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

Trac

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:

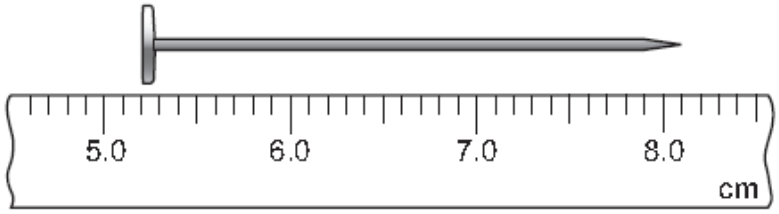
Energy and Work	W = Fs P.E. = mgh	E (or W) = Pt K.E. = ½ mv^2
Force	W = mg	Moment = force x perpendicular distance
Pressure	$P = \frac{F}{A}$	P = hρg
Heat	ρ (or D) = $\frac{m}{V}$	$\Delta Q = mc\Delta\theta$

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)

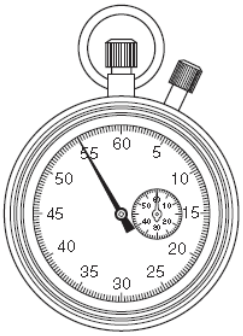


Diagram 1

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.

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)

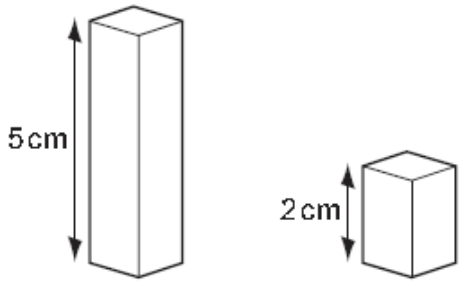


Diagram 2

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.

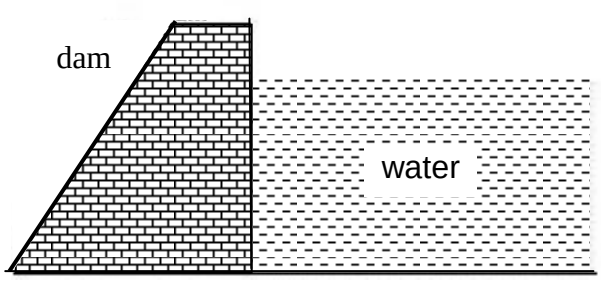
_____

_____

(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.

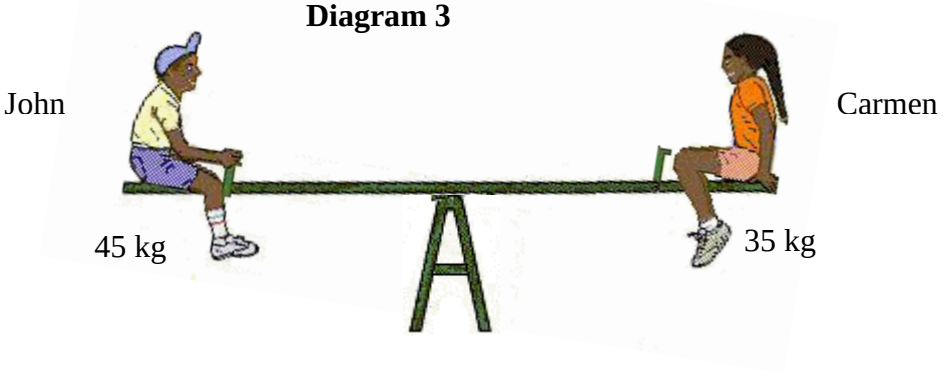
_____

_____

(2)

5.a. Two children play on a seesaw 5.0 m long. They sit at 2.5 m from the pivot at the centre of 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.

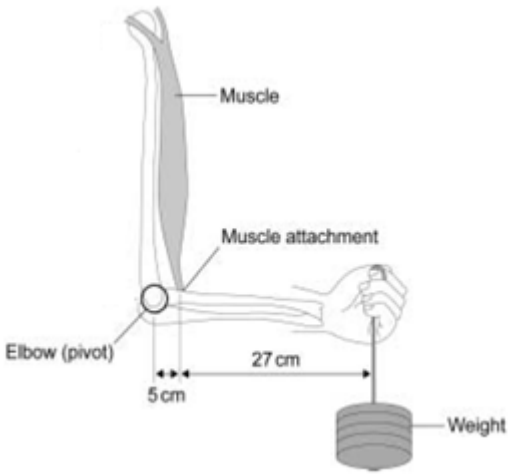
_____

_____

_____

(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)

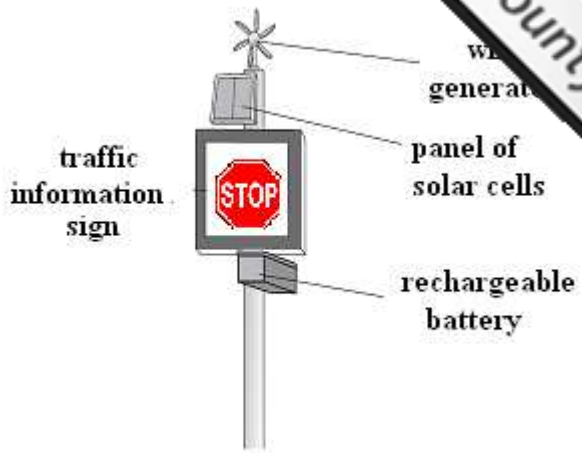
ii. Suggest why the muscle must contract with a force greater than 9 N to stop the arm from moving down.

_____

_____ (1)

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

6.a. A traffic information sign is supplied with energy by a **wind generator** and a panel of **solar cells**. These are connected to a rechargeable battery.



i. Underline the correct word.

Solar and wind are (**renewable / non-renewable**) sources of energy. (1)

ii. Write in the table below **one** advantage and **one** disadvantage of each of the following energy sources.

	Advantage	**Disadvantage**
Solar energy		
Wind energy		

(4)

iii. An area of 4 m^2 of solar cells can generate up to 320 W. The panel of solar cells used for the traffic sign has an area of 1 m^2. Calculate the maximum power output that can be generated by the panel of solar cells.

_____

_____

(2)

iv. If the solar panels receive 400 W of sunlight, calculate their efficiency. Use the formula $\text{Efficiency} = \frac{\text{Useful energy output}}{\text{Useful energy input}} \text{ x } 100\%$

_____

_____

(1)

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

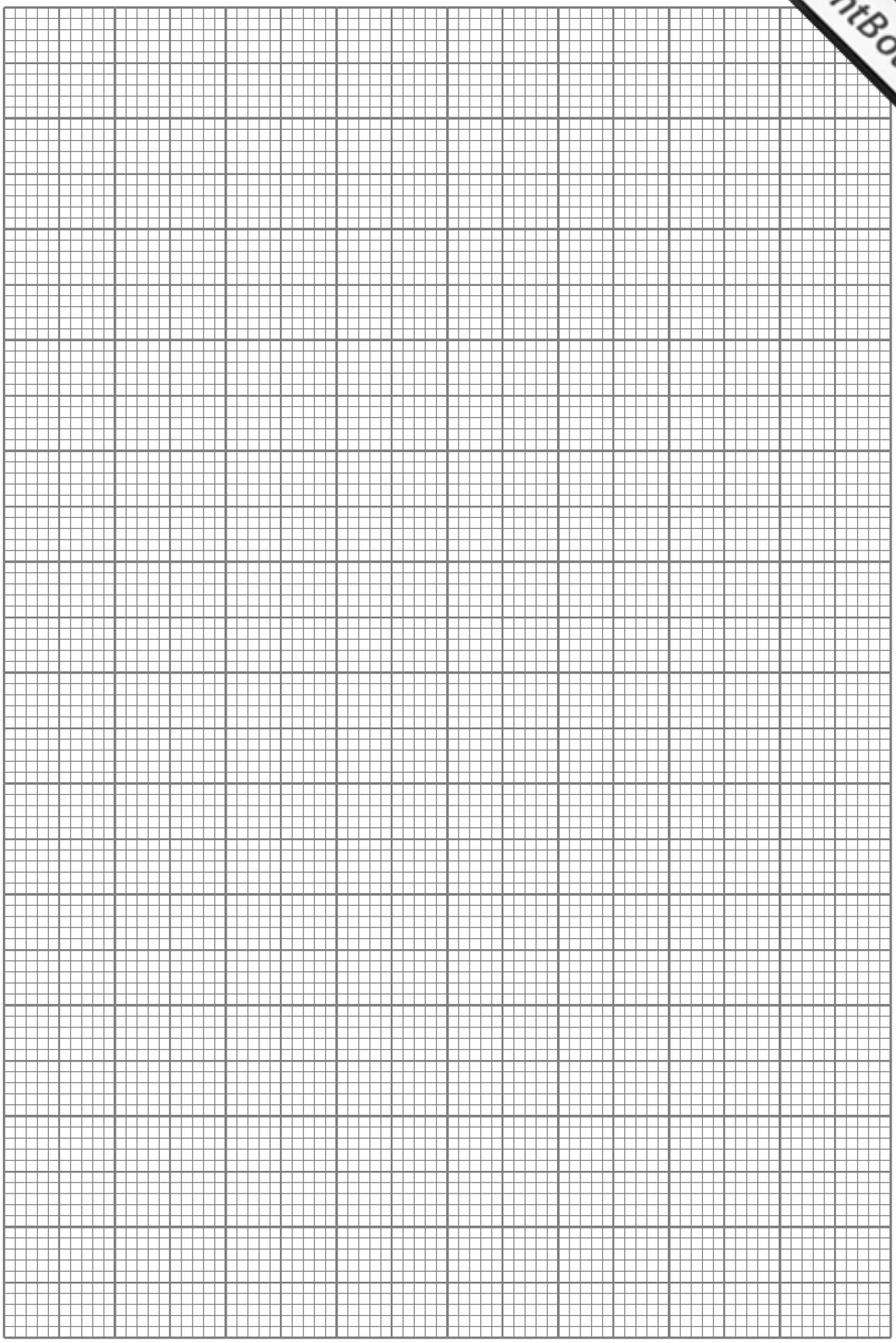
Power output (W)	8	16	24	32	40
Wind speed (m/s)	2	4	6	8	10

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

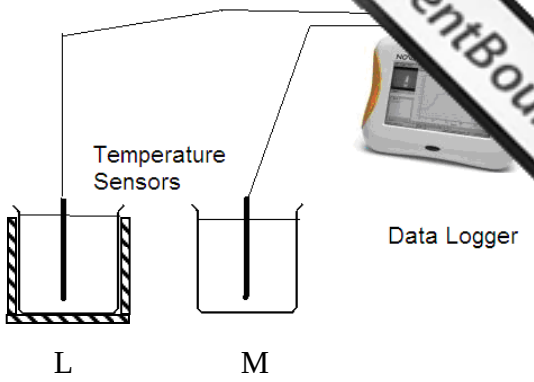
ii. Use your graph to find the power produced when the wind speed is 7 m/s.

_____

(2)



7.a. Jacqueline and Peter wrap beaker L with insulation material. They fill the two beakers with hot water. They place a temperature sensor in each beaker and take readings every minute for 20 minutes. Beaker M is used as a control.



i. Which beaker, L or M, will cool faster? _____ (1)

ii. Underline **one** of the following which is used as insulation around beaker L.

cotton wool, copper, aluminium

(1)

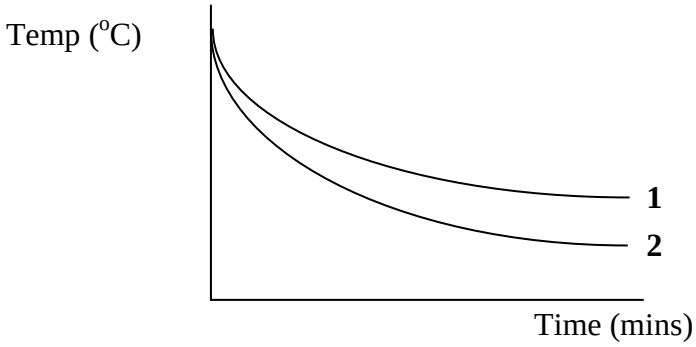
iii. Heat from the beaker is transferred by *conduction*, _____ and _____. (2)

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

_____

(1)

v. The graph below shows the results that Jacqueline and Peter obtained.



Which graph, 1 or 2, represents the temperature change in the insulated beaker L? Explain why.

_____

_____

(3)

vi. Peter suggests placing a lid over the beakers to reduce heat loss. Do[illegible]? Explain.

_____

_____

(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.

coolant pack

i. After some time the temperature of the pack rises to 7 °C. What is the change in temperature of the pack?

_____

(1)

ii. Calculate the energy absorbed by the pack.
(specific heat capacity 'c' of pack = 2100 J/kg°C)

_____

_____

_____

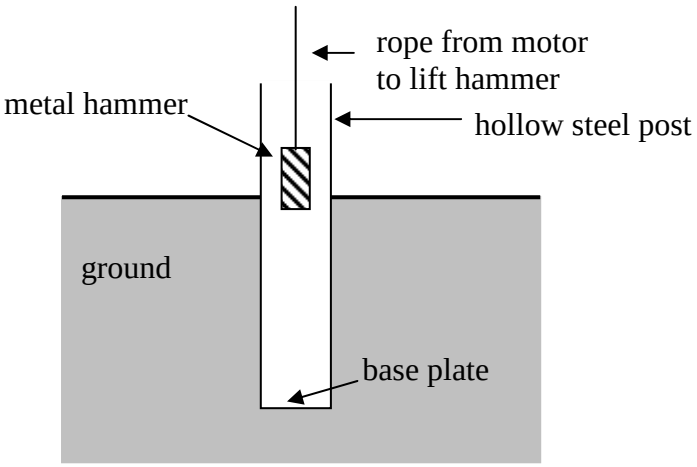
(3)

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

_____

(1)

8. 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 **Principle of Conservation of Energy** states that energy is neither _____ nor _____ but only _____ from one form to another. (3)

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

(3)

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.

_____

_____

(3)

iv. What is the initial potential energy of the hammer if all the energy is conserved?

_____

(1)

v. Using the formula $\mathbf{h = \frac{P.E.}{mg}}$, calculate the height above the base plate h the hammer was dropped.

_____

_____

(2)

vi. Energy is lost in the rope and motor due to work done against friction. Suggest **one** way of reducing this friction.

_____

(1)

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

_____

_____

(2)