FORM 3          PHYSICS          TIME: 1 h 30 min

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/s².

You may find some of these formulae useful.

<table>
<thead>
<tr>
<th>Measurement &amp; Density</th>
<th>Speed = ( \frac{\text{Distance}}{\text{Time}} )</th>
<th>Density = ( \frac{\text{Mass}}{\text{Volume}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force</td>
<td>W = mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moment of a force = Force \times \text{Perpendicular distance}</td>
<td></td>
</tr>
<tr>
<td>Energy &amp; Work</td>
<td>Work done = F s</td>
<td>Power = ( \frac{\text{Work done}}{\text{Time taken}} )</td>
</tr>
<tr>
<td></td>
<td>PE = m g h</td>
<td>KE = ( \frac{mv^2}{2} )</td>
</tr>
<tr>
<td>Pressure</td>
<td>Pressure = ( \frac{\text{Force}}{\text{Area}} )</td>
<td>Pressure = ( \rho ) ( \text{h} ) ( g )</td>
</tr>
<tr>
<td>Heat</td>
<td>Q = m c ( \Delta \theta )</td>
<td></td>
</tr>
</tbody>
</table>

For office use only:

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Mark</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>Actual Mark</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Total Theory</th>
<th>Total Practical</th>
<th>Final Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Mark</td>
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<td></td>
</tr>
<tr>
<td>Max Mark</td>
<td>85</td>
<td>15</td>
</tr>
</tbody>
</table>
SECTION A
Answer all questions in the space provided. This section carries 40 marks.

1. Fill in the missing words in the paragraph below using the following words. Each word may be used more than once.

<table>
<thead>
<tr>
<th>mass</th>
<th>volume</th>
<th>density</th>
</tr>
</thead>
</table>

Two aluminium blocks shown above have different ________ and different ________, but their ________ is the same. When a piece of plastic foam is compressed, its ________ remains the same, but its ________ decreases whilst its ________ increases. When air is heated its ________ increases but its ________ decreases. (8)

2. Complete these sentences about our solar system.

(i) The sun is a ____________.

(ii) The Earth takes ____________ days to orbit once around the sun.

(iii) When for some countries it is daytime, for others it is night time. This takes place because the Earth is ____________ on its axis.

(iv) Jupiter is a large ____________ visible from Earth. It orbits the ____________.

(v) Other solar systems within our galaxy are ____________ away from us.

(vi) Scientists and other people use ____________ to see far away planets.

(vii) What keeps a planet orbiting a star is the force of ____________ between the planet and the star. (8)
3. (a) The diagram below shows a plastic container completely filled with water. Complete the diagram to show how water flows out from outlets A, B and C.

![Diagram of water flowing out from outlets A, B, and C.]

(b) Claire blows up a balloon as shown in the diagram.

(i) What happens to the balloon when Claire blows in more air inside? Explain why.

__________________________________________________________________________
__________________________________________________________________________  (2)

(ii) Claire ties the end of the balloon and allows the balloon to escape up in the sky. What happens to the atmospheric pressure acting on the balloon as the balloon rises?

__________________________________________________________________________  (1)

(iii) The balloon finally bursts when it is very high up above the ground. Explain in terms of air pressure, why it bursts.

__________________________________________________________________________  (1)

(c) Hot air is used to make balloons rise up to the sky.

(i) Why is air heated?

__________________________________________________________________________  (1)

(ii) Suggest one way how the balloon can be made to move slowly downwards.

__________________________________________________________________________  (1)
4. (a) Underline **two** vectors from the following Physical quantities.

mass  weight  displacement  distance  pressure  

(b) The diagram shows a method for lifting water using a rod and a bucket. The weight of the rod AB is negligible.

![Diagram of rod and bucket](image)

W = 180N

(i) What is the horizontal distance between the bucket and the pivot?  

_________________________________________________  

(ii) What is the direction of rotation of the bucket about the pivot, clockwise or anticlockwise?  

_________________________________________________  

(iii) Calculate the size of the moment of the bucket about the pivot. Give the correct units.  

_________________________________________________  

_________________________________________________  

(iv) Calculate the downward force \( F \) required to balance the bucket.  

_________________________________________________  

_________________________________________________
5. (a) Joseph of mass 60 kg climbs up a long flight of stairs in 12 s. He moves through a vertical distance of 8.0 m. Calculate the:

(i) potential energy gained when he is at the top of the stairs. Give the correct units for potential energy,

______________________________________________________________________________________________________ (2)

(ii) work done in climbing up the stairs, giving the correct units,

______________________________________________________________________________________________________ (2)

(iii) personal mechanical power gained, giving the correct units.

______________________________________________________________________________________________________ (2)

(b) Circle one of the diagrams below which shows ‘work’ being done. Explain your answer.

Holding a heavy object  Pushing against a wall  Pushing a cart up a slope  Reading a book

______________________________________________________________________________________________________ (2)
SECTION B
Answer ALL questions. This section has a total of 45 marks.

6. (a) Robert Hooke discovered the law of elasticity in the middle of the 17th century.

   (i) State Hooke’s Law: ________________________________
       ________________________________ (2)

   (ii) State what is observed when the elastic limit of a spring is exceeded.
       __________________________________________________________
       __________________________________________________________ (2)

   (iii) Draw a well labelled diagram of all the apparatus used to investigate Hooke’s Law.

   (iv) Name two precautions that you have taken when carrying out this experiment in
        the school laboratory.
       __________________________________________________________
       __________________________________________________________ (2)

(b) Joseph and Adrian used a helical spring and read the following measurements:

   | Length of spring | 6.2 cm |
   | Length of spring with 0.1N weight | 11.5 cm |
   | Length of spring with 0.3N weight | 22.1 cm |

   (i) Calculate the extension of the spring due to the
       • 0.1N weight ________________________________
       • 0.3N weight ________________________________ (2)

   (ii) Estimate the length of the spring when a 0.4 N weight is attached, provided that the
        elastic limit has not been exceeded.
       __________________________________________________________
       __________________________________________________________ (2)
(iii) Joseph and Adrian plot their results on a graph. They find that the readings plotted are not in a straight line.

Which of the above graphs (A) or (B) should they present on their lab book and why?

________________________________________________________________________

________________________________________________________________________ (2)

7. (a) Nicole and Grace set up an experiment as shown in the diagram below.

They build three identical solar cookers and place them in direct sunlight. Nicole fills the three containers with the same amount of water and places them in the cardboard solar cookers.

Grace measures the temperature of the water in each container every 5 minutes during the next 30 minutes while Nicole records each reading in a table in her lab book.

(i) Name the instrument used to measure temperature.

________________________________________________________________________ (1)

(ii) Why is a white cardboard used?

________________________________________________________________________ (1)

(iii) Name the two main processes through which heat is lost from containers.

________________________________________________________________________ (2)
(iv) Why is it better to cover the beakers with a lid?

________________________________________________________________________________ (1)

(v) Which container reaches the highest temperature after 30 minutes?

________________________________________________________________________________ (1)

(b) Nicole tabulates the temperature of one of the containers against time as shown below.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>22</th>
<th>29</th>
<th>36</th>
<th>41</th>
<th>46</th>
<th>50</th>
<th>53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (minutes)</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>

(i) Plot a graph of temperature (y-axis) against time (x-axis) on the graph paper provided. Draw the best smooth curve. (4)

(ii) Use your graph, to find the temperature of the water after 12 minutes.

________________________________________________________________________________ (1)

(c) A group of students heat a copper block of mass 2 kg using an electric heater for 4 minutes. The temperature of the copper rises from 20°C to 34°C. The specific heat capacity of copper is 385 J/kgK.

(i) Calculate the heat absorbed by the copper block in 4 minutes.

________________________________________________________________________________

________________________________________________________________________________ (2)

(ii) Assuming that no heat is lost, calculate the energy per second provided by the electrical heater.

________________________________________________________________________________

________________________________________________________________________________ (1)

(iii) The value obtained in c(ii) is less than that marked on the heater. Give one possible reason for the difference observed.

________________________________________________________________________________ (1)
8. (a) Explain what is meant by:
   (i) renewable energy sources,
       ________________________________________________________________ (1)
   (ii) non-renewable energy sources.
       ________________________________________________________________ (1)

(b) (i) Name two examples of renewable energy sources.
       ________________________________________________________________ (2)

(ii) Name two examples of non-renewable energy sources.
       ________________________________________________________________ (2)

(c) List two disadvantages of using non-renewable sources of energy.
   i. ________________________________________________________________
   ii. ________________________________________________________________ (2)

(d) Complete the following sentences about energy sources.
   (i) One way of generating electricity is by using ____________ fuels, such as oil, gas and coal.
   (ii) When dead plants and animals decay, bacteria produce methane gas which is collected and burned as a fuel. This type of energy is called ____________.
   (iii) Electrical energy generated from water falls is called ____________ energy.
   (iv) Two suitable renewable energy sources to generate electrical power in Malta are ____________ and _____________. (5)

(e) Today a number of people install a solar water heater on the roofs of their houses. Name two advantages of using solar energy.
   ________________________________________________________________
   ________________________________________________________________ (2)