Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 5_Waves

Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

The photograph shows a guitar.

When a guitar string is plucked, a standing wave is created.

One end of the guitar string is wrapped around a cylindrical tuning peg. Turning the peg changes the total length of the string and hence changes the tension in the string.

This changes the frequency of vibration of the string.

(i) The length of one string is 68 cm.

Calculate the extension required to produce a tension of 93.4 N in the string.

Young modulus of string material = 1.8×10^{9} N m^{-2}
cross-sectional area of string = 6.6×10^{-7} m^{2}

(4)

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Extension = ...

(ii) The vibrating length of string is unchanged by turning the tuning peg.

Explain the effect that tightening the string has on the frequency of the sound produced.

(2)

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(Total for question = 6 marks)

Q2.

Read the passage and answer the question below.

© Reuters

The Solar Impulse 2 is a solar-powered plane that completed a round the world trip in 2016 without using fossil fuels.

The wings are covered in thin solar panels, keeping the total mass of the plane and pilot at 1600 kg. The need to reduce the weight limits the efficiency of the solar panels to 23%. However, in daylight, these panels generate enough energy to run the four 7.5 kW electric motors that keep the plane airborne and to fully charge the batteries that power the plane during the night. The batteries take about 6 hours to fully charge.

In daylight the plane flies at a height of 8500 m to harness the most sunlight, and at night descends to 1500 m. This descent makes use of the gravitational potential energy gained during the day to help the plane get through the night.

(Source: www.solarimpulse.com)

The solar panels are illuminated with an average light intensity of 1300 W m^{-1} over an 8 hour period in any day.

Calculate the electrical energy generated by the solar panels in one day.

(4)

upper area of wings = 200 m^2

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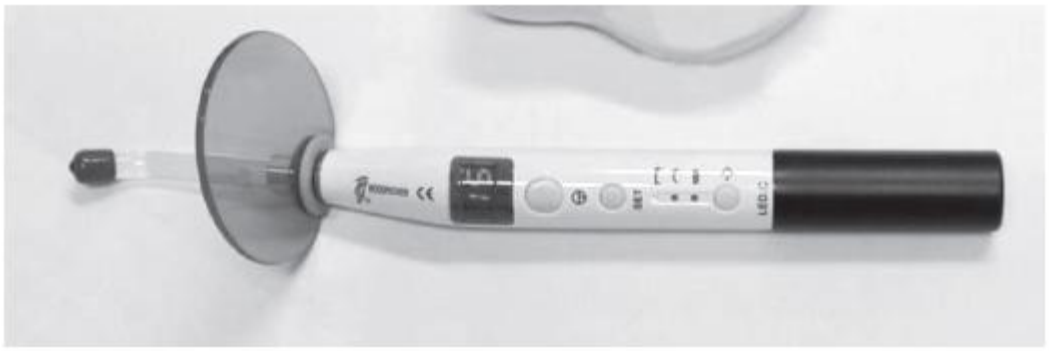
Energy = ...

(Total for question = 4 marks)

Q3.

Dentists often use a white composite material for fillings for teeth. This material is applied as a liquid and then hardened using blue light.

The photograph shows a light gun, used by dentists, that emits the blue light.



© Zhengzhou Smile Dental Equipment Co., Ltd.

(a) The light gun emits light of radiation flux 8000 W m^{-2}.

A particular tooth needs a filling of cross-sectional area 1.5×10^{-5} m^2. It requires 2.3 J of incident light energy to harden the filling.

Calculate the time for which the light must be applied.

(3)

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Time = ...

(b) The light gun is supplied with a rechargeable battery of capacity 1.4 amp hours. When in use, the output potential difference of the battery is 3.7 V.

(i) Assuming the potential difference is constant, show that the maximum energy supplied by the battery is about 20 000 J.

(2)

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(ii) Assuming each filling requires 2.3 J of incident light energy, a fully charged battery can be used to power the light gun to harden 210 fillings.
Calculate the efficiency of the light gun at supplying the energy stored in the battery to the fillings.

(3)

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Efficiency = ...

(Total for question = 8 marks)