**Topic Test solns: Fuel**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* C

*Explanation:*

Biogas is a mixture with methane and carbon dioxide as its main components. It can be made from animal waste.

**Question 2**

*Answer:* D

*Explanation:*

The long alkane shown is a typical component of petrodiesel.

**Question 3**

*Answer:* A

*Explanation:*

The Data Book shows that petrodiesel has a higher molar heat of combustion but a lower energy density than methane.

**Question 4**

*Answer:* A

*Explanation:*

Energy = 6.1 × 1015 J = 6.1 × 1012 kJ

Mass = 6.1 × 1012/55.6 = 1.1 × 1011 g = 1.1 × 108 kg

**Question 5**

*Answer:* B

*Explanation:*

During the combustion of coal, some nitrogen in air combines with oxygen to form nitrogen monoxide.

**Question 6**

*Answer:* D

*Explanation:*

 The intramolecular bonds are covalent and the intramolecular bonds are mainly dispersion but also some dipole to dipole between the polar ends of the molecules.

**Question 7**

*Answer:* B

*Explanation:*

The ester bonds in the triglyceride are hydrolysed, then reform into a different ester.

**Question 8**

*Answer:* A

*Explanation:*

 Bioethanol is the same molecule as ethanol formed from petroleum – it is just the raw material that differs.

**Question 9**

*Answer:* D

*Explanation:*

 Petrodiesel contains alkanes with 10 -15 carbons.

**Question 10**

*Answer:* B

*Explanation:*

 This is one of the transformations in a coal-fired plant.

**SECTION B: Short-answer questions**

**Question 1** (8 marks)

**a**. **i**. CH4(g) + 2O2(g) 🡪 CO2(g) + 2H2O(l) 1 mark

 **ii**. S(s) + O2(g) 🡪 SO2(g) 1 mark

**b. i**. It is more efficient, creates less toxic emissions. 2 marks

 **ii**. 2 marks

 Source: coal seam gas (natural gas, shale oil, petroleum)

 Environmental issue: Fracking might contaminate water supplies.

**c**. potential 🡪 thermal coal 🡪 thermal steam 🡪 mechanical 🡪 electrical

 or potential 🡪 thermal coal 🡪 mechanical 🡪 electrical

**Question 2** (10 marks)

**a.**

 **i**.

 1 mark

 ii. C14H28O2 1 mark

 iii. C14H28O2 + 20O2(g) 🡪 14CO2(g) + 14H2O(l) 1 mark

**b**. i. 654 1 mark

 ii. 218 1 mark

c. 3 marks

 Circle the correct answer.

|  |  |
| --- | --- |
| Viscosity of biodiesel |  lower equal higher |
| Melting point of biodiesel |  lower equal higher |
| Water absorption of biodiesel. |  lower equal higher |

d. Oleic acid has the higher melting point. The Data booklet shows it has less carbon-to-carbon double bonds so its molecules will pack better, allowing the dispersion forces to be stronger.

 2 marks

**Question 3** (10 marks)

a. i. Sugar cane, wheat 1 mark

 ii. 1 mark

b. 6CO2(g) + 6H2O(l) 🡪 C6H12O6(aq) + 6O2(g)

1 mark

c. i. glucose 1 mark

 ii. C6H12O6(aq) 🡪 2C2H5OH(aq) + 2CO2(g) 1 mark

d. CO2 is produced by the farming machinery and the processing equipment in the factory .

 2 marks

e. 500 g of E10 contains 450 g of petrol and 50 g of ethanol

energy = 450 x 49.6 + 50 x 29.6 = 22320 + 1480 = 23800 kJ 3 marks

**Question 4** (7 marks)

a. The pressure of the Earth’s crust squeezes water from the coal. The carbon content increases,

 increasing the energy produced during combustion. 2 marks

b. i. Grinding the coal increases the surface area – energy released faster. 1 mark

 ii. If coal is wet, energy is wasted heating the water in the coal instead of the water you are

 trying to heat. 1 mark

c. Mass carbon in 100 kg of black coal = 92 kg

Energy = 92 x 32 = 2944 kJ

Mass carbon in 100 kg brown coal = 78 kg

Energy = 78 x 32 = 2496 kJ

Difference = 448 kJ 3 marks

**Question 5** (5 marks)

**a**. The density of methane is lower than that of diesel. Therefore a set volume actually contains a lot less mass.2 marks

**b**. Queensland has a number of suitable sources for bioethanol – such as sugar cane. Any bioethanol in Victoria probably has the added cost of transport from Queensland. 2 marks

**c**. The melting point of the biodiesel might be low and it will turn to a solid in Victoria’s winter. 1 mark