

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JANUARY 2020

CYFNOD ARHOLIADAU
IONAWR 2020

MODULE CODE: M4X02192
Engineering Science

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Scientific Calculator

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REMEMBER:

Take Gravity as 9.81m/s^2

Give all answers to 2.d.p unless otherwise instructed.

1.



Figure 1: Tesla Model S

A Tesla accelerates from rest up to 96.6km/h in 4s. It then accelerates up to its top speed of 250km/h in a further 15 seconds, before coming back to rest in 350m. Draw a velocity time graph [5 marks] and calculate:

- a. the total time taken for the movement and [8 marks]
- b. the total distance travelled in km. [9 marks]

2.

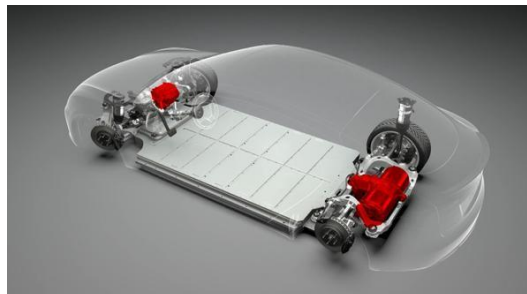


Figure 2: Tesla electric motors

The motors in the Tesla can generate a peak torque of 601Nm. Given that the motor is made up of a single spinning homogenous rotor of diameter 310mm that can spin up to 18000rpm in 1.5 seconds, calculate the mass and kinetic energy (in kJ) of the rotor. [18 marks]

$$k^2 = \frac{d^2}{8}$$

$$I = mk^2$$

$$T = I\alpha$$

$$KE = \frac{1}{2} I\omega^2$$

3.



Figure 3: Ski lift

A ski lift similar to that in figure 3 pulls skiers up a slope inclined at 45 degrees at a velocity of 3m/s. The coefficient of friction between the snow and skis is 0.4. Given that there can be up to 10 skiers on the lift at any one time and that the power of the lift is 51kW, construct a forces diagram [5 marks] and calculate the maximum allowable mass of one skier.

[14 marks]

$$P = F \cdot v$$

$$F_R = \mu R$$

4.

A single cylinder engine has the piston assembly shown in Figure 4. Each piston assembly has a mass of 0.125kg and can be considered to operate in simple harmonic motion. Given that the maximum velocity of the assembly is 5m/s and the periodic time for motion is 0.008s, calculate:

- The frequency of the motion. [3 marks]
- The angular velocity of the assembly in rpm [5 marks]
- The stroke 'l', of the engine, [5 marks]
- The maximum force experienced by the assembly. [2 marks]

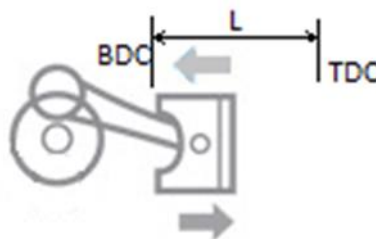


Figure 4: Piston assembly

$$T = \frac{1}{n}$$

$$n = \frac{\omega}{2\pi}$$

$$v_{\max} = \omega A$$

$$F_{\max} = m\omega^2 A$$

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