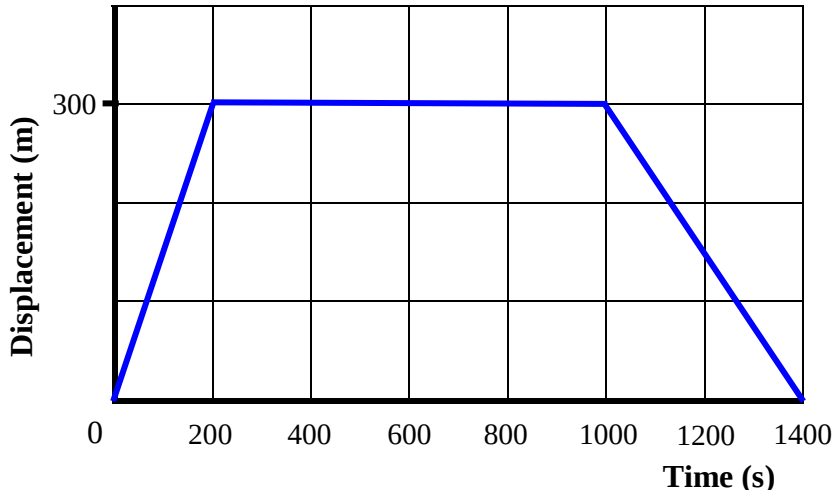
b. Another simple but useful optical instrument is the magnifying lens. It can be used to examine closely very small objects.

i. Draw the missing rays in the ray diagram below. (2)



ii. The image formed is enlarged, upright and _____. (1)

5. Martina rides from her home to the village library to borrow some books.
The **displacement-time** graph describes her journey to the library and back ho



a. How far is the library from her home?

_____

(1)

b. How long does she:

i. take to arrive at the library?

_____

(1)

ii. stay at the library?

_____

(1)

iii. take to ride back home?

_____

(1)

c. Calculate her **average speed** while riding:

i. to the library,

_____

(1)

ii. back home.

_____

(1)

d. Calculate the:

i. **total distance** she travels,

_____

(1)

ii. overall **displacement**.

_____

(1)

SECTION B **This section ca rks**

6. Samantha uses the apparatus shown in Figure 3 to investigate the relationsh **acceleration and force.**

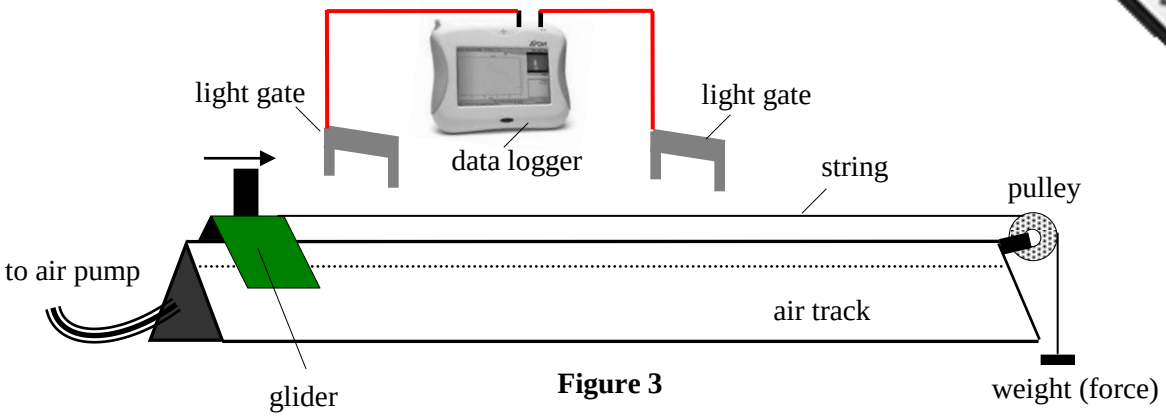


Figure 3

She hangs a 0.10 N weight as shown and releases the glider. The data logger measures the acceleration of the glider between the two light gates. She obtains several readings by adding more weights each time. The results obtained are shown in the table below.

Force (N)	0	0.10	0.20	0.30	0.40	0.50	0.60	0.70
Acceleration (m/s^2)	0	0.20	0.40	0.60	0.80	1.00	1.20	1.40

a. Plot a graph of **acceleration** (m/s^2) on the y-axis against **force** (N) on the x-axis. (6)

b. From the graph we notice that if the force increases the acceleration _____.

We say the force is _____ proportional to the acceleration. (2)

c. The air track reduces the force of _____ between the air track and the glider. (1)

d. State **one** precaution which she needs to take during this experiment.

_____

(1)

e. Use the graph to find the:

i. **acceleration** of the glider when the force acting on it is 0.35 N,

_____

(1)

ii. **force** acting on the glider which causes an acceleration of 1.30 m/s^2.

_____

(1)

f. When the force is 0.3 N, the acceleration is 0.6 m/s^2. Calculate the **mass** of the glider.

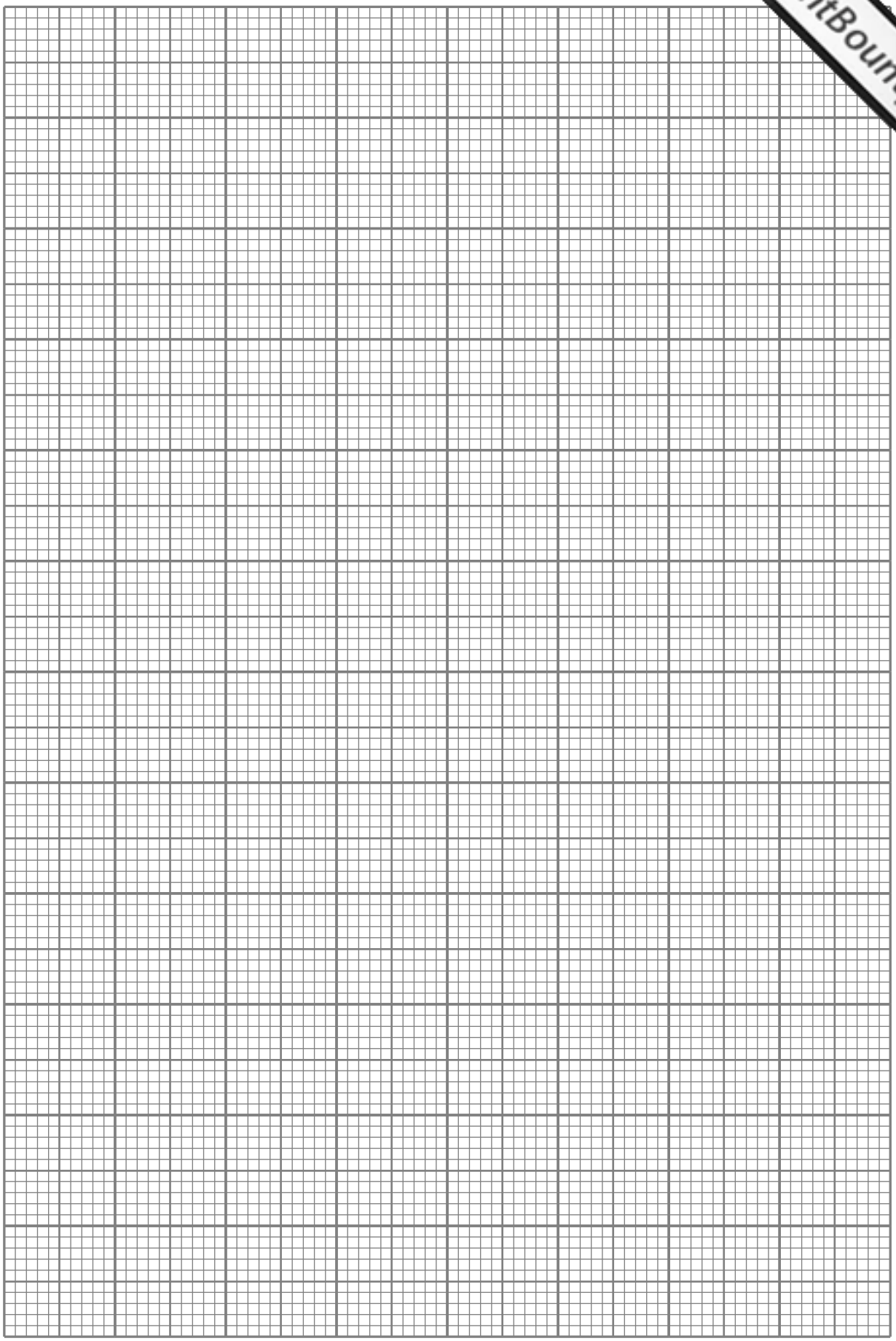
_____

(2)

g. What will happen to the acceleration when a glider of a larger mass is used?

_____

(1)



7. A **light dependent resistor** (LDR) is a special resistor. Its resistance chan[illegible]ng to the amount of light falling on it.

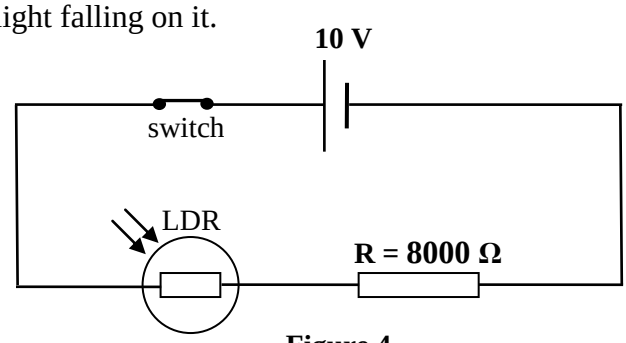


Figure 4

a. Figure 4 shows a light dependent resistor connected in a circuit. Given that in the dark the LDR has a resistance of 500 000 Ω, calculate the:

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

_____

(2)

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

_____

(2)

iii. **voltage** across the LDR if the voltage across the 8000 Ω resistor is 0.16 V.

_____

(2)

b. Jake switches on a torch and places it vertically above the LDR in Figure 4. He wants to investigate how the **height** of the torch affects the **current** flowing through the circuit.

i. On Figure 4 **draw** and **label** an instrument which he can use to measure the **current** flowing through the circuit. (2)

ii. Name the instrument which he could use to measure the **height** of the torch above the LDR.

_____

(1)

iii. Jake records his results in the table below. Fill in the missing quantities.

_____ (cm)	_____ (A)
20	0.00005
30	0.00004
40	0.00003
50	0.00002

(2)

iv. Jake concludes that as the light intensity increases, the current flowing through the circuit _____ because the resistance of the LDR _____. (2)

v. Write down **one** precaution which he needs to take during this experiment.

_____

(2)

8. X-rays are electromagnetic waves that form part of the electromagnetic spe

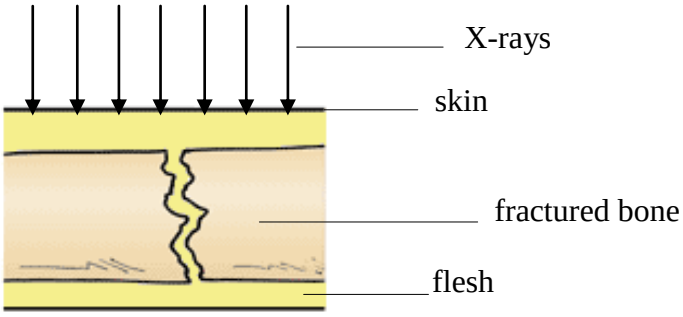


Figure 5

a. Figure 5 shows X-rays incident onto a fractured arm.

i. X-rays are suitable to detect fractures because they _____ through skin and flesh but are _____ by bones. (2)

ii. Name one precaution taken when using X-rays.

_____

_____

(1)

iii. Why is ultrasound used instead of X-rays to monitor unborn babies?

_____

_____

(1)

b. Underline the correct answer about electromagnetic waves:

i. They are all (longitudinal, transverse) waves. (1)

ii. They (can, cannot) travel through a vacuum. (1)

iii. They have a (different, common) speed. (1)

Please turn over

c. Match the type of radiation in column A with its use in column B.

A Type of radiation	Number	B Use
i. Gamma		seeing objects with our eyes
ii. Ultraviolet		night vision cameras
iii. Visible light		to detect fake banknotes
iv. Infrared		mobile phone communication
v. Microwaves		sterilise medical instruments

(5)

d. Which of the radiations, in question 'c' above, has the:

i. shortest wavelength?

_____

(1)

ii. longest wavelength?

_____

(1)

iii. highest frequency?

_____

(1)