



Half Yearly Examinations for Secondary Schools 2011

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 $g = 10\text{m/s}^2$.

You may find some of these equations useful:

Energy and Work	$W = Fs$ $PE = mgh$	$E \text{ (or } W) = Pt$ $KE = \frac{1}{2} mv^2$ $\text{Efficiency} = \frac{\text{Useful Output Power}}{\text{Input Power}} \times 100\%$
Weight	$W = mg$	
Moments	$M = Fs$	
Density	$\rho = m/V$	

Question	1	2	3	4	5	6	7	8	9	10	11	Theory	Practical	Total
Max Mark	5	5	5	5	5	5	5	5	15	15	15	85	15	100
Score														

	Total Theory	Total Practical	Final Mark
Actual Mark			
Maximum Mark	85	15	100

SECTION A

This section carries 40 marks.

1. Complete the following paragraph by filling in the blank spaces from the words below.

Newtons, push, gravity, direction, smaller, downwards, vectors, pull, scalars, upwards, mass, greater, weight.

A force can be described as a _____ or a _____. Tension, _____, upthrust and drag are all different types of forces. Unlike temperature and density which are _____ quantities, forces are called _____ quantities because we refer to them by means of magnitude and _____. The weight of an object acts _____ and is defined as the pull of _____ on the object. The larger the _____ of the object, the _____ is its weight.

[5 marks]

2. Tom has various items in his school bag.

- a. The length of one of his files is measured using a _____.
- b. The weight of Tom's bag is found using a _____.
- c. Tom's bag has a mass of 2.5kg. The weight of the bag is _____.
- d. The thickness of a computer CD is found using a _____.
- e. A large measuring cylinder could be used to measure the _____ of water found in his drinking bottle.

[5 marks]

3. John was investigating how a spring of original length 5 cm stretches when some weights are loaded to one of its ends.

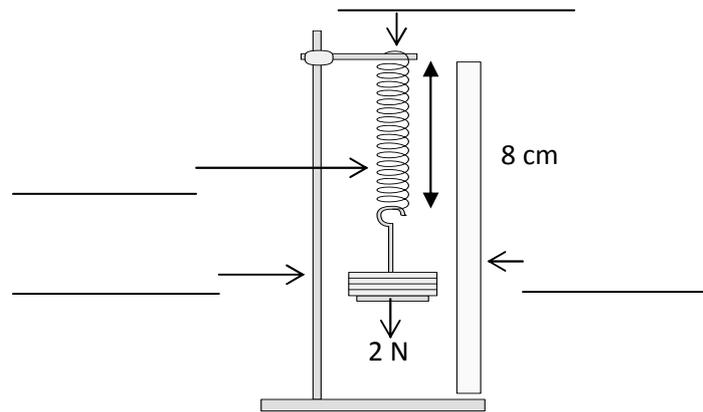


Figure 1

- Label the apparatus shown in Figure 1.
- Calculate the total length of the spring when it is loaded with 4 N weights.

[2, 3 marks]

4. A rock climber climbs up a rock face, as shown in the following diagram.

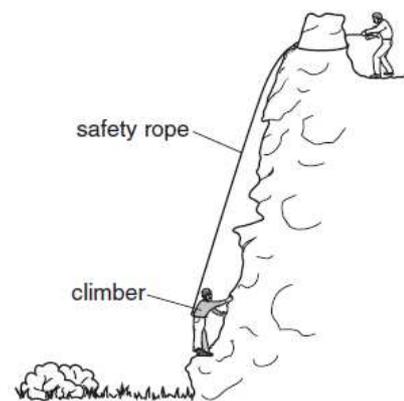


Figure 2

- To climb the rock face, the climber must do work. Which force must the climber work against as he climbs?

[1 mark]

- What other quantity, as well as the force named in (a) must be known in order to find the work done by the climber?

[1 mark]

- c. One climber named John weighs 1000 N and another Peter weighs 800 N. They both take 5 minutes to climb the cliff of height 12 metres.

- Which one will do the most work in order to climb the cliff?

[1 mark]

- Which one has the greater power rating? Calculate this power?

[2 marks]

5. **Error! Reference source not found.** shows a rocket on its launching pad. The total weight of the rocket and its contents is 500 000 N and the engines exert a force 700 000 N upwards.

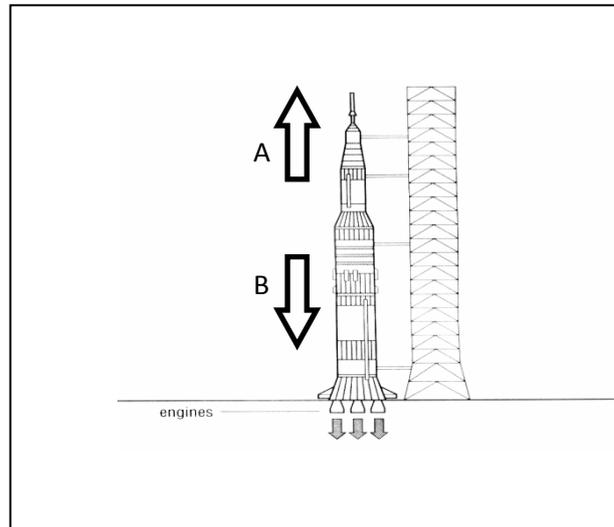


Figure 3

- a. Calculate the resultant force acting on the rocket.

[1 mark]

- b. Two forces act over the rocket. In the diagram, name the 2 forces A and B.

[2 marks]

- c. The rocket in the diagram uses 1000 kg of fuel to power its engines. The fuel used has a density of 800 kg/m^3 , calculate the volume of fuel carried in the rocket's fuel tank.

[2 marks]

6. The diagram in **Error! Reference source not found.** shows Peter and his helper John paint a wall. The plank weighs 100 N and is balanced horizontally. **Underline** the correct answer.

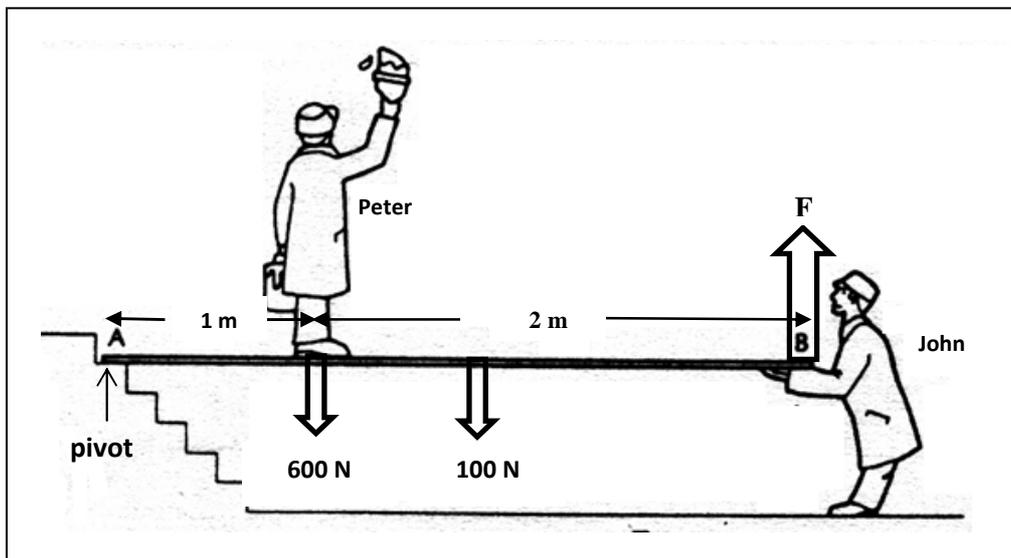


Figure 4

- a. Peter produces a (clockwise, anti-clockwise) moment. [1 mark]
- b. The weight of the plank acts through (centre of gravity, left side of plank, right side of plank) [1 mark]
- c. If the plank is balanced the clockwise moment is (greater than, equal to, less than) the anti-clockwise moment. [1 mark]
- d. Clockwise moment is equal to (600 Nm, 800 Nm, 750 Nm). [1 mark]
- e. Force F is therefore equal to (150 N, 200 N, 250 N). [1 mark]

7. As John was doing some repairs on the roof of his house, he drops the hammer to the ground from a height of 6 m. The hammer has a mass of 1.2 kg.

a. Calculate the potential energy of the hammer.

_____ [2 marks]

b. What is the kinetic energy of the hammer as it is going to hit the ground?

_____ [1 mark]

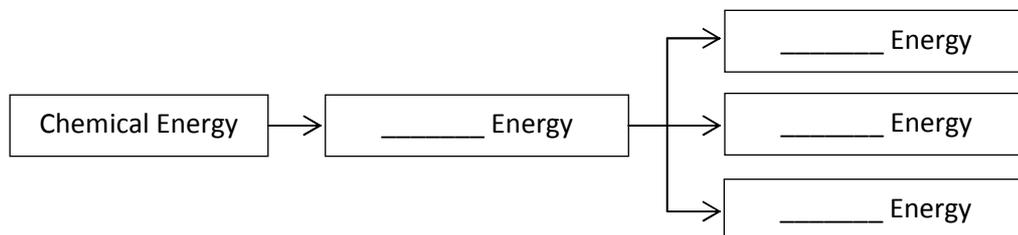
c. Calculate the velocity with which the hammer hits the ground.

 _____ [2 marks]

8. A small child is playing with a toy truck. The motor of a small toy truck is operated by a set of batteries. The truck tows a small box with a force of 10N for a total distance of 15 m in 50 seconds.



a. Fill in the energy change diagram.



[2 marks]

b. Calculate the power developed by the toy truck.

 _____ [2 marks]

c. If the efficiency of the toy truck is 60 %, calculate the power output from the batteries.

 _____ [1 mark]

SECTION B

This Section carries 45 marks.

9. A Pharmacist needs to determine the density of an unknown liquid. He places the liquid in an empty measuring cylinder of mass **161 g**, and measures the final volume to be **35 cm³** and the final mass to be **191 g**. Determine the following:

- a. Mass of liquid: _____
- b. Volume of liquid: _____
- c. Density of liquid: _____

d. Which of the following liquids could the unknown liquid be?

[1, 1, 2, 2 marks]

Liquid Density (g/cm ³)	
Turpentine	0.86
Benzine	0.81
Acetone	0.79

e. Figure 5 shows three **cubic** blocks, A and B have sides **2.00 cm** long and C has sides **4.00 cm** long. A is made of metal and has a mass of **90.4 g**. B has a mass of **9.6 g**. B and C are made of the same type of plastic. Use this information to answer these questions:

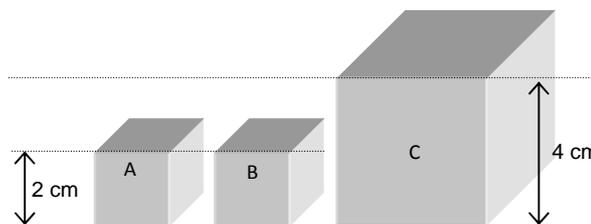


Figure 5

i. Which block has the greatest mass?
Explain your answer.

_____ **[2 marks]**

ii. If we submerge all the blocks in some water, which one will displace the most water? Explain your answer.

_____ **[1 mark]**

iii. Which block has the greatest density? Calculate this density?

_____ **[3 marks]**

iv. If we squash plastic block B into a flat shape, how will these quantities change? **Underline the correct answer.**

- a) Mass: (increase / decrease / no change)
- b) Volume: (increase / decrease / no change)
- c) Density: (increase / decrease / no change)

[3 marks]

10. This question is about energy.

- a. State the principle of conservation of energy.

- b. Name **one renewable source** and **one non-renewable source** of energy.

Renewable Source of Energy	Non-Renewable Source of Energy

- c. State two advantages of using renewable sources of energy over non-renewable sources of energy.

[1, 2, 2 marks]

- d. The Three Gorges Dam shown in Figure 6 is a hydroelectric power station in China. Water in the upper reservoir falls a height of 185 m.

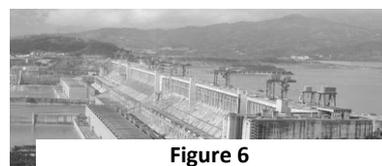


Figure 6

- i. What type of energy does 10 000 kg of water have at the top of the dam? Calculate this amount of energy.

- ii. If this water falls in 5 seconds, what would be the electrical power generated if the turbines are 75 % efficient.

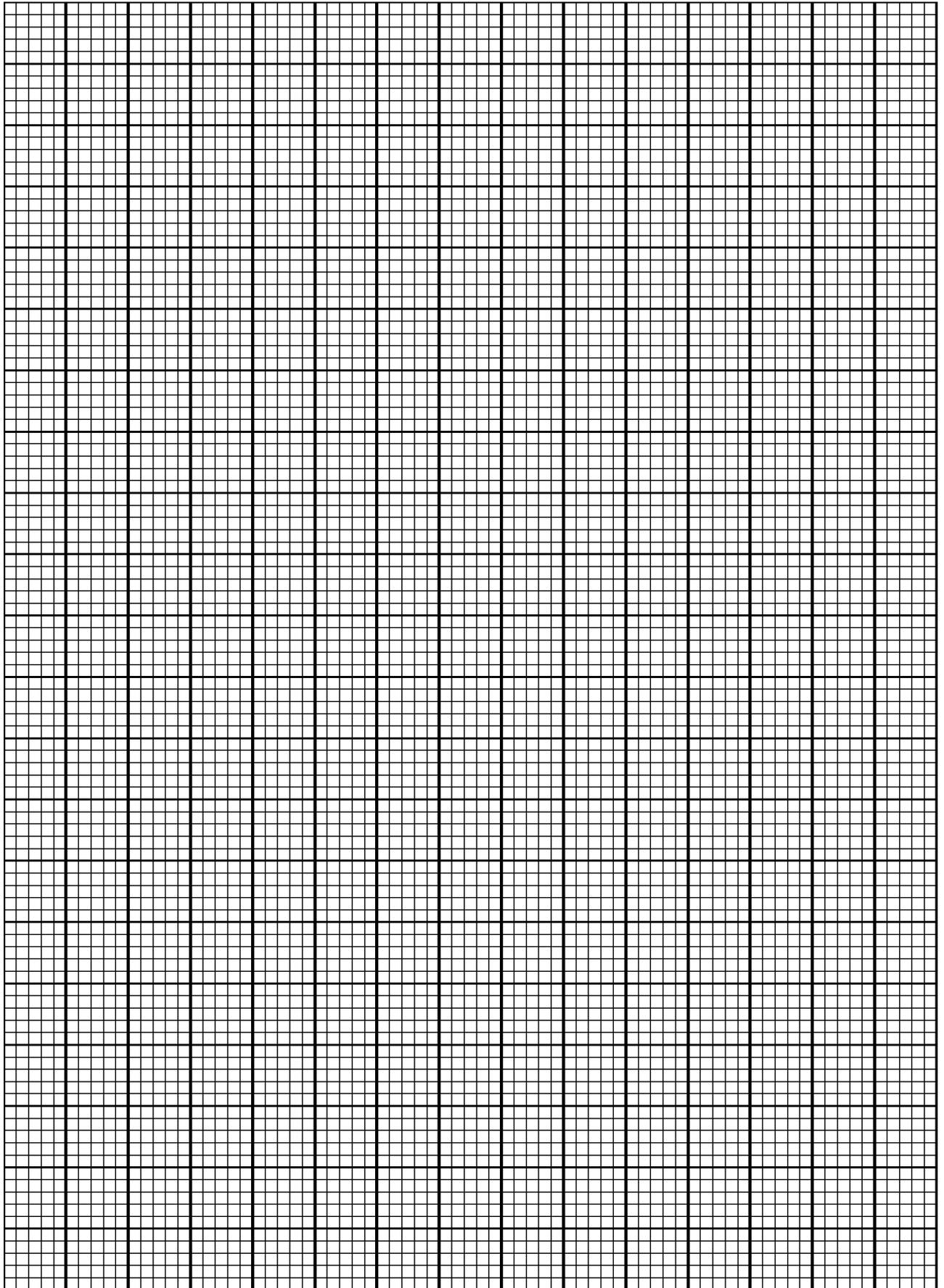
[3, 2 marks]

- iii. This table shows how the mass of water that falls per second effects the electrical power that is generated. Plot a graph of **Power Generated/GW** on the **y-axis** against **Mass of Water/ktons** on the **x-axis**. **[4 marks]**

Mass of Water falling per second /ktons	Power Generated / GW
25	35
50	68
75	106
100	139
125	170

- iv. What can you conclude from the graph?

[1 mark]



11. In a history book, John found the diagram below that shows an instrument of punishment used in mediaeval times. The victim was tied to the chair and lowered in the cold water of the sea as shown in Figure 7.

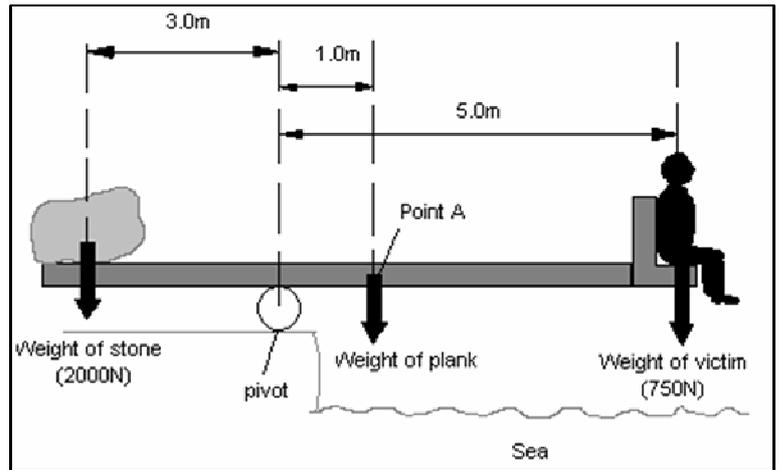


Figure 7

- a. What is the name given to point A, the point through which the weight of the plank acts?

_____ [1 mark]

- b. Calculate the mass of the victim if he has a weight of 750 N. [2 marks]

- c. Calculate the moment produced by the victim about the pivot. [3 marks]

- d. Is the stone creating a clockwise or anticlockwise moment? [2 marks]

- e. Calculate the weight of the plank acting from point A. [4 marks]

- f. What change should take place in the instrument so that the victim is lowered in the sea? [3 marks]
