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

Track

FORM 5	**PHYSICS**	**TIME: 2 hours**

Name: ______________________________ **Class:** ____________

Answer ALL questions in the spaces provided on the Examination 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.

Density	$m = \rho V$	
Pressure	$P = h \rho g$	$P = F/A$
Moment	Moment = F x perpendicular distance	
Energy	$PE = m g h$ $E = P t$	$KE = \frac{1}{2} m v^2$ Work Done $= F s$
Force	$F = m a$	$W = m g$
Motion	Average speed $= \frac{\text{total distance}}{\text{total time}}$ Momentum = m v	$v = u + at$ $s = ut + \frac{1}{2} at^2$ $v^2 = u^2 + 2as$ $s = \frac{(u+v)\,t}{2}$
Electricity	$Q = I t$ $V = I R$ $P = I V$ $E = I V t$	$E = Q V$ $R_T = R_1 + R_2 + R_3$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$	
Heat	$Q = m c \Delta\theta$	
Waves	$v = f \lambda$ $\quad f = \frac{1}{T}$ $\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$ $\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$
Radioactivity	$A = Z + N$	

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	9	10	11	12	Th.	Prac	Total	**Final Mark %**
Mark	10	10	10	10	10	10	10	20	20	20	20	20	170	30	200	100
Score																

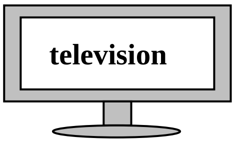
Section A: This section has 7 questions. Each question carries 10 marks.
(Total 70

1a. Complete the missing words by choosing the **correct** words from the list below:

created, diminished, destroyed, magnified, changed

The principle of conservation of energy states that energy can neither be _______________ nor _______________, but can be _______________ from one form to another. (3)

b. The list below includes various forms of energy:



heat energy, electrical energy, sound energy, wind energy, light energy

Choose from this list **one** form of energy for each of the following:

i. energy input to the television, ___________________________

ii. useful energy output by the screen of the television, ___________________________

iii. useful energy output by the speakers of the television, ___________________________

iv. energy wasted by the television. ___________________________

(4)

c. A television set uses 300 W of electrical power to produce 270 W of useful power. Calculate:

i. the power wasted by the television set,

____

(1)

ii. the efficiency of the television set.

____

(2)

2. Matthew has four solid blocks of the same size but of different materials as shown below. The density of the material of each block is given in Table 1 below.

copper **iron** **redwood** **lead**

a. Calculate:

i. the mass of the 20 cm^3 copper block in grams (g),

____ (2)

ii. the mass of the copper block in kilograms (kg),

____ (1)

iii. the weight of the copper block.

____ (2)

Material	**Density ρ in g/cm^3**
copper	8.9
iron	7.9
redwood	0.5
lead	11.4

Table 1

b. The density of water is 1 g/cm^3.

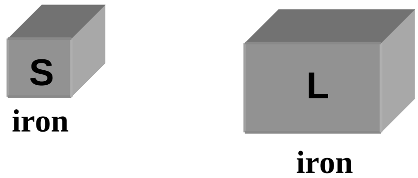
i. Name **one** material from Table 1 which floats on water. ____________________

ii. Give a reason for your answer.

____

(1)

c. Joseph has another iron block, marked L, larger than that of Matthew's, marked S.



i. Tick (√) one box with the correct answer.
The density of the larger iron block **L** is:

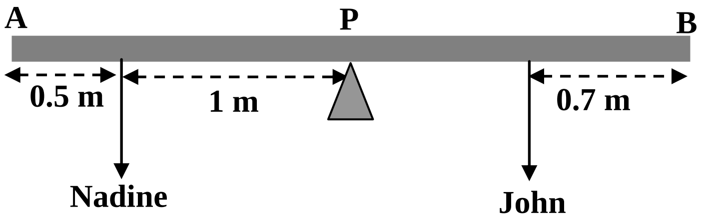
☐ greater than 7.9 g/cm^3 ☐ smaller than 7.9 g/cm^3 ☐ equal to 7.9 g/cm^3 (1)

ii. Give a reason for your answer.

____

(2)

3. The figure below represents Nadine and John sitting on a uniform seesaw AB. The weight of the seesaw is 300 N and the pivot is at the centre of the seesaw. Nadine weighs 400 N.



a. Find:

i. the distance between John and the pivot **P**, ____________________

(2)

ii. the direction of Nadine's turning effect about the pivot **P**. ____________________

(1)

b. On the above figure, mark the position of the weight of the seesaw **AB** by means of an arrow.

(1)

c. Calculate:

i. the size of Nadine's moment about the pivot,

____

(2)

ii. John's weight assuming that the seesaw is perfectly horizontal (in equilibrium),

____

____

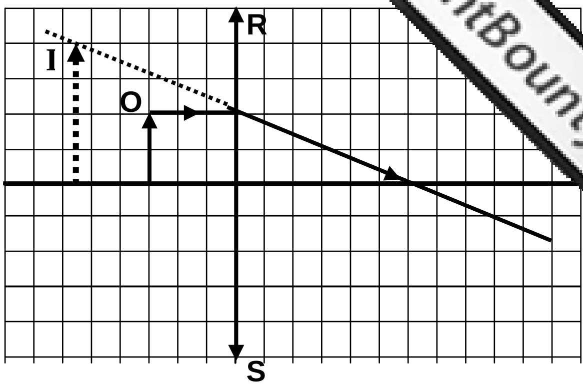
(2)

iii. the total weight supported by the pivot.

____

(2)

4a. The figure represents a ray diagram for an object O placed in front of a converging lens RS. A ray of light from the top of the object O is drawn to indicate the position of the image I.



i. Draw another ray of light from the top of the object O to show how the position of the image **I** is formed. (1)

ii. Is the image real or virtual? ____________________ (1)

iii. Name one **<u>other</u>** property of the image. ____________________ (1)

iv. The ray diagram shows the converging lens RS being used as a ____________________ (1)

b. Use the ray diagram (**one square represents 1 cm)** to determine the **<u>approximate</u>**:

i. object distance, u, ____________________ (1)

ii. height of the image, h_i, ____________________ (1)

iii. magnification of the converging lens RS,

____ (2)

iv. focal length of the lens RS. ____________________ (2)

5. The list below includes a set of electrical components that can form part of an electric circuit:
switch, diode, rheostat, light dependent resistor (LDR), thermistor, connecting wire

a. State which component from the above list:

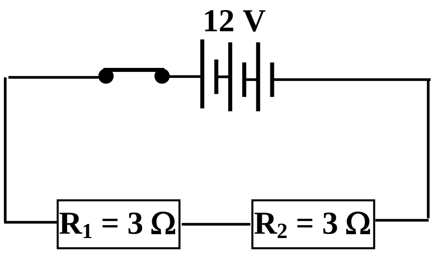
i. is used to allow current to flow in one direction only, ___________________________

ii. causes a break in the circuit, stopping the current flow, ___________________________

iii. has a high resistance at low temperature, ___________________________

iv. has its resistance dependent on the light intensity. ___________________________ (4)

b. In the circuit diagram shown, calculate:



i. the total resistance of the circuit,

____ (2)

ii. the total current flowing through the circuit,

____ (2)

iii. the power P of the circuit.

____ (2)

6. Ralph, of weight 700 N, jogs every morning wearing running shoes. The area of each foot is 0.25 m^2.

running shoes

a. Calculate:

i. the **<u>total area</u>** of contact with the ground when Ralph stands on both feet,

____ (2)

ii. the pressure exerted by Ralph while standing on both feet.

____ (2)

b. How does the pressure exerted on the ground change when Ralph:

i. stands on one foot? Explain.

____ (2)

ii. stands on two feet holding a 200 N weight in his hand? Explain.

____ (2)

c. Explain why football shoes studs provide for a better grip with the ground.

football shoes (with studs)

____ (2)

7. A slinky spring fixed at one end is held by Elise at the other end.

Wave A	Wave B

a. Draw in the space above **<u>two</u>** possible types of waves that Elise can produce with the slinky spring. (2)

b. Draw arrows to show how she moves her hands to produce each type of wave. (2)

c. Name each type of wave.

Wave A - ________________________ Wave B - ________________________ (2)

d. Complete the following:

i. Sound waves are ________________ ii. Water waves are ________________ (2)

e. Sound waves travel with a speed of 330 m/s and have a wavelength of 2 m. Calculate the frequency of these waves.

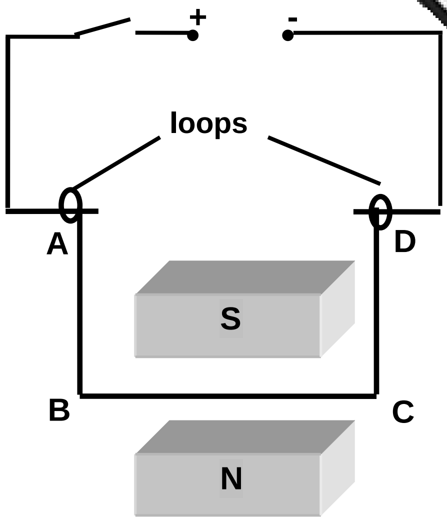
____ (2)

Section B. This section has 5 questions. Each question carries 20 marks.

(Total 1

8. ***This question is about the motor effect of an electric current.***

The figure represents a circuit connected to a metal swing ABCD. This metal swing can move freely.



a. Draw an arrow on the wire BC to show the direction of the current when the switch is closed. (1)

b. Draw **magnetic field lines** between the poles of the magnet. (2)

c. i. State what happens **<u>around</u>** the wire in the circuit when the switch is closed.

_______________________________________ (1)

ii. **<u>Underline</u>** the instrument that can be used to test the presence of the answer you mentioned in **c (i**).

(voltmeter, plotting compass, ammeter, stopwatch) (1)

d. When the switch is closed, the wire BC experiences a force.

i. **<u>Underline</u>** the correct answer:

This force acts (*out of the page towards you* / *inside the page away from you*). (2)

ii. Which rule did you use to find the answer in **d (i**) ?

____ (2)

iii. State **<u>two</u>** ways to increase the size of this force.

____ (2)

e. Richard varies the current flowing in the circuit and records the size of the force as shown in the table below.

Force F / N	0	0.5	1.0	1.5	2.0
Current I / A	0	0.2	0.4	0.6	0.8

i. Plot a graph of the force F (y-axis) against the current I (x-axis). (5)

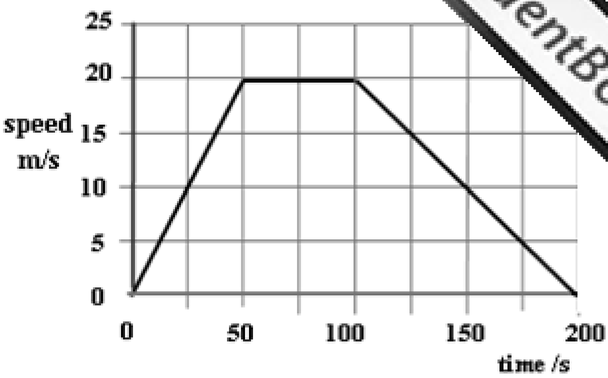
ii. From the graph it can be concluded that the Force and Current are __________________ proportional. (2)

iii. Use your graph to find the value of the current that produces a force of 2.5 N.

____ (2)

9. ***This question is about linear motion.***

Kimberly drives her car on a journey. The graph shows how the **speed** of the car changes throughout the whole journey.



a. Use the graph to determine:

i. the **speed** while she drives at constant speed. ______________ (2)

ii. the **time** Kimberly takes to decelerate, ______________ (2)

iii. the **acceleration** during the first part of her journey.

____

____

(3)

b. Use the graph to calculate:

i. the **distance** covered by Kimberly during the first **50 s** of her journey,

____

(3)

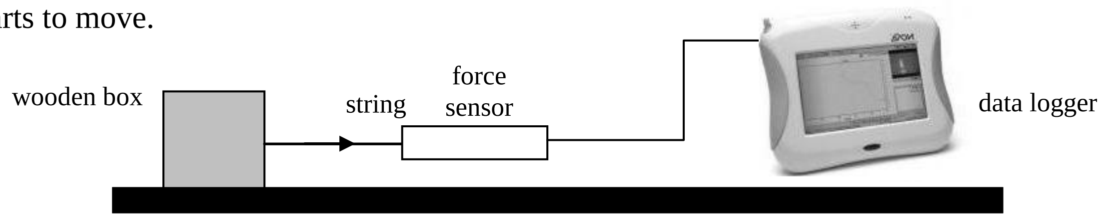
ii. the **total distance** covered during the whole journey,

____

____

(4)

c. Andrew investigates whether the **force** required to move an object at rest depends on the **mass** of the object. He is given a number of boxes, a string, a force sensor and a data logger. He attaches a string to a force sensor which is connected to a data logger and pulls the box until it starts to move.



i. Write down the following steps in order.

	No.
A graph of mass of boxes against force is plotted.	
The smallest force to make the box move is recorded.	
The apparatus is set up as shown above.	1
The experiment is repeated a few times, each time taking note of the mass of the boxes and the force required to move them.	
A box of known mass is pulled by the string attached to the force sensor.	

(4)

ii. **Underline** the correct answer:

The **force** required to move an object (*increases / decreases / remains the same*) as the **mass** of the object increases. (2)

10. ***This question is about radioactivity.***

a. Complete the following statements:

i. Proton number **Z** is the number of __________ in the nucleus of an atom. (1)

ii. Nucleon number **A** is the number of protons and __________ in the nucleus of an atom. (1)

b. Carbon-14 and carbon-12 are isotopes.

i. Explain the term **isotopes**. ____

____ (2)

ii. The proton number of carbon-12 is 6. **Fill in** the following symbol of carbon-12 by writing its proton and nucleon number. $^{\_\_}_{\_\_}\mathrm{C}$ (2)

c. A student observed that with the appropriate instruments a reading is obtained even though a radioactive source is not present.

i. This count is due to ____________________ radiation. (1)

ii. Name **<u>two</u>** sources of this radiation.

____ (2)

iii. Name the instrument used to **detect** this radiation rate.

____ (2)

d. Paula and Andrea set up the necessary apparatus to find the ***half-life*** of an unknown radioactive substance **X**. They notice that at the beginning of the experiment the apparatus gives a count of 16 counts per minute. When **X** is brought near the apparatus the count rate increases to 816 counts per minute.

i. What is the count rate due to the radioactive substance **X** only? ____________________ (1)

ii. Explain the term '***half-life***'.

____ (2)

iii. After 5 minutes the count rate, due to the radioactive substance only, drops to 400 counts per minute. Find its ***half-life***.

____ (2)

iv. What would be the count rate, due to the radioactive substance only, after 10 minutes?

____ (2)

v. Give the **<u>total</u>** count rate given by the apparatus after 10 minutes.

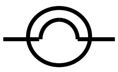
____ (2)

11. ***This question is about Ohm's Law.***

a. **Complete** the following: Ohm's law states that the ____________ flowing through a wire is directly proportional to the ____________ across it, provided that the ________________ remains constant. (3)

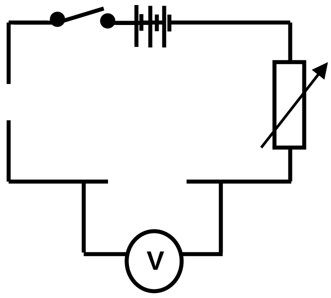
b. Malcolm and Simone set up an experiment to investigate whether a **filament lamp** obeys Ohm's law. Two electrical components are left out as shown below.

i. **Write** the name of the two electrical components drawn below:

 __________________ 

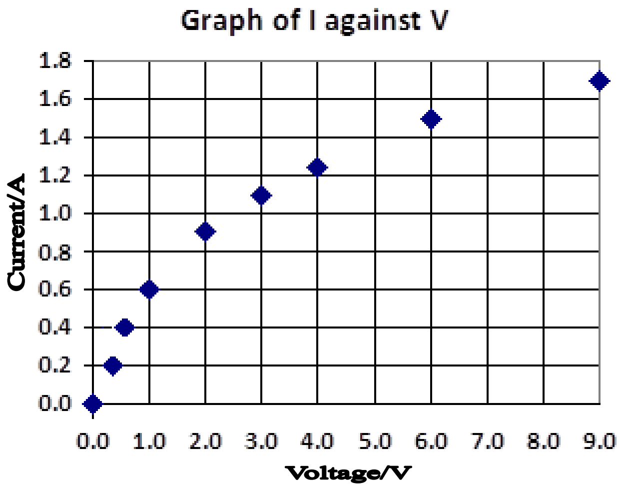
____

(2)



ii. **Draw** the above electrical components in their correct positions in the circuit. (2)

c. Malcolm and Simone plot the points on a graph grid as shown below.



i. Draw the **best smooth curve** through the plotted points on the graph grid. (1)

Use the graph to find:

ii. the **voltage** across the filament lamp when a current of **1.5 A** flows through it, ______ (1)

iii. the **current** flowing through the lamp when the voltage across it is **5 V**, ______ (1)

iv. the **resistance** of the filament lamp at a voltage of 9 V using V = I R.

____

____

(3)

v. **Underline** the correct answer:
From the graph or otherwise one can conclude that the resistance of the filament lamp (*changes / remains the same size*). (1)

vi. Does the filament lamp obey Ohm's law? __________________ (2)

d. Malcolm notes that when the voltage across the filament lamp is set to a **high** [...] lamp turns off.

i. What may happen to the filament of the lamp when this high voltage is applied ac[...] it?

(2)

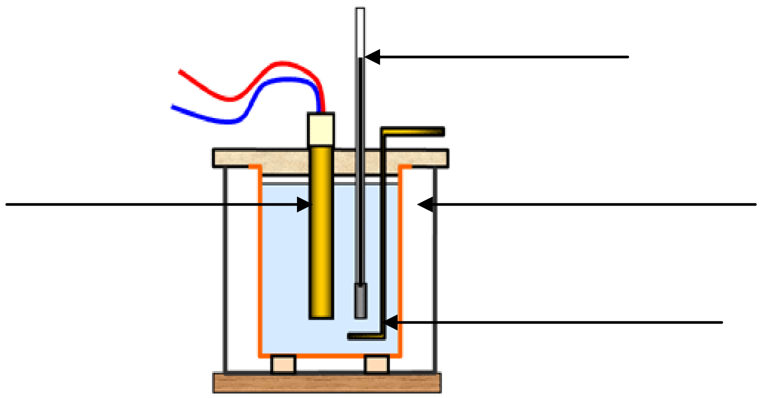
ii. State what happens to the size of the current flowing through the filament lamp when a high voltage is applied across it.

(2)

12. ***This question is about energy.***

Julia and Mario set up an experiment to find the **specific heat capacity** of orange juice.

a. They use the following set up to carry out their investigation:



i. **<u>Label</u>** the diagram of the experimental setup. (4)

ii. What are the **<u>three</u>** measurements Julia and Mario need in order to determine the specific heat capacity of orange juice?

(3)

iii. Which of the above apparatus will they use to ensure that the heat supplied by the immersion heater is evenly distributed throughout all the orange juice?

(1)

iv. Write **<u>one</u>** precaution that they need to take during this investigation.

(2)

b. A block of lead of mass 5 kg is dropped from a height of 8 m. Calculate:

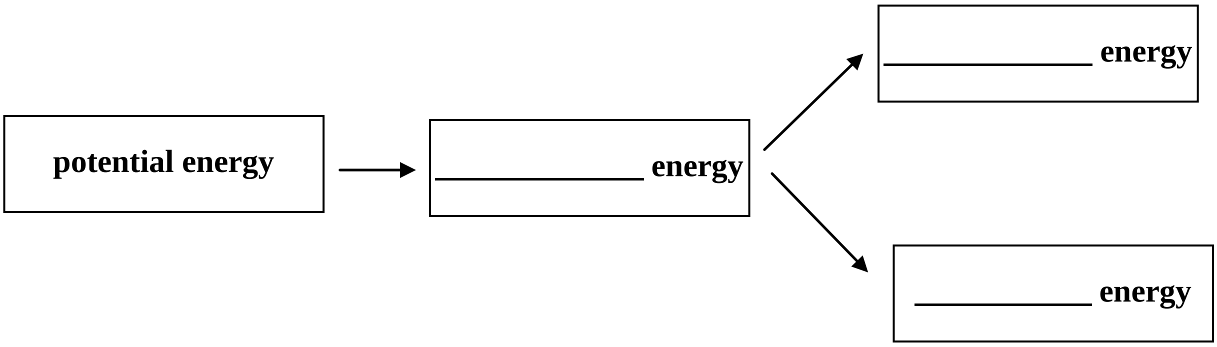
i. the initial **potential energy** of the lead block at the top,

____ (2)

ii. the **kinetic energy** of the lead block just before it touches the ground, assuming no air resistance.

____ (2)

iii. Complete the following energy flow diagram showing the energy changes when the lead block falls through a height of 8 m and hits the ground, assuming no air resistance.



(3)

c. When the lead block of mass 5 kg hits the ground, its temperature increases by 0.5 ^{o}C. Using the formula, $Q = m\ c\ \Delta\theta$, calculate the increase in energy of the lead block given that the specific heat capacity of lead is 130 J/kg ^{o}C.

____

____

____ (3)