



WESTMINSTER SCHOOL
THE CHALLENGE 2019

PHYSICS

Thursday 2 May 2019

Time allowed: 30 minutes

Please write in black or blue ink.

Calculators are allowed.

Write your answers in the spaces provided.

For examiner use only

Total		
Mark		

Data: on the Earth each kg of mass has a weight of 10N

P1 (Multiple Choice – 10 marks)

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

a) The thickness of a page of this exam paper is approximately

A: 0.01 mm B: 0.1 mm C: 1 mm D: 10 mm E: 0.000001 m

b) A beaker of water sits on a top pan balance. When a student sticks his finger in the water, the reading on the balance

A: decreases

B: increases

C: remains the same

D: increases or decreases depending on the relative depth of the finger and the water

E: initially increases then decreases to its original value

c) Which of the following words best describes the charged particles in a solution of dilute sulphuric acid?

A: atoms

B: molecules

C: ions

D: electrons

E: neutrons

d) Weather is colder in winter in the British Isles compared with in the summer because

A: the sun is further away

B: more clouds cover the sky

C: the sun is cooler

D: the northern hemisphere is tilted towards the Sun

E: the southern hemisphere is tilted towards the sun

e) The following objects can all (just) be seen in a clear evening sky with the naked eye or with binoculars. Which produces its own light?

A: Venus

B: Artificial satellite

C: Andromeda galaxy

D: Moon

E: None of these

f) A motorway traffic monitoring device counts the number of cars that pass it every minute. With steady traffic flow, it gives a reading of 45 cars per minute. How many whole cars should pass the device in the next 7 seconds?

A: 1

B: 2

C: 5

D: 6

E: 9

g) Which of these values is an appropriate estimate of the weight of a tennis racket?

A: 0.03 kg

B: 0.3 N

C: 3 lb

D: 30 N

E: 300 g

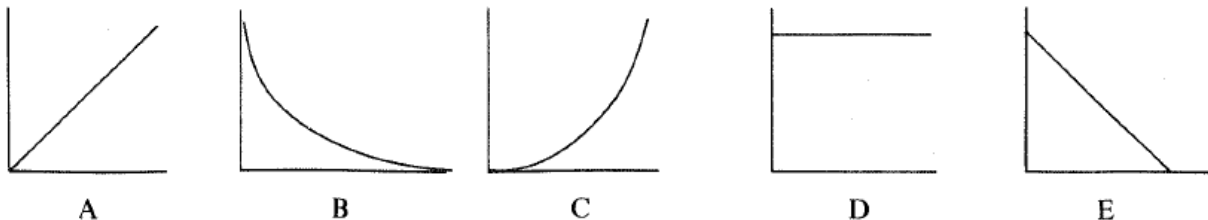
h) A Reliant Robin is a rarely seen three-wheel car.



This car has a mass of 550 kg and each tyre makes contact with the ground over a region 15 cm by 10 cm. The pressure exerted by each tyre, in Newtons per square metre, is

- A: 3.7 B: 37 C: 370 D: 37,000 E: 370,000

i) A trolley is accelerated down a completely smooth, frictionless slope by a constant force. Which of the following graphs most nearly represents the variation of distance travelled by the trolley (y-axis) with time (x-axis)?

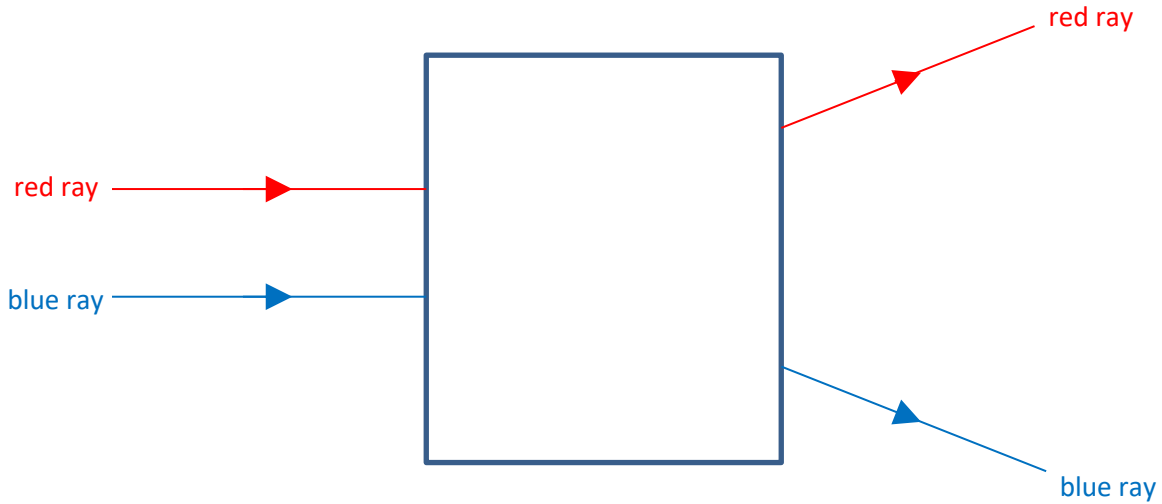


j) If a lorry moves at a steady speed as it climbs a hill, the change in its kinetic energy as it moves from the bottom to the top of the hill is

- A: a loss greater than the gain in potential energy.
B: a loss equal to the gain in potential energy.
C: a loss less than the gain in potential energy.
D: zero.
E: a gain.

Short answer Questions

P2



A beam of red light and a beam of blue light are shone into a box as shown. Light comes out on the other side as indicated. The box contains just **one** of the following:



plane mirror



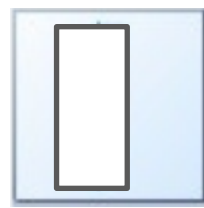
converging
(convex) lens of
glass



diverging
(concave) lens
of glass



prism



rectangular
block of glass

Select the most appropriate optical device from the list above and draw it inside the box. Add appropriate rays to indicate the path of the light beams inside the box.

P3 ENERGY

- a) When a football rolls down a hill, the potential energy of the ball turns into kinetic energy at the bottom. However, if you carry the ball down and stand with it at the bottom, the ball has no kinetic energy. Explain what has happened to the energy.

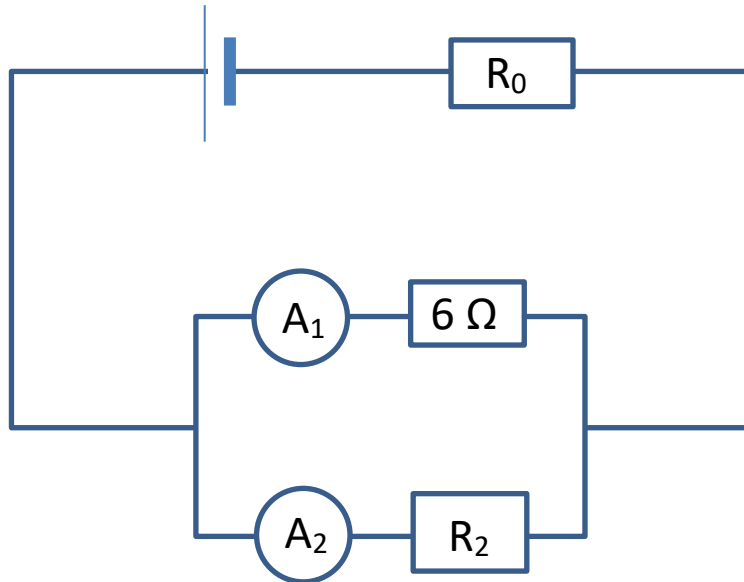
[4]

- b) If you walk across a room with bare feet, the tiles feel colder than the carpet although they are at the same temperature. Why is this?

[4]

P4 ELECTRICITY

In the following circuit, cells, ammeters and wires of negligible resistance are used. The reading of ammeter A_1 is 0.1 A.



- a) Ammeter A_2 reads 0.15 A. Is the resistance of R_2 greater, equal to or less than 6Ω ? State the value of R_2 .

[2]

- b) What current flows through resistor R_0 ?

[1]

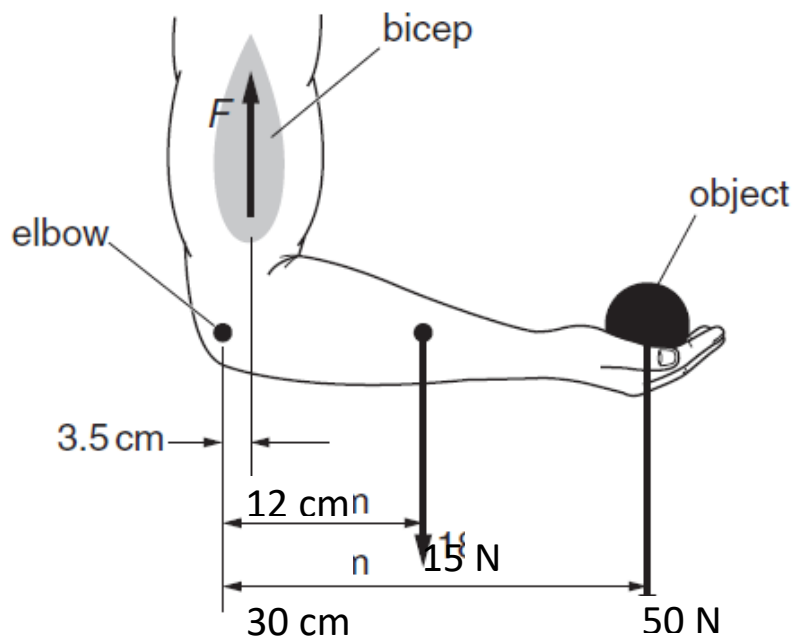
- c) If ammeter A_2 had a large resistance, how would this affect your answer to b)?

[1]

P5

The upwards tension force provided by the bicep muscle of a human arm can provide a turning moment around the elbow.

In the diagram below, the forearm is held horizontal with a weight of 50 N held in the hand. The centre of gravity of this weight is 30 cm from the elbow. The weight of the forearm itself is 15 N and the centre of gravity of the forearm is 12 cm from the elbow. The bicep provides an upwards force F and the distance between the line of action of this force and the elbow is 3.5 cm.



By taking moments about the elbow, determine the magnitude of the force F provided by the bicep.

P6

You are given a bottle of milk and asked to find the density of the milk.

a) How would you measure the mass of the milk?

[1]

b) How would you measure the volume of the milk?

[1]

c) State one likely source of error in your measurements and the effect it would have on your calculated value.

[2]