

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

Electric cars have motors that are powered by a battery.

Diesel cars have engines that are powered by diesel fuel.

The following table compares one type of electric car with one type of diesel car.

Power source	Energy density in MJ / kg	Mass of power source in kg	Total mass of car in kg	Time to recharge battery or refill fuel tank in minutes
Battery	0.95	280	1600	40
Diesel fuel	45	51	1500	3

- (a) The electric car has a range of 400 km with a fully charged battery.

The diesel car has a range of 1120 km with a full tank of diesel.

Explain the difference in the time needed to complete a 500 km journey using the electric car compared with the diesel car.

Assume both cars travel at the same speed.

(2)

- (b) Energy density is the amount of energy stored per kilogram of the energy source.

Show why the diesel car has a greater range than the electric car.

Use data from the table above.

Assume the efficiency of the two cars is the same.

Include calculations in your answer.

(3)

Engineers have developed a way of charging electric cars while they are driving along the road.

Coils of wire buried under the road transfer energy to the car's battery as the car is passing over the coils.

The figure below shows a charging lane on a motorway.



- (c) Suggest **two** advantages of using this method to charge electric cars compared with plugging them into the mains electricity supply.

1 _____

2 _____

(2)

- (d) When electric cars are not being driven, energy stored in their batteries could be used to meet sudden peaks in electricity demand.

Suggest how.

(2)

(Total 9 marks)

Q2.

Figure 1 shows a person using an electric lawn mower.

Figure 1



- (a) The lawn mower is connected to the mains electricity supply.

What is the frequency of the mains electricity supply in the UK?

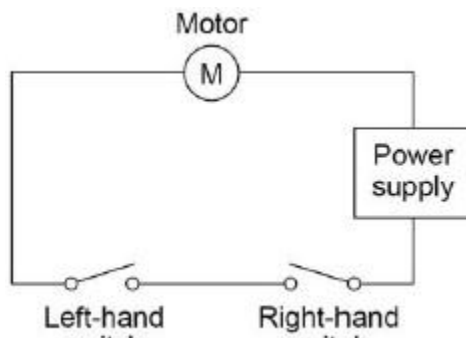
Frequency = _____ Unit _____

(2)

The lawn mower has a switch on each side of the handle.

Figure 2 shows the circuit diagram for the lawn mower.

Figure 2



- (b) The motor in the lawn mower can only be turned on when the person using it holds the handle of the lawn mower with both hands.

Explain why.

(2)

- (c) The power input to the motor is 1.8 kW

The resistance of the motor is $32\ \Omega$

Calculate the current in the motor.

Current = _____ A

(3)

- (d) The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.

Time = _____ seconds

(3)

(Total 10 marks)

