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

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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.

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

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 (70 marks).

1. a. Underline the appropriate word:

i. A (scalar / vector) is a physical quantity having **size and direction**. (1)

ii. A (scalar / vector) is a physical quantity having **size only**. (1)

b. Ian walks from home to the supermarket at an average velocity of 0.75 m/s for 2 minutes. Calculate:

i. the number of seconds in 2 minutes ________________________________

(2)

ii. the distance between Ian's home and the supermarket.

____

____

(2)

c. Ian takes the same time to return home from the supermarket.

i. Does his average **speed** change? ________ (1)

ii Does his average **velocity** change? ________ (1)

iii. Explain your answers to questions (i) and (ii) above.

____

____

(2)

2. According to the Kinetic Theory, all matter is made up of particles. Complete:

a. i. The three states of matter are _____________, _____________ and _____________.

ii. The particles that make up all matter have _____________ energy and are moving all the time.

iii. The energy of the particles decreases as the temperature _____________. (6)

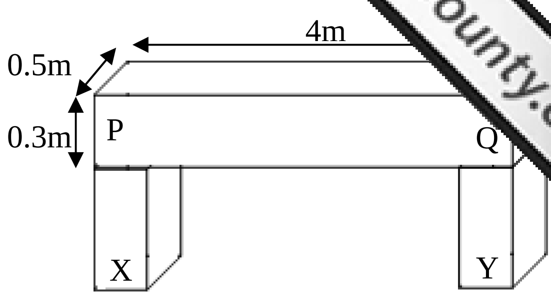
b. i. An iron bar expands when it is _______________.

ii. An iron bar contracts when it is _______________. (2)

c. **Underline** the correct word within the brackets in the following sentence:

(Evaporation / Expansion) is the change of a liquid from its liquid state to the gaseous or vapour state without reaching its (melting point / boiling point). (2)

3. The figure represents a uniform concrete beam PQ resting on two **identical** suppo



a. Mark on the diagram with a letter 'C', the centre of gravity of the beam PQ. (1)

b. Calculate the:

i. volume of the concrete beam PQ

____

(2)

ii. density of the concrete beam PQ given that its mass is 1440 kg

____

(2)

c. i. The weight of the beam PQ carried by <u>each</u> support is 7200 N. Calculate the total weight of the beam PQ. ____

(2)

ii. The total area of contact between the beam and the supports is 0.4 m^2. Calculate the total pressure exerted by the concrete beam on these supports.

____

____

(3)

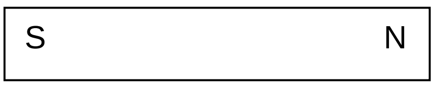
4. Magnets are made up of magnetic materials.

a. i. Magnetic materials are _______________ by both poles of a magnet.

ii. Two common magnetic materials are _____________ and _____________.

(3)

b. Draw the magnetic field around a bar magnet.



(3)

c. The figure below shows a plotting compass.

i. In which direction does a plotting compass point?

____

(2)

ii. Mention **one** use of the plotting compass.

____

(2)

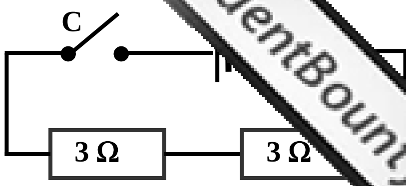


Diagram 1

5. **Diagram 1** shows two resistors connected in series.

a. Name the:

i. meter used to read the p.d. across the resistors _______________

ii. meter used to read the current flowing through the circuit _______________

iii. electrical component C. _______________ (3)

b. Calculate the:

i. total resistance of the circuit ____ (1)

ii. current which flows through the circuit

____

____ (2)

iii. total power of the circuit.

____

____ (2)

c. Calculate the total resistance in the circuit shown in **Diagram 2.** Show your working.

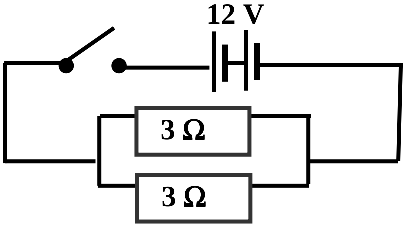


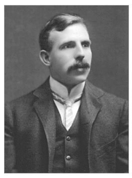
Diagram 2

____

____

____ (2)

6. Ernest Rutherford (1871-1937) is considered to be the father of nuclear physics. Particles named by him include the alpha particle, the beta particle and the proton.



a. Complete the following:

i. Proton number is the number of protons in the _____________ of an atom.

ii. Nucleon number is the number of ___________ and ___________ in the nucleus of an atom.

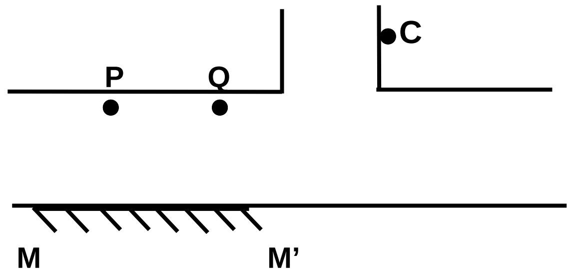
iii. $^{238}_{92}U$ and $^{235}_{92}U$ are called _____________. (4)

b. Complete the following table.

	Number of protons	*Number of neutrons*	*Number of electrons*
$^{238}_{92}U$			
$^{235}_{92}U$			

(6)

7. The diagram below shows a sign **C** in the corridors of a clinic. Petra can see the image of the sign **C** in the plane mirror MM' from P but Andrea cannot see it from Q.



a. i. On the above diagram draw a ray from C which reaches P after reflection at the plane mirror. (2)

ii. Draw the Normal at the plane mirror. (1)

iii. What can be said about the size of the angle of incidence and the angle of reflection?

____ (1)

b. On the above diagram, draw a ray diagram to show the position of the **image** of the sign **C.** (2)

c. What can be said about the:

i. image distance and the object distance of the sign C?

____ (1)

ii. type of image produced? ____________________ (1)

d. Why does Petra find it difficult to read the sign?

____ (1)

e. Explain why Andrea cannot see the image of the clinic sign C from Q.

____ (1)

Section B:
This section has 5 questions. Each question carries 20 marks (100 marks).

8. This question is about the relationship between mass and weight.

Mark and Nathalie set up an experiment to find the relationship between mass and weight.

a. Describe **briefly** how Nathalie finds the mass of an amount of water.

(4)

b. Mark and Nathalie present the data in the table below.

m / kg	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
W / N	0		9.8	14.7	19.6	24.5	29.4	34.3

i. Plot a graph of weight **W** in N (y axis) against the mass **m** in kg (x axis). (6)

ii. Use your graph (or otherwise) to complete the missing value in the table.

(2)

c. The gradient of the graph gives the acceleration due to gravity **g**. Find the value of **g**.

(4)

d. Use your graph to describe the relationship between mass and weight. Explain.

(2)

e. Explain why **weight** is plotted on the y axis and not on the x axis.

(2)

9. This question is about the Earth and the Universe.

a. Complete the following:

i. A natural mass in outer _____________ is referred to as a celestial body.

ii. The three main types of celestial bodies are Stars, _____________ and _____________.

iii. The force keeping the planets in orbit around the Sun is the pull of _____________ provided by the ______________. (5)

b. Name:

i. a star ________________

ii. the natural satellite of the Earth ________________

iii. a celestial body orbiting the Sun. ________________

(3)

c. On August 24th 2006 the General Assembly of the International Astronomical Union defined a planet as a celestial body which orbits the Sun; it is nearly round and has its orbit free of other masses.

i. How many major planets orbit the sun in our solar system? ________________

ii. Name the celestial body in our solar system, which recently has no longer been classified as a major planet. ________________

iii. This celestial body is now classified as a ________________ planet.

iv. Why is this celestial body no longer classified as a major planet?

____

(5)

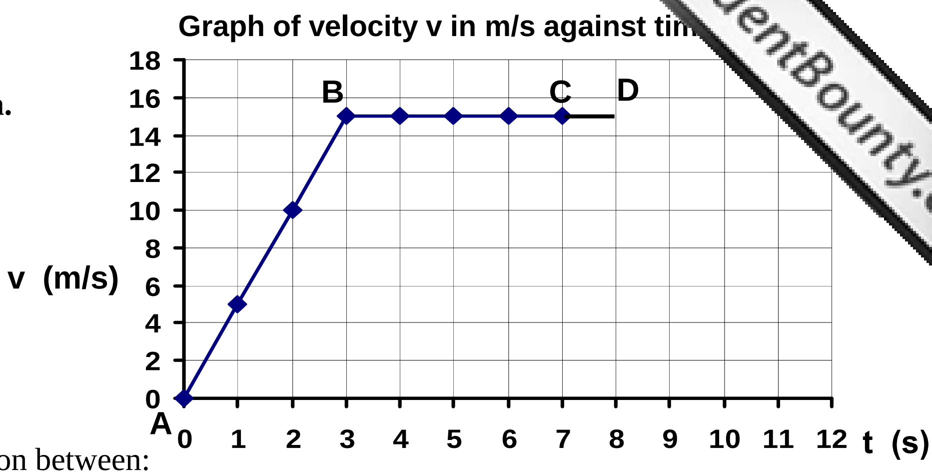
d. Say whether each of the following statements is True or False.

No.	Statement	True / False
i.	The Earth spins on its own axis once every 12 hours.	
ii	Only half of the Earth faces the Sun at any one time.	
iii	The universe is made up of a number of galaxies.	
iv	The Sun is one of the millions of stars in the Milky Way galaxy.	
v	The force of attraction between two planets increases as the distance between the planets decreases.	
vi	All parts of Earth have the same season at the same time of the year.	
vii	The Sun orbits the Earth.	

(7)

10. This question is about motion and momentum.

The velocity/time graph shows part of Claudia's car journey from the hospital to home.



a. Describe Claudia's motion between:

i. A and B ______________________ ii. B and C ______________________

(2)

b. Point C on the graph shows the point at which Claudia sees the traffic lights turn orange. She applies the brakes with a constant force F. Her reaction time is 1s.

i. Explain the term 'reaction time'.

____

(2)

ii. The reaction time of a young healthy person is approximately 0.7 s. Give **one** reason why Claudia's reaction time is actually longer.

____

(1)

c. Claudia's car decelerates uniformly for 4 s coming to a stop as the traffic lights turn red. Complete the graph to show Claudia's velocity during braking time. (2)

d. Calculate the:

i. distance covered during reaction time (from C to D)

____

(2)

ii. braking distance

____

(2)

iii. total stopping distance.

____

(1)

e. The total mass of Claudia and her car is 1000 kg. Use the graph to find the:

i. total momentum of the car and its driver at A

____

(2)

ii. total momentum of the car and its driver at B

____

(2)

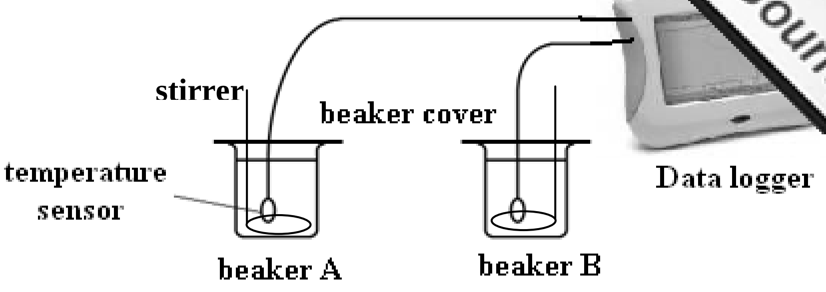
iii. resultant force acting on the car during deceleration.

____

____ (4)

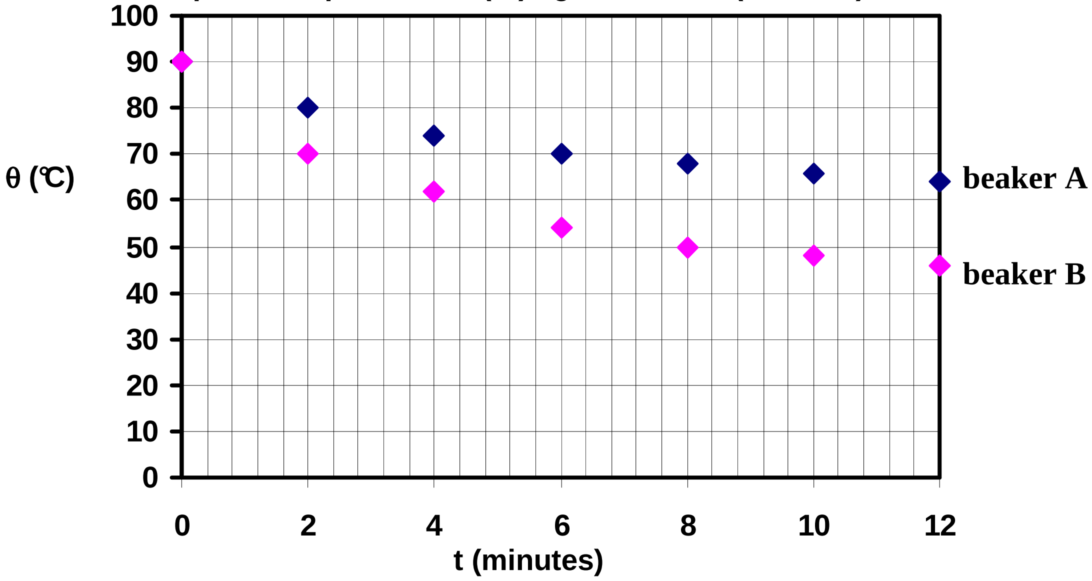
11. This question is about heat transfer.

Joseph investigates the heat loss from two metal beakers, A and B. The beakers are identical except for the outside colour.



a. Joseph pours equal volumes of hot water into the two beakers. He inserts the temperature sensors in the water through the small hole in the lids.

Graph of temperature θ (℃) against time t (minutes)



i. Draw the best smooth curves for beaker A and beaker B. (2)

ii. What is the initial temperature of the water? ________________ (1)

iii. Fill in the table below:

	Temp. **after** the first two minutes / ^{o}C	Temp. **drop** for the first two minutes / ^{o}C
Beaker A		
Beaker B		

(4)

iv. Calculate the quantity of heat lost when the temperature of 0.5 kg of water changes from $70^{o}C$ to $65^{o}C$, given that the specific heat capacity of water is 4200 J/kg^{o}C.

____

____

(3)

b. Name **two** advantages of using a temperature sensor rather than a glass thermometer.

____

____

(2)

c. One of the metal beakers is painted black and the other is painted silver.

i. Which beaker, A or B, is coloured black? __________

ii. Give **one** reason for your answer. ____

iii. Name the **two** main processes through which heat is lost by the water in the covered, black painted beaker. _______________ and _______________

iv. Name the **other** process through which heat energy is also lost by the water in both beakers when **not** covered. _______________ (6)

d. When the investigation is over Joseph notes that the temperature of the water in each beaker is 20°C. An hour later he takes the temperature of the water in both beakers again and finds that it is still 20°C. Explain why there is no further temperature drop.

____

____ (2)

12. This question is about the magnetic effect of current flowing through a solenoid.

a. Robert and Sharon set up an experiment to investigate how the strength of the magnetic field varies with the number of turns of wire. They are provided with the following apparatus:

> *a 12 V d.c. supply; five iron core solenoids labelled A, B, C, D and E having 500, 1000, 1500, 2000 and 2500 turns respectively; an ammeter, a variable resistor, a switch, connecting wire, iron nails in a small plastic dish, wooden stand and clamp*

Explain how they should carry out this investigation. Your answer should include:

i. a labelled diagram of the experimental setup

(4)

ii. a brief account of how the investigation is carried out

____

____

____

____ (4)

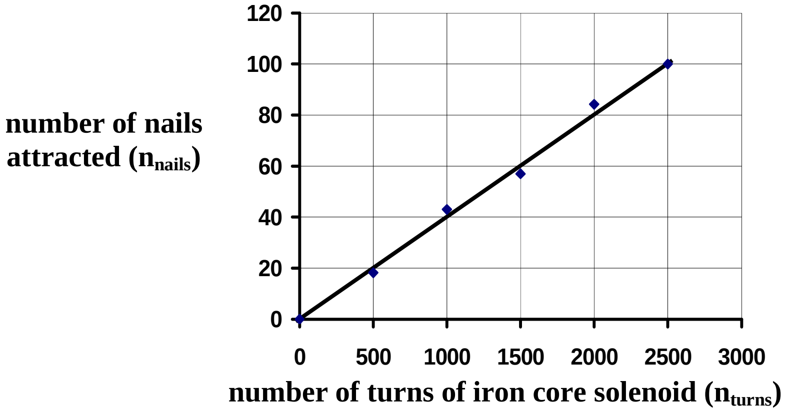
iii. **one** physical quantity which must remain constant during this investigation

iv. **two** precautions that they need to take during this investigation.

(2)

b. They use the results recorded in the table to obtain the best straight line graph shown below:

Graph of number of nails attracted (n_{nails}) against number of turns of solenoid (n_{turns})



i. Describe the relationship between the number of turns of wire of an iron core solenoid and the strength of the magnetic field set up around the solenoid.

(2)

ii. Use the above graph to predict the number of nails that will be attracted by an iron core solenoid of 3000 turns using the same circuit as the other five iron core solenoids.

(2)

iii. Describe the effect on the magnetic field when the iron core is removed from the solenoid.

(2)

iv. Name one **other** physical quantity affecting the strength of the magnetic field.

(2)