

Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 2 (Mechanics)

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

Aluminium is one of the most widely recycled metals. Aluminium cans are heated from room temperature until all the aluminium has melted. The molten aluminium is then used to make new cans. This process uses only 5% of the energy needed to extract aluminium from raw materials.

On a website it is claimed that recycling one aluminium can of mass 14 g saves enough energy to listen to music on a mobile phone continuously for 7 days.

Assess the validity of this claim.

- melting point of aluminium = 660 K
- specific heat capacity of aluminium = $902 \text{ J kg}^{-1} \text{ K}^{-1}$
- specific latent heat of aluminium = 396 kJ kg^{-1}
- room temperature = 293 K
- mobile phone p.d. = 3.7 V
- mobile phone current = 120 mA

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

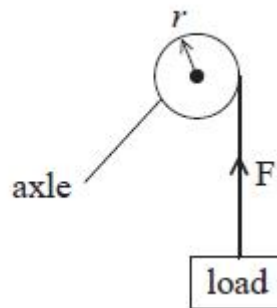
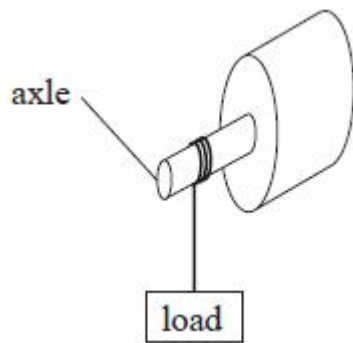
.....

(Total for question = 6 marks)

Q2.

Motors usually have a rotating component which can do work W .

(a) A motor lifts a load in a time t . The axle of the motor has a radius r and exerts a force F .



The power produced by a motor can be calculated by using the following word equation.

Power = moment of the force exerted by the rotating axle × angular velocity

$$P = \frac{W}{t}$$

Derive this equation, starting with power

(4)

.....

.....

.....

.....

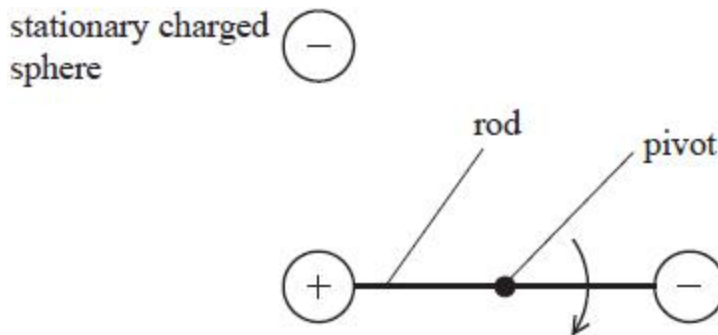
.....

.....

(b) An electrostatic motor was first demonstrated by Benjamin Franklin in 1750.

The diagram shows a simplified version of part of this motor.

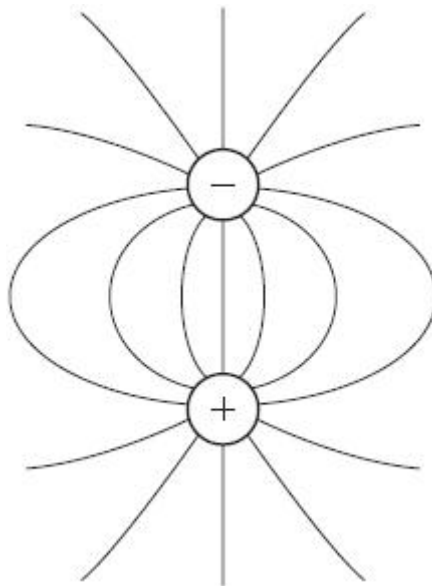
This consists of a rod, with an oppositely charged sphere at either end, which rotates around a fixed pivot. Two stationary charged spheres apply a force on the spheres at either end of the rod.



(i) In the diagram below, electric field lines have been drawn around one pair of these spheres. Add to the diagram to show

- the directions of the field lines
- the lines of equipotential.

(3)



(ii) The distance between the centres of each charged sphere in this pair is 5.0 cm.
 Show that the force between this pair of charged spheres is about 0.04 N.
 charge on each sphere = 0.10 μC

(2)

.....

.....

.....

.....

.....

(c) The table shows the typical power and the corresponding angular velocity required for three different appliances.

	Power / W	Angular velocity / rad s⁻¹
Electric car	2.0×10^4	300
Vacuum cleaner	1.4×10^3	1000
Small pond pump	0.5	200

Deduce which of these appliances, in principle, could use the electrostatic motor in (b).
 You should use the word equation in (a) and assume that the length of the rod in the electrostatic motor is 8.0 cm.

Assume that the electrostatic motor would deliver a constant force throughout one complete rotation.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 13 marks)