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

Track

FORM 3 **PHYSICS** **TIME: 1h 30min**

Name: _____ **Class:** _____

Answer all questions.
All working must be shown. The use of a calculator is allowed.
Where necessary take acceleration due to gravity g = 10 m/s^2.

You may find some of these equations useful:

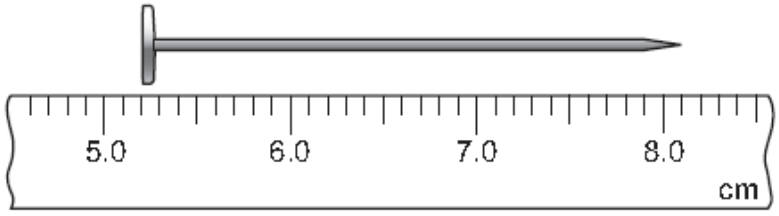
Energy and Work	W = Fs P.E. = mgh	E (or W) = Pt K.E. = ½ mv^2
Force	W = mg	Moment = force x perpendicular distance
Pressure	$P = \frac{F}{A}$	P = hρg
Heat	ρ (or D) = $\frac{m}{V}$	$\Delta Q = mc\Delta\theta$

For office use only:

Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total Mark**	**Practical Mark**	**Final Mark %**
Mark	**8**	**8**	**8**	**8**	**8**	**15**	**15**	**15**	**85**	**15**	**100**
Score											

SECTION A: Answer all questions. This section carries a total of 40 marks.

1.a. A ruler is used to measure the length of a nail.



i. What is the length of the nail in cm? _____ (1)

ii. The length of the nail in metres is _____ (1)

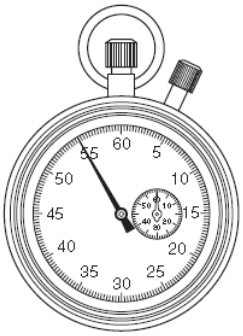


Diagram 1

b. A factory supervisor uses a seconds stopwatch to measure the time taken by a worker to pack boxes. He sets the stopwatch to zero. This time taken to pack 5 boxes is shown in Diagram 1.

i. How long did the worker take to pack 5 boxes?

_____

(1)

ii. Calculate the time required to pack 1 box.

_____

(1)

c. Diagram 2 shows two rectangular **glass** blocks.
The length and breadth of both blocks is 1cm.

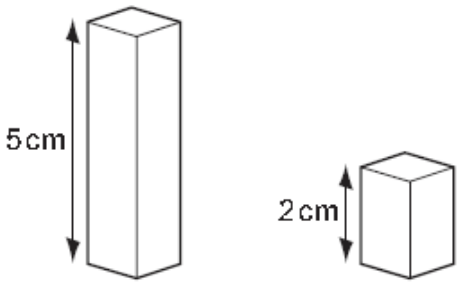


Diagram 2

i. Calculate the volume in cm^3 of the **taller** block.

_____

(1)

ii. Calculate the density of the taller block if its mass is 13.0 g.

_____

_____

(2)

iii. Is the density of the smaller glass block **larger**, **smaller** or **the same** as the larger block?

_____

(1)

2. A climber of mass 55 kg takes 40 s to reach the top of a 20 m climbing wall.

i. Calculate the weight of the climber.

_____

(2)

ii. What is the minimum upward force she exerts while climbing the wall?

_____

(1)

iii. Calculate the work done by the climber to reach the top of the wall.

_____

(2)

iv. Calculate her power during this climb.

_____

(2)

v. Explain why the climber uses chalk on her hands as she climbs the wall.

_____

(1)

3.a. Underline the correct answer in each of the following:

i. The Earth is a (planet / moon / star) orbiting the Sun.

ii. The Earth has one natural satellite called the (International Space station / Hubble telescope / moon).

iii. The Sun is at the centre of our (solar system / universe / galaxy).

iv. The nearest star to the Earth is (Sirius / Mars / the Sun).

v. The Earth spins on its axis once every (12 / 24 / 36) hours.

vi. One theory that suggests that the universe started from a big explosion is known as (Supernova / Big Bang / Nuclear bomb).

(6)

b. Complete the following:

i. One **light year** is _____

_____

(1)

ii. One **advantage** of exploring space is _____

_____

(1)

4.a. A garden pot containing soil weighs 360 N. The pot rests on three small blocks so that unwanted water can drain out of the holes in the base of the pot. The soil is uniformly distributed in the pot.

i. Draw an arrow on the diagram to represent the weight of the pot. Label it W.

(1)

ii. The area of **each** block in contact with the base of the pot is 0.0025 m^2. Calculate the total pressure, in pascals, exerted on the blocks.

_____

_____

(2)

iii. The gardener finds that the blocks sink into the ground. The water in the pot cannot drain easily out of the pot. Suggest **one** way of reducing the sinking of the pot.

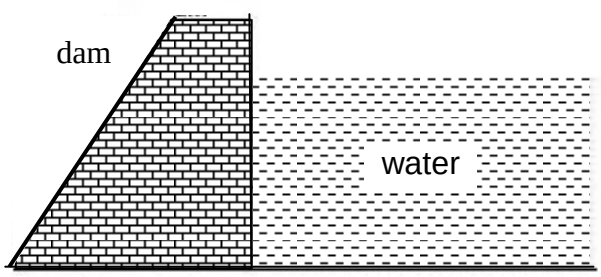
_____

_____

(2)

b. i. A dam is used to collect water. Mark with an **X** the position on the dam where the water pressure is greatest.

(1)



ii. The water is 5 m deep. Calculate the pressure exerted by the water at this depth if the density of the water is 1000 kg/m^3.

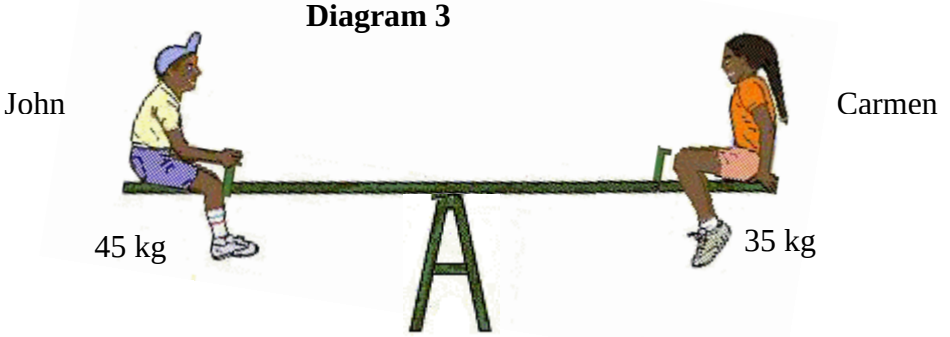
_____

_____

(2)

5.a. Two children play on a seesaw 5.0 m long. They sit at 2.5 m from the pivot at [illegible] f the seesaw as shown below.

Diagram 3



i. Calculate the moment produced by John about the pivot.

_____

(1)

ii. Calculate the moment produced by Carmen about the pivot.

_____

(1)

iii. The seesaw is not balanced. Explain why.

_____

(1)

iv. Another boy, Frank of mass 25 kg, sits on the seesaw to balance it. Calculate the distance from the pivot where Frank should sit to balance the seesaw.

_____

_____

_____

(3)

b. A physiotherapist suggests arm exercises to a patient to strengthen her arm muscles. Diagram 4 shows the bones and one muscle of her arm.

i. Calculate the moment in Ncm of the 9 N weight about the elbow.

_____

_____

(1)

ii. Suggest why the muscle must contract with a force greater than 9 N to stop the arm from moving down.

_____

_____

(1)

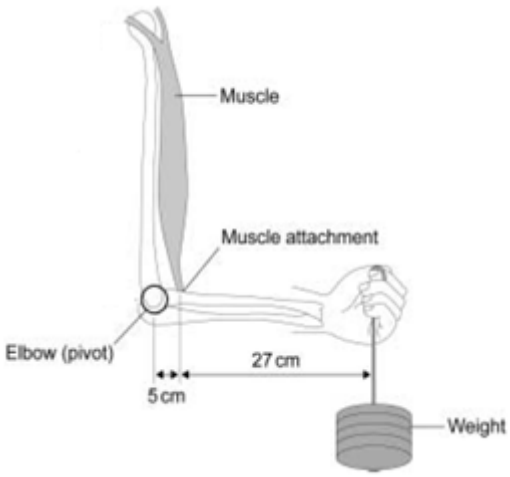
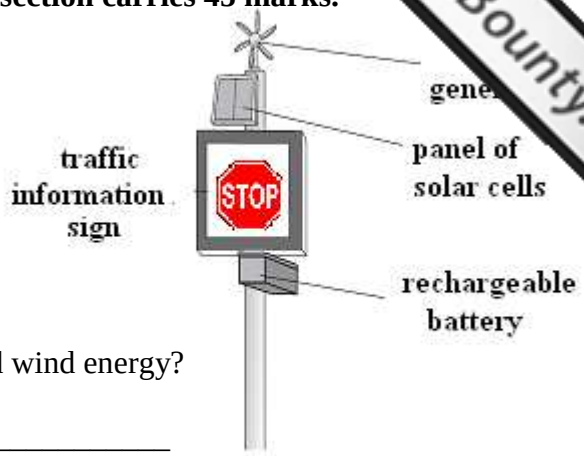


Diagram 4

Section B: Answer all questions in this section. This section carries 45 marks.

6.a. A traffic information sign, located in a remote area, is supplied with energy by both a panel of solar cells and a wind generator. The panel of solar cells and the wind generator are connected to a rechargeable battery.



i. What type of energy sources are solar and wind energy?

_____

(1)

ii. Name **one** advantage of using these types of energy sources.

_____

(1)

iii. Explain why a rechargeable battery is required to supply energy to the traffic information sign.

_____

_____

(2)

iv. 1 m^2 of solar cells can generate up to 80 W. The panel of solar cells has an area of 0.4 m^2. Calculate the maximum power output produced by the solar cells panel.

_____

_____

(2)

v. 100 W of sunlight falls on these solar panels. Calculate their efficiency.

_____

_____

(2)

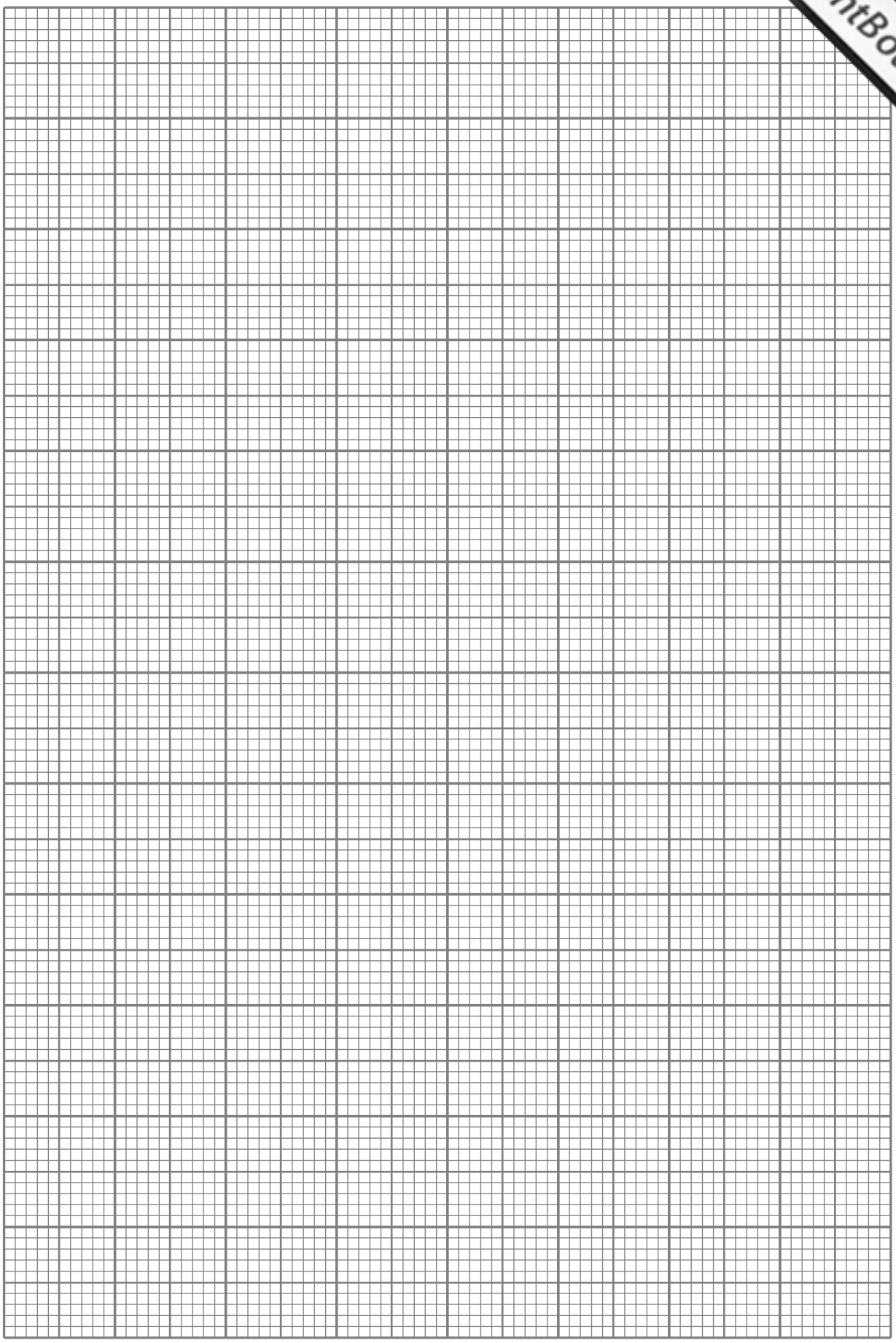
b. The following table shows the power produced by the wind generator at different wind speeds.

Power output (W)	8	16		32	40
Wind speed (m/s)	2	4	6	8	10

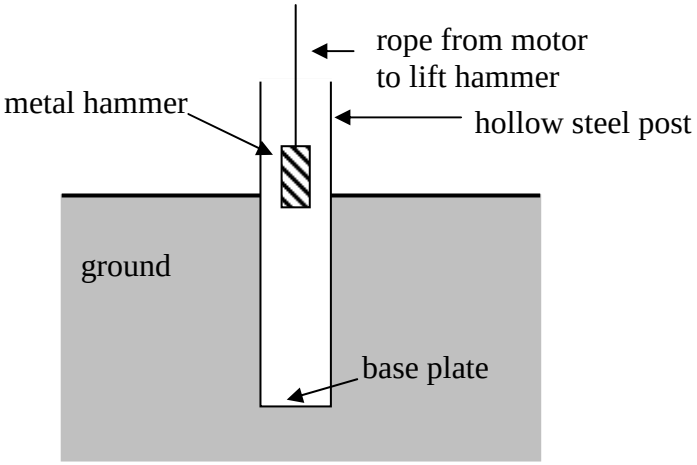
i. Draw a graph of power output (y-axis) against the wind speed (x-axis). (5)

ii. From the graph find the power produced when the wind speed is 6 m/s. Write your answer in the **above table**.

(2)



7. A falling metal hammer is used to insert a hollow steel post into the ground as s… diagram. The hammer is lifted by an electric motor and then allowed to fall freely … base plate.

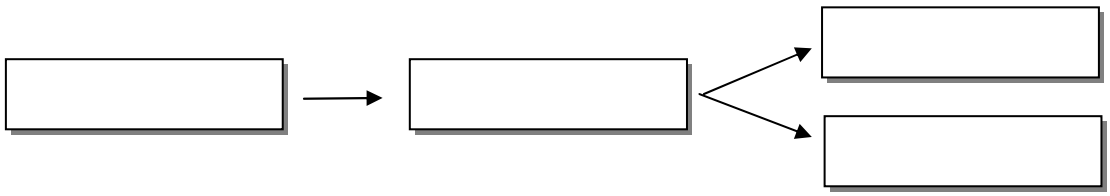


i. The law of conservation of energy states that _____

_____

(2)

ii. State the energy conversions that take place as the hammer falls.



(4)

iii. The metal hammer has a mass of 1500 kg. It hits the base plate with a speed of 8 m/s. Calculate the kinetic energy of the hammer as it hits the base plate.

_____

_____

(2)

iv. What is the initial potential energy of the hammer assuming no energy losses?

_____

(1)

v. Calculate the height above the base plate from which the hammer was dropped.

_____

_____

(2)

vi. In raising the hammer, the electric motor uses more energy than the initial poten
Give **one** reason why the motor uses more energy.

_____

_____

(2)

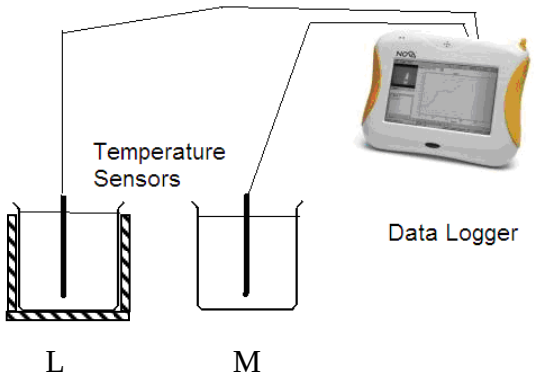
vii. Suggest **two** changes in the diagram that would cause the base plate to move further into the ground each time the hammer falls.

_____

_____

(2)

8.a. Jacqueline and Peter investigate how insulation affects heat loss. Two identical metal beakers, L and M, are filled with hot water. An insulating material is placed around beaker L. They place a temperature sensor in each beaker and take readings every minute for 20 minutes. Beaker M is used as a control.



i. Suggest a suitable insulating material that can be placed around beaker L.

_____

(1)

ii. Name the **three** methods by which heat is transferred from a beaker.

_____

(3)

iii. Insulation around the beaker reduces one type of heat loss. Which one?

_____

(1)

iv. To obtain reliable results, only one variable (insulation) is changed. All the other variables are controlled. State **two** precautions that should be taken to obtain a reliable result.

_____

_____

(2)

v. Peter suggests placing a lid over each beaker. Explain how this will [illegible] losses.

_____

(1)

vi. Sketch **two** graphs, one for beaker L and one for beaker M to show their temperature change with time.

(2)

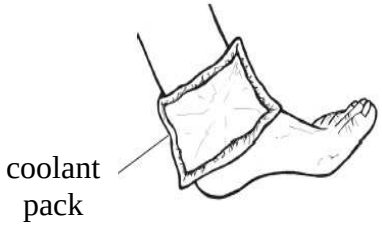
vii. In both beakers, the water cooled faster at the beginning of the investigation. Explain how your graph shows this.

_____

_____

(2)

b. A coolant pack is used to treat an injured ankle of a football player. The pack of mass 0.5 kg is initially cooled to 2 °C. The pack is then placed on the injured ankle.



i. Calculate the energy required to raise the temperature of the pack to 7 °C.
(specific heat capacity of pack = 2100 J/kg°C)

_____

_____

_____

(2)

ii. From where does **most** of the energy required to raise the temperature of the coolant pack come from?

_____

(1)