



WESTMINSTER SCHOOL  
THE CHALLENGE 2014

**PHYSICS**

Thursday 1 May 2014

Time allowed: 30 minutes

Please write in black or blue ink.

Write your answers in the spaces provided.

For examiner use only

Total Mark	
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**P1 (Multiple Choice – 10 marks)**

Choose A,B,C,D or E for each of the following questions.

a) Which of these values is an appropriate estimate of the weight of an adult?

A: 500 kg      B: 100kg      C: 1000N      D: 20000N      E: 900lb

b) An elephant lumbers along a straight road at 5 km/h. After 15 minutes it has travelled

A: 75m      B: 75km      C: 1250m      D: 3000m      E: 3km

c) Which of these is an electrical component that gives out light when current flows through it?

A: LED      B: LDR      C: Transistor      D: Resistor      E: Cell

d) The International Space station is visible in the night sky because:

A: It has many bright lights      B: It reflects light from the Earth      C: It is burning up in the atmosphere  
D: It reflects light from the Sun      E: It has large nuclear reactor on board

e) Heat is transferred to the Earth from the Sun by

A: Conduction      B: Convection      C: Radiation      D: Evaporation

E: All of the above

f) Which of the following astronomical objects lies the furthest away from Earth?

A: Jupiter      B: The Moon      C: The Sun  
D: The Andromeda Galaxy      E: The star Sirius

g) An aeroplane is flying horizontally at constant speed. Which one of the following is **not true** about the forces acting on it?

A: *The lift upwards is equal to the weight downwards.*

B: *The forward thrust from the engines is slightly larger than the air resistance backwards.*

C: *The total force acting on the aeroplane is zero.*

D: *The air resistance will increase if the aeroplane speeds up.*

E: *The weight of the aeroplane decreases as the fuel is used up*

h) A spring is compressed by a weight to a length of 20cm. Two identical such springs side by side are then each compressed to a length of 30cm by the same weight. What is the uncompressed length of one spring?

A: 38 cm

B: 40 cm

C: 42 cm

D: 48 cm

E: 64 cm

i) Which of the following statements is correct

A: *The molecules in ice are bigger than the molecules in steam*

B: *The molecules in ice are smaller than the molecules in steam*

C: *The molecules in ice are much closer together than the molecules in steam*

D: *The molecules in ice are heavier than the molecules in steam*

E: *The molecules in ice are not moving, but those in steam are.*

j) Which of the following has a volume of 10 cm<sup>3</sup>?

A: *A rectangular box of dimensions 10cm x 10cm x 10cm*

B: *A rectangular box of dimensions 10mm x 1cm x 10m*

C: *A rectangular box of dimensions 0.2m x 100mm x 0.5m*

D: *A rectangular box of dimensions 0.5cm x 0.2m x 10mm*

E: *A rectangular box of dimensions 0.02m x 2.0 cm x 0.25m*

Short answer Questions

P2



Newton's law of Universal Gravitation is as follows:

The force of gravity  $F$  between two masses  $m_1$  and  $m_2$  separated by a distance  $r$  is given by

$$F = \frac{G m_1 m_2}{r^2}$$

Where  $G$  is a constant equal to  $6.67 \times 10^{-11}$  (in units of  $\text{Nm}^2/\text{kg}^2$ ) and  $r$  is measured between the centres of masses (*NB You don't need to have seen this equation before*)

For example the force between two 1kg masses at a distance of 1m from each other is equal to  $6.67 \times 10^{-11}$  N

- a) If the two 1kg masses that are initially placed at a distance of 1m apart are moved to a distance of 2m apart, what would the force between them be now?

[2]

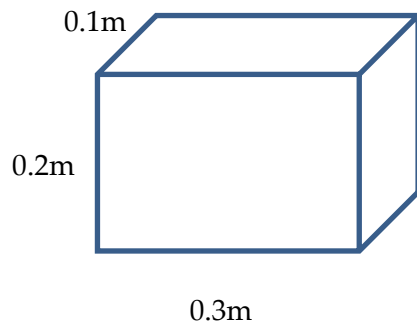
- b) Calculate the force of gravity on a mass of 1kg due to the Earth (mass  $6.0 \times 10^{24}$  kg) at the Earth's surface (ie a distance of  $6.4 \times 10^6$  m from the centre)

[3]

- c) What happens to the force of gravity on a mass as it gets further away from the Earth's surface?

[1]

P3



A rectangular wooden block has a mass of 15kg and dimensions of 0.1m by 0.2m by 0.3m. On Earth 1kg weighs 10N.

- a) Calculate the weight of the block.

[1]

- b) Calculate the maximum pressure (in  $\text{N/m}^2$ ) that the block can exert on the floor when standing freely on one of its faces.

[2]

- c) Calculate the minimum pressure (in  $\text{N/m}^2$ ) that the block can exert on the floor when standing freely on one of its faces.

[2]

**P4**

Three rugby players named Chris, Tom and Billy are at the beach discussing how strong they are, and what size of rock they could lift. They make the following statements:

- i) Chris says "I can pick up this Granite rock, which has a volume of  $0.10\text{m}^3$  and has a mass of  $250\text{kg}$ "
- ii) Tom says " That's nothing, I can pick up this Sandstone which has a density of  $2000\text{kg}/\text{m}^3$  and its volume is 1.5 times the volume of your Granite"
- iii) Billy says "I can pick up this Basalt rock which is the same mass as the Sandstone but the same volume as the Granite"

Fill in the gaps in this table:

Rock	Mass (kg)	Volume ( $\text{m}^3$ )	Density ( $\text{kg}/\text{m}^3$ )
Granite	250	0.10	
Sandstone			2000
Basalt			

**P5 Electricity**

a) Draw a circuit with 2 lamps (labelled A and B) connected in parallel to a battery, and 2 switches that can turn the lamps on and off independently.

[2]

b) If lamp A is brighter than the lamp B, what can you say about the current through each lamp in this parallel circuit?

[1]

c) If the same two lamps were arranged in a series circuit, what could you say about the current through each lamp?

[1]

d) What device would you use to measure the current, and what is its circuit symbol?

[2]

**END OF PHYSICS SECTION**