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Question 1

a)

Hydrogen

Hydrogen can be used to reduce CO_2 greenhouse emissions in Europe a drop in fleet consumption of 15% and 30% is set as target by regulation until 2025 and 2030.

bio-butanol

Butanol is nonhygroscopic fuel therefore it is less likely to separate from base fuels than ethanol when water contamination is occurring.

b) Hydrogen

Hydrogen is very hard to store in gaseous form can be stored at high pressures from 5000psi to 10,000psi. Liquid form must be stored at ~~extremely~~ low temperatures of -232°C .

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Q1

b)

Hydrogen

The most of today's hydrogen is grey hydrogen, grey hydrogen is used by burning fossil fuels and natural gases which produce greenhouse emissions.

Biobutanol

The higher viscosity of biobutanol may lead ~~still need some further~~ to a potential corrosive or aggradation problem when it was used in spark ignition engines. Therefore more maintenance cost and time.

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Q1

~~Q1~~ C) Hydrogen

Blue Hydrogen is becoming more popular. It involves burning fossil fuels and natural gas. However, they use carbon capture technology by using steam reforming to stop carbon dioxide from releasing ~~into~~ into the ~~atmosphere~~ atmosphere.

Bio butanol

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Question 2

a) ^{electrons}
The number of ~~electrons~~ in the outer shell shows the valency of an atom if they add up between 1 and 4. The valency is classed as positive if the compound has 4, 5, 6, 7 ~~valency~~ ^{valency} by subtracting the electrons from 8 the valency is determined.

Ionic bonding is when atoms transfer electrons between each other. This occurs when the ions attract each other through an electrostatic force when they have opposite charges.

Metallic bonding. Metals atoms shed electrons from the outer shell freely. This creates positively charged ions and a sea of 'free' electrons, also known as delocalised electrons.

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Q2

a)

Covalent bonding

In covalent bonding atoms share electrons but don't permanently transfer them to each other. Therefore it is the interatomic linkage.

This occurs when the elements are the same or similar. This arises from electrostatic attraction of their nuclei for the same electron.

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Question 2

b) $a = 0.362 \text{ nm}$ $a = 0.362 \times 10^{-9} \text{ m}$

~~$a = 2\sqrt{2}R$~~

$$R = \frac{2\sqrt{2}}{a} \quad R = \frac{2\sqrt{2}}{0.362 \times 10^{-9}} = 7.81 \times 10^{-9} \text{ m}$$

$$R = 7.81 \text{ nm}$$

C) A point defect can be an atom missing from a site in the crystal (a vacancy) or an impurity atom that occupies either normal lattice site (a substitutional impurity) or a hole in the lattice between atoms (an interstitial impurity).

Line defect, ~~or~~ or lines along which whole rows of atoms in a solid are arranged anomalously. The line defect ~~can~~ can weaken or strengthen solids.

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Q2

C) Area defect ~~represent~~ represent a large area discontinuity in a lattice. Defect appear during crystal growth.

D) The Dislocation movement is closed as the secondary creep. When the stress is applied to help save the material from creep and fatigue due to the dislocations generated.

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Question 6

- (i) ^{a)} The main alloying element in 7XXX is zinc is the principal alloying element. When coupled with a smaller percentage of magnesium, this results in heat treatable alloy of moderate to very high strengths. This can also be used in air frame structures and mobile equipment and other stressed parts. Also reduce the resistance to corrosion cracking.

(ii)

First number shows that is a carbon steel. The last two numbers shows it is a carbon percentage of 0.45%.

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Q11

b) particle reinforced

- Fiber reinforced
- Structural ~~reinforced~~

Particle reinforced are stronger than the matrix materials. Also they are particles of microscopic scale. Also they can improve mechanical behaviour depending on the interface bonding.

Fiber reinforced are high strength to low weight such as Carbon Fiber.

Structural ~~reinforced~~ is able to sandwich panels to higher strength. Along with better creep and fatigue resistance.

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Q 10

C)

$$\text{Volume} = 0.45$$

$$E_F = 65 \text{ GPa}$$

$$E_m = 3.2 \text{ GPa}$$

$$F_F =$$

$$F_m =$$

$$F_F/F_m = 30 \text{ MPa} \times 0.03 = 9 \text{ N}$$

$$F_F/F_m = \frac{(65 \times 0.45)}{(3.2 \times 0.55)} = 16.62$$

$$F_c = 30 \text{ MPa} \times 0.03 = 9 \text{ N}$$

$$F_c = F_F + F_m = 9 \text{ N}$$

$$F_m \times 16.62 = 9 \text{ N}$$

$$17.62 \times F_m = 9 \text{ N}$$

$$\frac{17.62}{a} = 1.957 \text{ N} \quad F_m = 1.957 \text{ N}$$

$$F_F = 9.1957 = 7.0042 \text{ N}$$