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	$Average\ speed = \dfrac{total\ distance}{total\ time}$	$v = u + at$ $s = ut + \frac{1}{2} at^2$ $v^2 = u^2 + 2as$ $s = \dfrac{(u + v) t}{2}$
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	$v = f \lambda \qquad f = \dfrac{1}{T}$ $\eta = \dfrac{real\ depth}{apparent\ depth}$	$m = \dfrac{h_i}{h_o} = \dfrac{image\ distance}{object\ distance}$

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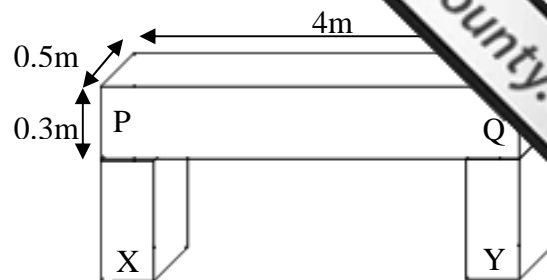
(Evaporation / Expansion) is the change of a liquid from its liquid state to the gaseous or vapour state without reaching its (melting point / boiling point). (2)

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 m². 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.

S   N

(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)

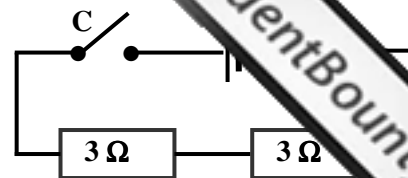**5**. **Diagram 1** shows two resistors connected in series.

Diagram 1

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.
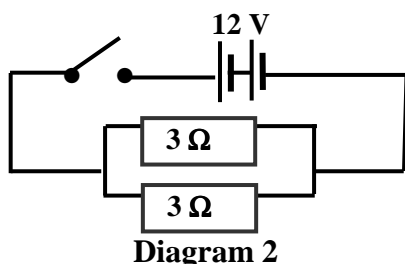

12 V

3 Ω

3 Ω

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
sign **C** in the plane mirror MM' from P but Andrea cannot see it from Q.
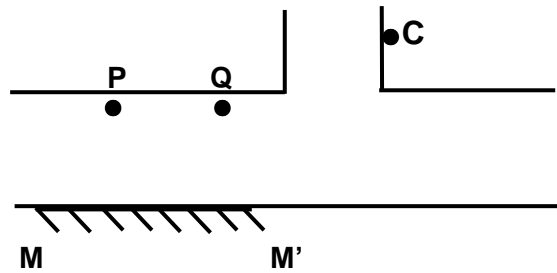
a. i. On the above diagram draw a ray from C which reaches P after reflection at the plane
mirror. (2)

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.   Draw and label **two** pieces of apparatus required to find the mass of an amount of water.

(4)

b.   Describe **three** steps how Nathalie finds the mass of an amount of water.

_____

_____

_____

_____
(3)

c.   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	5.0	10.0	15.0	20.0	25.0	30.0	35.0

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

ii.   Use your graph to find the mass of 12 N of water.   _____   (1)

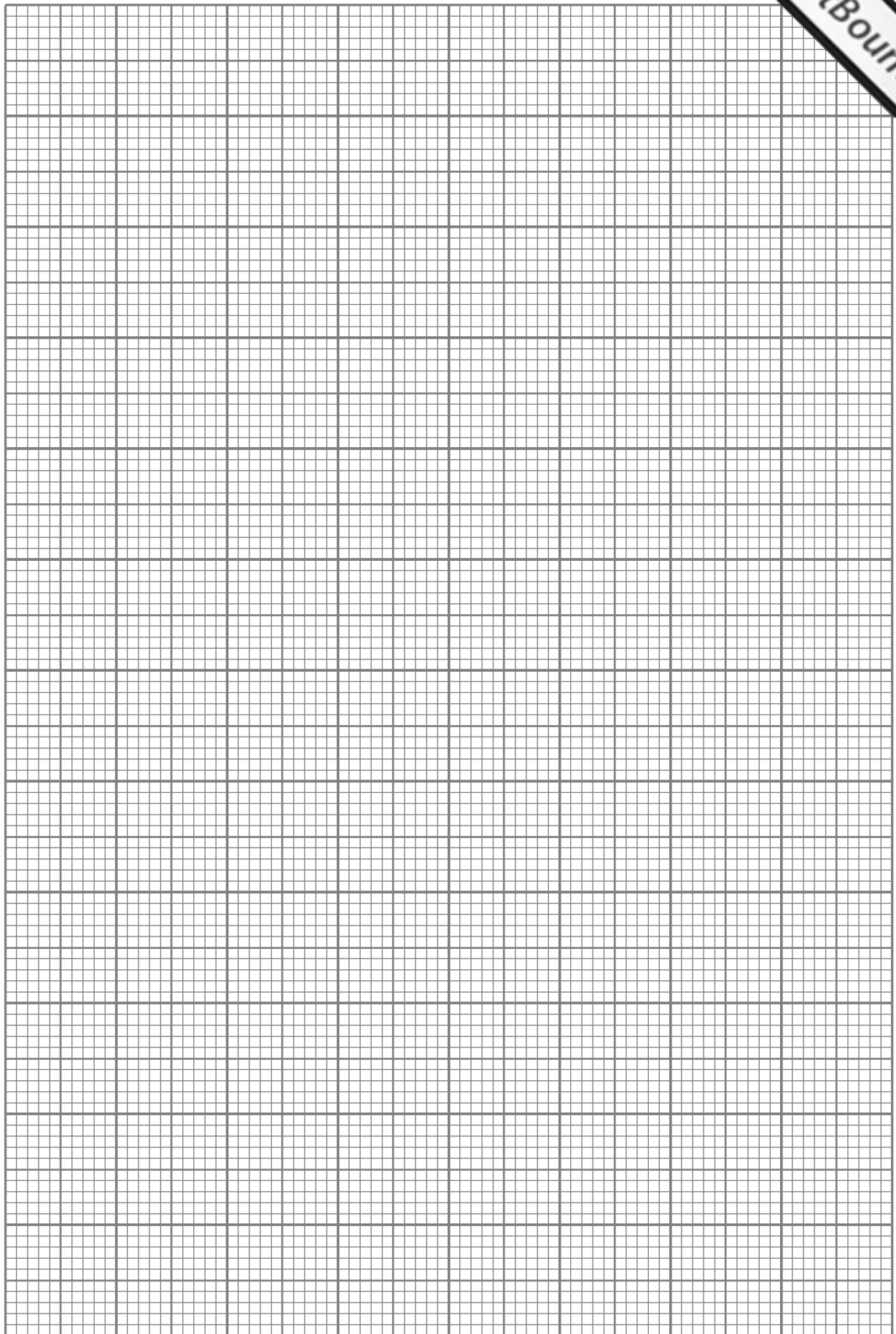d.   Use your graph to describe the relationship between mass and weight. Explain.

_____

_____
(2)

e.   The mass of an amount of water is 1.8 kg. Calculate the weight of the water.

_____

_____
(2)

f.   Is the value of 'g', the acceleration due to gravity, the same on Earth and on the Moon?
Explain.

_____
(2)

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

Complete the following by choosing one of the following terms.

| gravity, | space, | Sun, | Moon, | planets, | Earth, | solar systems, | galaxies |

a. Complete the following:

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

ii. The Universe is made up of a number of _____, which are made up of a number of _____. A solar system is made up of a Sun and a number of _____.

iii. The force keeping the planets in orbit around the sun is the pull of _____.

iv. The star of our Solar System is the _____.

v. The natural satellite of the Earth is the _____.

vi. One year on Mercury is shorter than one year on _____. (8)

b. i. How many planets orbit the sun in our solar system? _____

ii. Which planet is closest to the Sun in our solar

system? _____

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

iv. This celestial body is now classified as a _____ planet.

v. One _____ is the distance that light travels in one year. (5)
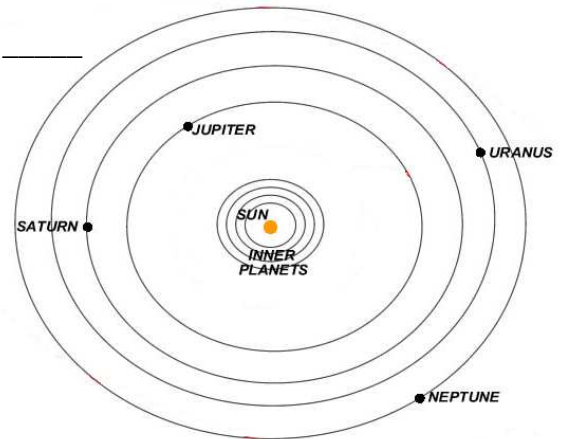
c. Say whether each of the following statements is True or False.

No.	Statement	True / False
i	The Earth spins on its own axis once every 12 hours.	
ii	At any one time, part of the Earth faces the Sun and part of the Earth is in darkness.	
iii	The instrument used to observe the sky is called a telescope.	
iv	Saturn is one of the planets that orbits the Sun.	
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.

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Graph of velocity v in m/s against

v (m/s)

t (s)
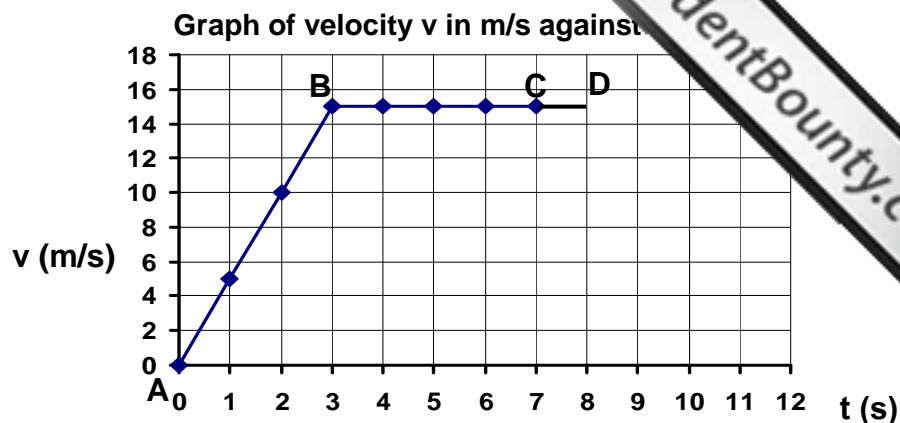
a. Use the graph to answer the following:

    i.   What is the car's velocity after 2 s?   _____

    ii.   What is the maximum velocity of the car?   _____

    iii.   How long does the car take to travel from A to B?   _____

    (3)

b. Describe the motion of the car between:

    i.   A and B _____   ii.   B and C _____

    (4)

c. 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)

d. 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)

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. (Hint: Use the formula $F = \dfrac{mv - mu}{t}$)

_____

_____

_____ (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 their outside colour.

stirrer   beaker cover

temperature
sensor

Data logger

beaker A   beaker B
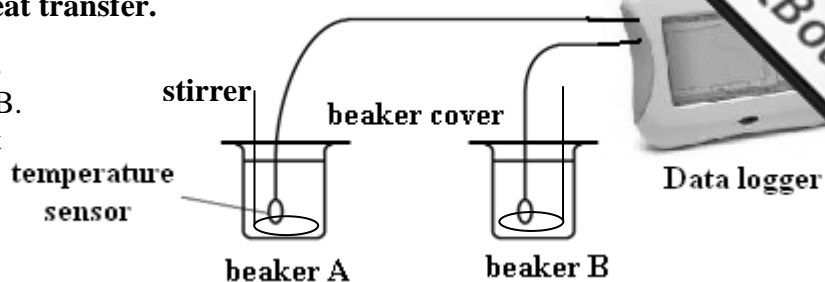
a. Joseph pours equal volumes of hot water into the two beakers. He inserts the temperature
    sensors in the water through the small hole in the **beaker covers**.

Graph of temp θ (°C) against time t (min)
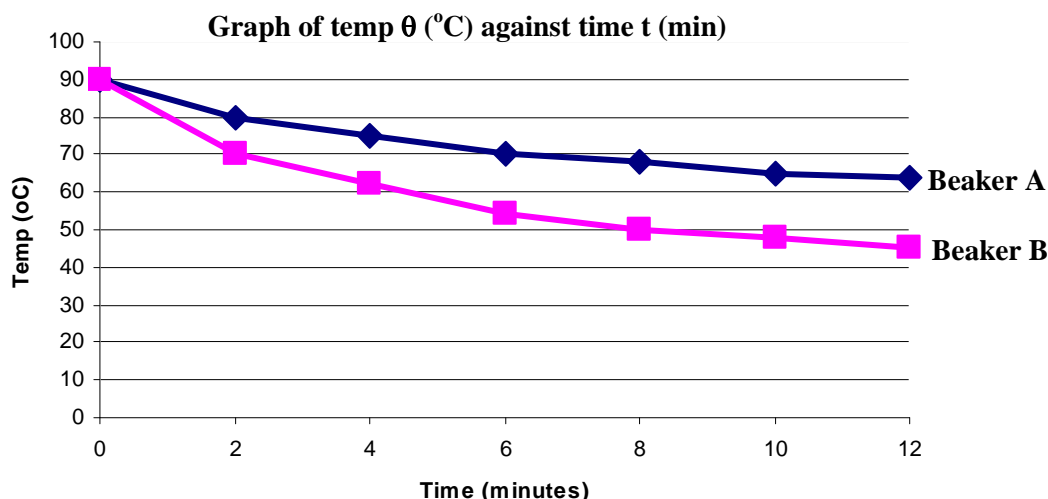
From the above graph:

i.   what was the initial temperature of the water?   _____   (1)

ii.   for how long were readings taken during the experiment?   _____   (1)

iii   what was the approximate temperature difference between the beakers at the end of the
      experiment?

_____
                                                                                (2)
iv.   which beaker (A or B) is cooler at the end of the experiment?   _____   (1)

v.   the colour of the beaker which cooled faster was _____.
                                                                                (2)
vi.   Heat was lost from the beakers by: (mark with a ✓ where appropriate):

	Yes	No
Conduction		
Convection		
Radiation		

                                                                                (3)
vii. Give **two** precautions that should be taken when performing this experiment.

_____

_____
                                                                                (2)

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

_____

_____
                                                                            (2)

c.   It was observed that after some more time, the temperature of both beakers did not change any
       more. Explain why.

_____
                                                                            (2)

d.   The temperature of 0.5 kg of water changes from 70^oC to 65^oC. Given that the specific heat
       capacity of water is 4200 J/kg^oC, calculate:

       i.   the change in temperature   _____   (1)
       ii.   the quantity of heat lost during this change.
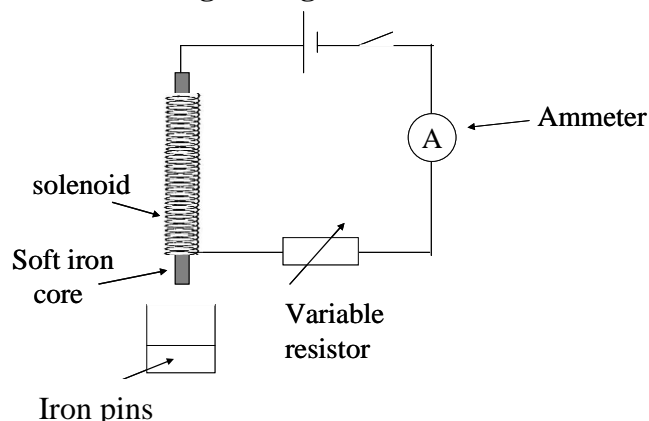
_____

_____
                                                                            (3)

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
      of an iron core solenoid.

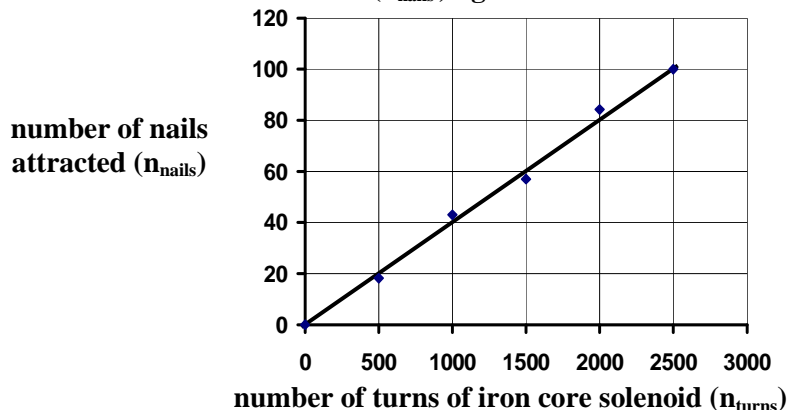   i.   Put the following statements in order. The first one is done for you.

The apparatus was set up as shown in the above diagram.	1
Experiment was repeated with more turns of wire.	
The number of pins attracted was counted.	
The number of turns of wire was counted.	
A graph of number of turns of coil against number of pins attracted was plotted.	
The switch was closed.	

                                                                            (5)

       ii.   Name **one** physical quantity which must be kept constant during this investigation.

_____
                                                                            (2)

b. They use the results recorded in the table to obtain the best straight line graph sho

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

number of nails attracted (n_{nails})

number of turns of iron core 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)

c. A transformer has 2400 turns on the primary and 120 turns on the secondary coil. The voltage across the primary circuit is 240 V.

Input   240 V   Output

2400 turns   120 turns
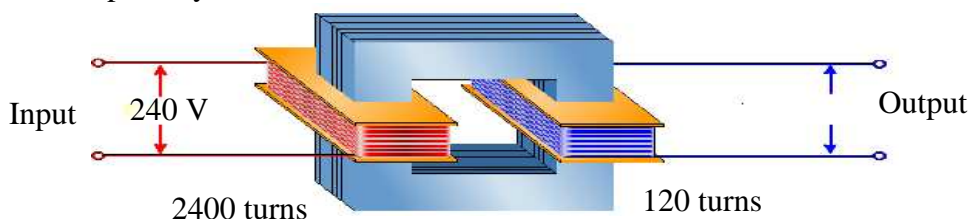
i. This transformer is a (step-up / step-down) transformer. (1)

ii. Calculate the voltage in the secondary coil, given that the transformer is 100% efficient.

_____

_____
(2)

iii. The current flowing in the secondary circuit is 1.2 A. Calculate the power in the secondary coil.

_____
(2)

iv. Give **one** reason why in practice a transformer is never 100% efficient.

_____ (2)