SECONDARY SCHOOL ANNUAL EXAMINATIONS 2010

Directorate for Quality and Standards in Education
Educational Assessment Unit

FORM 5 | **Physics** | **TIME: 1h 45min**

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.

Equations for Annual Exam Physics

Density	$m = \rho V$	
Pressure	$P = h \rho g$	$P = F/A$
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$
	$E \text{ (or } W) = P t$	$W \text{ (or WD)} = F s$
Force	$F = m a$	$W = m g$
Motion	$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$	$v = u + a t$
	$s = \frac{(u + v) t}{2}$	$s = \frac{1}{2} a t^2$
	$\text{momentum} = m v$	$h = \frac{1}{2} g t^2$
Electricity	$Q = I t$	$W = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$P = I V = I^2 R = \frac{V^2}{R}$	$R \alpha \frac{\text{length}}{\text{area}}$
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$	
Heat	$H = m c \Delta\theta$	
Waves and Optics	$c = f \lambda$	$m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	Theory	Practical	Total
Max. Mark	8	8	8	8	8	15	15	15	85	15	100
Score											

Section A. **This Section carries 40 marks**

1. The driver of a car of mass 1200 kg, travelling in a straight line at 20 m/s requires 16m as 'thinking distance' and 34 m as 'braking distance' to stop the car.

a. Explain:

i. thinking distance, **1**

ii. braking distance. **1**

b. Calculate the:

i. total stopping distance of the car, **1**

ii. kinetic energy in J of the car when travelling at 20m/s, **1**

iii. momentum of the car in kgm/s just before braking, **1**

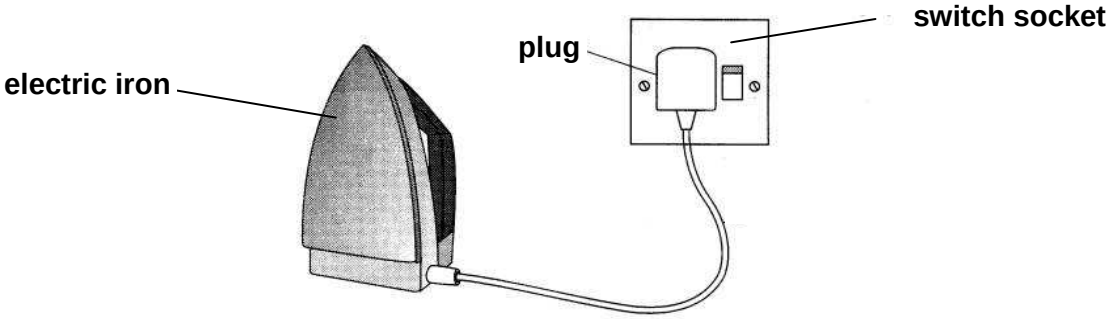
iv. momentum of the car in kgm/s when it comes to rest, **1**

v. average braking force in N given that the braking time is 3.4 s. **1**

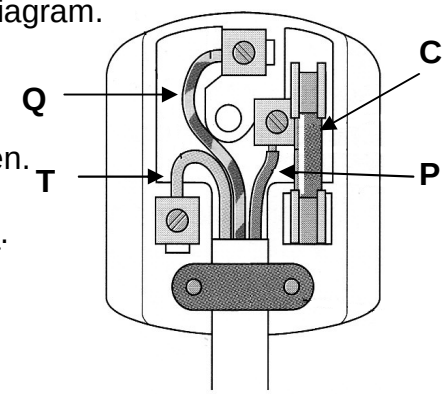
c. Explain why the use of a mobile phone while driving is not advisable? **1**

2. André-Marie Ampère (20 January 1775 – 10 June 1836), was a French physicist and mathematician. The SI unit of measurement of electric current, the ampere, is named after him.

The figure below shows an electric iron connected to the mains supply.



a. The top cover of the plug is removed as shown in this diagram.



i. P is the _____ wire and its colour is brown. **1**

ii. Q is the _____ and its colour is yellow-green. **1**

iii. T is the neutral wire and its colour is _____. **1**

iv. C is the _____. **1**

b. The heating element of the electric iron has a power rating of 1920 W when used on a 240 V supply. Calculate the:

i. current flowing through the heating element in Amps (A). **1**

ii. resistance of the heating element in Ohms (Ω). **1**

iii. number of kWh consumed when the iron is turned on for 45 minutes. **2**

3. The electromagnetic spectrum consists of a number of different radiations each with its own particular properties and uses.

a. **i.** What type of wave are **ALL** the radiations of the electromagnetic spectrum made up of? **1**

ii. State why sound energy is **NOT** a member of the electromagnetic spectrum. **1**

b. Complete the table below by naming the radiation having the particular distinguishing property described.

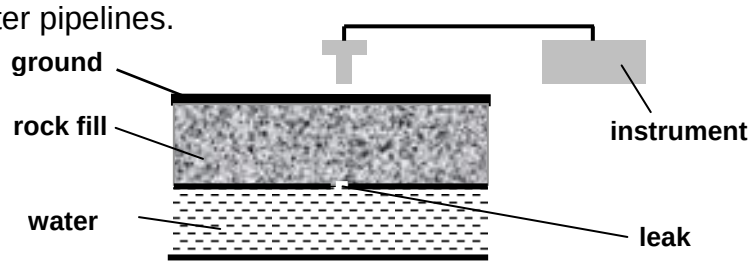
	Property	Radiation	
i.	detected by the eye		**1**
ii.	causes sun-tanning of the skin		**1**
iii.	emitted by decaying nuclei		**1**
iv.	used to detect broken bones		**1**

c. A radio station transmits at a frequency of 95 MHz.

i. Give the frequency of transmission in Hz. **1**

ii. Calculate the wavelength of these radio waves in metres given that their velocity is 3×10^8 m/s (300 000 000 m/s). **1**

4. Cobalt-60, which emits gamma radiation, is used to detect leakage points in long underground water pipelines.



a. Name the instrument used to measure radioactivity. **1**

b. The symbol for Cobalt 60 is $^{60}_{27}Co$. Give the value of the:

i. proton number Z of cobalt, _____ **1**

ii. mass number A of Cobalt, _____ **1**

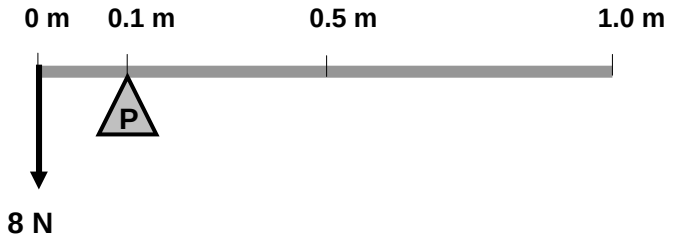
iii. the neutron number N of Cobalt. _____ **1**

c. Name the **<u>two</u>** other radiations given out by decaying nuclei of other radioactive substances. **2**

d. State **<u>one</u>** advantage of detecting leakage points in this way. **1**

e. Give **<u>one</u>** precaution taken when handling gamma radiation. **1**

5. The figure below shows a uniform metal meter ruler, of weight W, balanced at the 0.1 m mark when a load of 8 N is placed at the 0 m mark.



a. **i.** Mark with an '**X**' the position of the centre of gravity of the uniform metal ruler. **1**

ii. Indicate by means of an arrow the weight W of the uniform ruler. **1**

b. Calculate the:

i. anticlockwise turning effect in Nm of the 8 N force about the pivot P, **1**

ii. weight W in N of the uniform metal ruler, **1**

iii. reaction R in N at the pivot P. **1**

c. A pile of 50 similar metal meter rulers rest on a concrete floor of a store covering an area of 0.08 m^2. Calculate the:

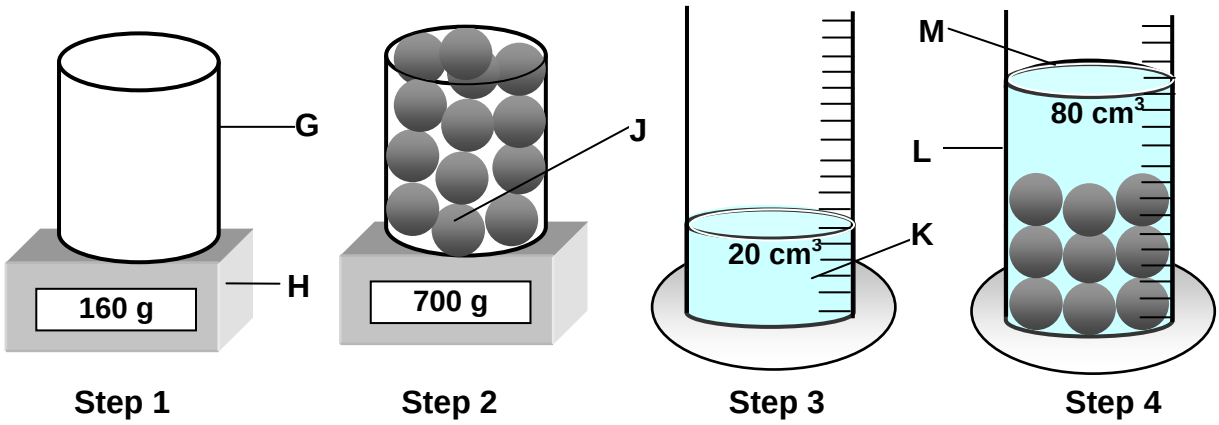
i. total weight of the pile in N, **1**

ii. pressure the pile exerts on the concrete floor. **2**

Section B. **This section carries 45 marks**

6. This question is about finding the density of nickel.

Andrew and Martha are required to find the density of nickel through an appropriate experiment using 100 nickel ball bearings. They set up the apparatus as shown in the diagram below.



a. Fill in the missing labels G, H, J, L and M in the following table as shown for label K which has been completed for you.

No.	Letter	Label	
	K	water	
i.	G		1
ii.	H		1
iii.	J		1
iv.	L		1
v	M		1

b. Complete using the data from diagram:

i. Mass of empty container in step 1 = _____ g **1**

ii. Mass of container and the100 nickel ball bearings in step 2 = _____ g **1**

iii. Therefore mass of the 100 nickel ball bearings = _____ g **2**

c. Complete using the data from diagram:

i. Volume of liquid in the container in step 3 = _____ cm^3 **1**

ii. Volume of liquid and the100 nickel ball bearings in step 4 = _____ cm^3 **1**

iii. Therefore volume of the100 nickel ball bearings = _____ cm^3 **2**

d. Calculate the density of nickel in g/cm^3 **1**

e. State **from where** Andrew and Martha can check whether the value obtained for the density of nickel through their experiment is within limits of experimental error. **1**

7. This question is about specific heat capacity of stainless steel.

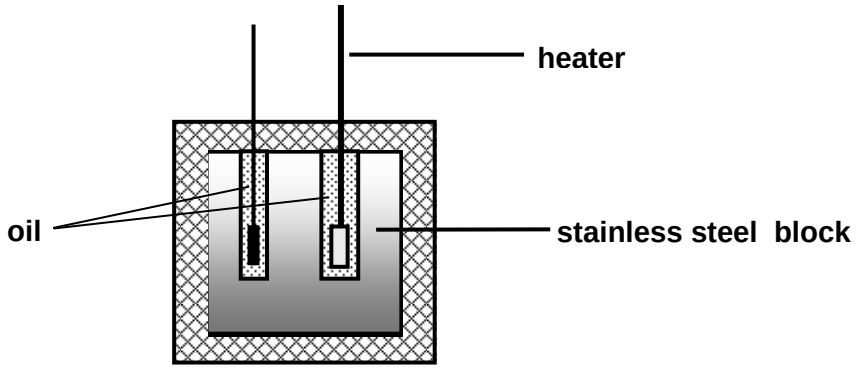
a. The following is a list of quantities and units in Physics.

current; heat; temperature; 1 kg; 1 g; 1℃; 2 ℃ .

Complete the following sentence using the appropriate words from the list above. **3**

The specific heat capacity of stainless steel is the _____ required to raise the temperature of _____ of stainless steel by _____.

b. The diagram below represents the experimental set-up to find the specific heat capacity of stainless steel.



i. On the diagram label
- thermometer, and
- lagging. **2**

ii. Why is the use of lagging material important? **1**

c. The table below shows the temperature changes of a well-lagged stainless steel block as it is heated through 20℃ above room temp erature. The lagging is assumed to be 100% efficient.

Temperature θ / ℃	20	25	30	35	40
Heat supplied Q / J	0	5000	10000	15000	20000

4

Plot a graph of temperature (y-axis) against heat supplies (x-axis) on the graph paper provided.

d. From your graph determine the:

i. room temperature, _____℃. **1**

ii. rise in temperature when the stainless steel block is 35℃, _____℃. **1**

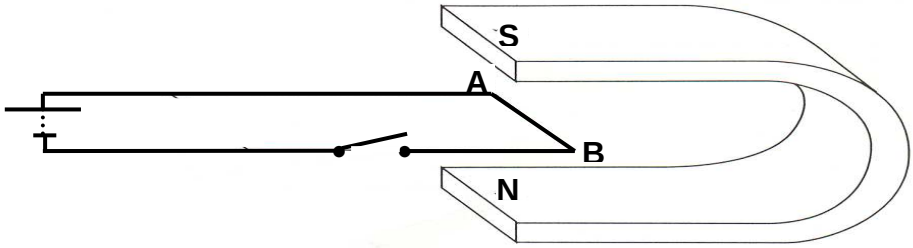
iii. heat supplied in Joules when the temperature of the stainless steel block rises from room temperature to 35 ℃. _____ **1**

e. The mass of the stainless steel block is 2 kg. Calculate the specific heat capacity of stainless steel using the equation: **2**

$$\textit{specific heat capacity} = \frac{\textit{heat supplied}}{\textit{mass} \times \textit{change in temperature}}$$

8. This question is about magnetic fields and the motor effect of current.

A length of wire AB is placed between the poles of a C-shaped magnet as shown in the diagram below.



a. On the above circuit diagram:

i. mark using the letter **X** the switch in the circuit, **1**

ii. mark with a **+** the positive terminal of the battery, **1**

iii. indicate with a **–** the negative terminal of the battery, **1**

iv. mark by means of an arrow the direction of current flow **along AB** when the switch is closed. **1**

b. When the current is turned on, wire AB of the circuit experiences a force.

i. Show by means of an arrow marked **F** the direction of this force. **2**

ii. Which rule helps you to determine the direction of this force? **1**

iii. Give **one** use of this motor effect. _____ **1**

c. State how current direction through the circuit can be reversed. **1**

d. What effect does reversing current direction have on the:

i. size of the force, **2**

ii. direction of the force? **1**

e. What effect does inverting the poles of the magnet have on the direction of the force? **1**

f. Give **two** ways how the size of the force on the wire AB could be increased. **2**