WESTMINSTER SCHOOL
THE CHALLENGE 2016

PHYSICS

Thursday 28 April 2016

Time allowed: 30 minutes

Please write in black or blue ink.

Write your answers in the spaces provided.

For examiner use only

Total Mark		

Blank Page

The first question consists of 5 multiple choice questions, each worth one mark.

P1 *Choose A,B,C,D or E for each of the following questions.*

a) Which of these values is an appropriate estimate for the density of rock?

A: 50 kg/m^3 B: 5000 kg/m^3 C: 500 g/cm^3 D: 5000 g/cm^3 E: 5kg/m^3

b) A shark swims in a straight line at 8 km/h. After 18 minutes it has travelled

A: 2.4m B: 96m C: 960m D: 2400m E: 96km

c) When a metal bar is cooled it contracts. Which of the following is true?

A: The density and mass increase.

B: The density increases and the mass remains constant.

C: The density and mass are unchanged.

D: The mass remains constant and the density decreases.

E: The mass decreases and the density stays constant

d) A spring that obeys Hooke's law has a spring constant *k*. Three such springs are linked to form a spring of thrice the length. What is the spring constant of this new longer spring?

A: k/3 B: 2k/3 C: k D: 3k/2 E: 3k

e) The rate of rotation of an object is measured by the angle that it turns through each second.

The scientific unit for angle is the radian, where 1 radian = 57.3 degrees.

In these units the rate of rotation of a planet that make one full revolution every 10 hours is:

A: 7.3 x 10^{-5} radians/second

B: 1.74 x 10^{-4} radians/second

C: 1.05 x 10^{-2} radians/second

D: 0.628 radians/second

E: 36 radians/second

Short answer Questions

P2 A pressure cooker has an escape valve that is essentially a 125 g weight resting on a circular hole of radius 1 mm.



a) On the Earth, the gravitational field strength is 10N/kg. Calculate the weight of the 125g mass in newtons.

[2]

b) Calculate the area of the circular hole in m^2.

[2]

c) Hence calculate the pressure in N/m^2 needed to lift the weight off the hole.

[2]

P3 This is a question about Units.

The Westminster Physics teachers have decided to use a new set of units for measuring length, mass and time, as follows:

1 Westminster Length Unit shall be called the **"Rayner"** and equal 75m

1 Westminster Time Unit shall be called the **"Carney"** and equal 20 minutes

1 Westminster Mass Unit shall be called the **"Thorley"** and equal 80kg

a) What is a length of 500 km in Rayners?

[2]

b) What is one day in Carneys?

[2]

c) What is a density of 10 g/cm^3 in Thorleys per cubic Rayner?

[2]

d) What is a speed of 20 km/h in Rayners per Carney?

[2]

P4



a) It is easy to walk along on a dry flat surface such as a pavement. However, it is very difficult to walk along on ice due to the fact that the friction forces are very much reduced on ice.

Explain why friction is necessary for us to walk along on a surface

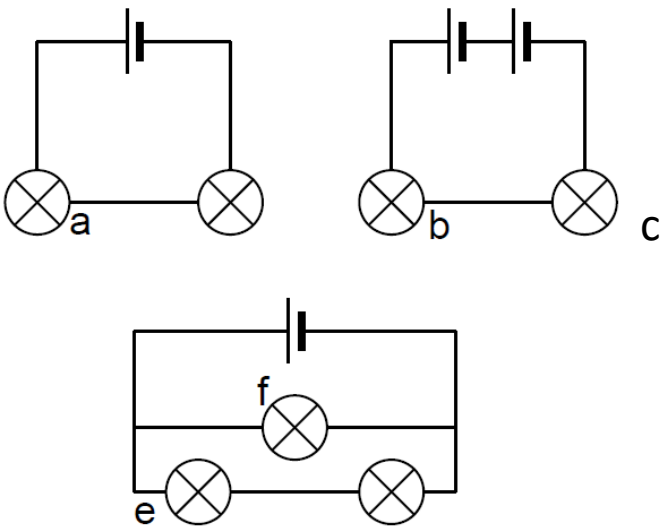
[2]

b) Why is it that sound cannot travel through a vacuum?

[2]

P5 Electricity

Take the normal brightness of a bulb to correspond to one cell connected to one bulb. In each case a-f below, say whether you think the bulb will be brighter, dimmer, normal brightness or off:



a

b

c

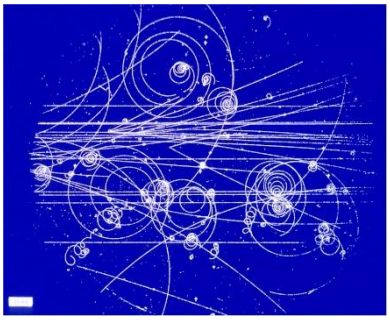
d

e

f

[6]

P6



At CERN, physicists are often discovering new particles. Here is some information about 3 new particles that they believe exist – named the Sharpon, the Prenton and the Chorarion. Can you work out what mass they each have?

- In the first collision, the data showed that **3 Sharpons** had the same mass as **one Prenton and one Chorarion combined**.
- Next, they discovered that **2 Prentons** had the same mass as **7 Chorarions**
- In their final experiment, they discovered that **one Sharpon** and **one Prenton** had a combined mass of **5×10^{-27} kg**.

Mass of Sharpon =

Mass of Prenton =

Mass of Chorarion =