Fuels

N4 & N5 Homework Questions

Answer questions as directed by your teacher.

National 4 level questions are first followed by National 5 level questions.

National 4 Questions

1. The following table shows the percentage of energy consumed in the world from various sources.

Fuel	Nuclear	Hydro-electric	Gas	Coal	Oil
%	5	7	19	29	40

    a) Draw a **bar** graph to show this information. (2)
    b) What percentage of the world energy consumption came from fossil fuels? (1)
    c) In an exam a student was asked to describe how coal was formed.
       Pick out and write down the **two incorrect words** in their answer.

       Question: How was coal formed?
       Answer: Coal was formed over thousands of years from the remains of animals
               which decayed under layers of mud. (1)

    d) Both coal and natural gas can be described as finite resources.
       What is meant by the term finite? (1)
    e) Biogas is a renewable fuel. Biogas consists mainly of methane which is a
       hydrocarbon. Name the two products formed when methane burns in a plentiful
       supply of air.

2. You are given three unlabelled cylinders of gas. Each cylinder contains one of the
    following gases:
         oxygen   nitrogen   carbon dioxide
    Describe how to find out which gas is in each container. (3)

3. Petrol is an important <u>fuel</u>. The <u>combustion</u> of petrol is an example of an <u>exothermic</u>
    reaction.

    Explain what is meant by the three terms underlined. (3)

4. (a) Why is coal described as a fossil fuel?
    (b) Explain why natural gas can be described as a **finite** resource.
    (c) Give **two** examples of renewable sources of energy. (3)

5. Paraffin is one of the fractions obtained from crude oil. It can be used as a fuel.
   In a paraffin burner, heat is produced when paraffin burns.

   (a)   What term is used to describe a reaction which produces heat?
   (b)   Which gas is used up when paraffin burns?
   (c)   Explain why it is dangerous to burn paraffin in a very poorly ventilated room.   (3)

6. The grid shows the formulae of some substances.

A He	B NO_2	C H_2
D K_2O	E O_2	F CO_2

   (a) Identify the substance which is used up when a fuel burns.
   (b) Identify the the substance that can cause global warming..
   (c) Identify the substance that can cause acid rain.   (3)

7. The higher the octane number the better the fuel burns.

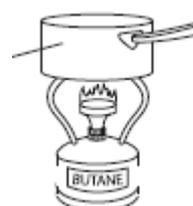| Number of carbon atoms	Octane number	
	alkane	alkene
4	94	98
5	62	93
6	25	85
7	0	75

   (a)   Describe the relationship between number of carbon atoms and the octane
          number of the alkanes?
   (b)   Predict the octane number of the **alkane** with 3 carbon atoms.
   (c)   In general, how does the octane number of an **alkane** compare with the
          octane number of the **alkene** with the same number of carbons?   (3)

8. Butane is a hydrocarbon which can be used as a fuel.
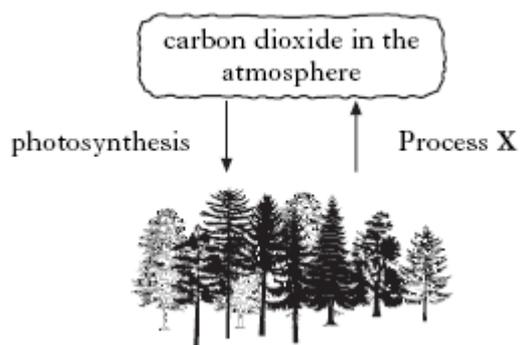   (a) When butane burns in oxygen, carbon dioxide and water are produced.
       Write a chemical equation for the burning of butane C_4H_{10}.
   (b) After sometime the bottom of the pot becomes covered in a black
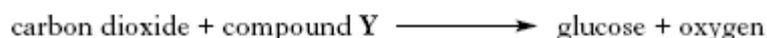   substance. Suggest what this black substance could be.   (2)

9. Forests are important in maintaining the level of carbon dioxide in the atmosphere.

(a) Name process X.

(b) The equation for photosynthesis is:

carbon dioxide + compound Y ⟶ glucose + oxygen

Name compound Y.

(c) The table shows how the level of carbon dioxide in the atmosphere has changed since 1975.

Year	Level of carbon dioxide/units
1975	330
1985	345
1995	358
2005	374
2015	

Predict the level of carbon dioxide in the atmosphere in 2015 if the trend continues. (3)

10. Catalytic converters in cars can help to reduce pollution. Harmful gases react as they pass over the catalyst.
Typical converter reaction:

$CO(g)$ + $NO(g)$ ⟶ $CO_2(g)$ + $N_2(g)$

(a) Why does burning petrol in a car engine produce carbon monoxide as well as carbon dioxide?

(b) Suggest why the catalyst is spread over a large surface area.

(c) Give another way by which pollution from a car engine can be reduced. (3)

9. Carbon dioxide is known as a 'Greenhouse gas' ie, a gas which can cause the earth's temperature to rise if too much of it gets into our atmosphere.

Research the names of other greenhouse gases. Draw a table which lists these gases in order of their ability to cause global warming, starting with the most damaging first, and also include in the table sources of these other greenhouse gases. (3)

10.A student burned gas **X** and the products were passed through the apparatus shown.
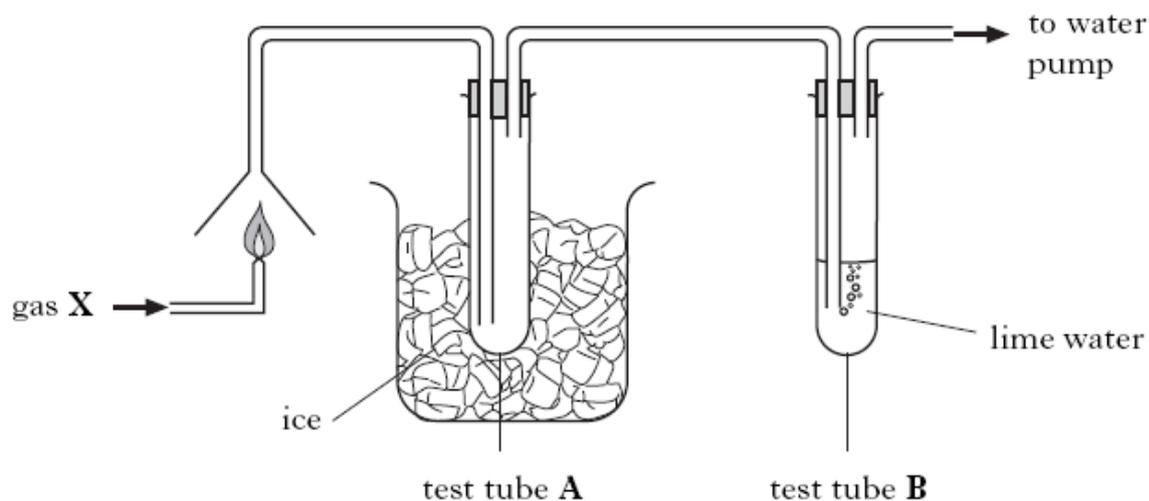
(a) The results are shown in the table.

Observation in test tube A	Observation in test tube B
colourless liquid forms	lime water turns milky

Using the information in the table, name two **elements** which **must** be present in gas **X**.

_____

(b) The experiment was repeated using hydrogen gas.

Complete the table showing the results which would have been obtained.

Observation in test tube A	Observation in test tube B

(2)

11. Which of the following fuels would make no contribution to global warming when burned?

A Hydrogen   B Natural gas
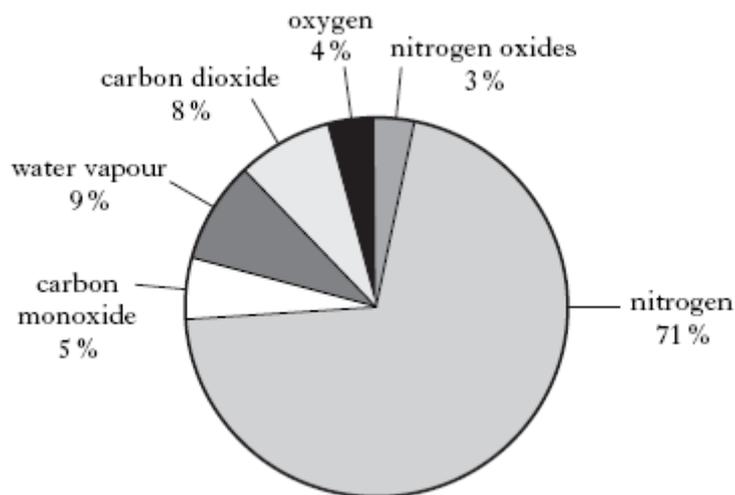
C Petrol   D Coal

(1)

12. Many different gases are found in car exhaust fumes. Some of these gases are produced by the combustion of petrol in car engines.

The pie chart shows the gases present in the exhaust fumes in a car.

(a) What evidence in the pie chart shows that incomplete combustion of petrol has taken place?

(b) The car's exhaust fumes were found to contain 3% nitrogen oxides. Predict the percentage of nitrogen oxides that could be found in the exhaust fumes if the car was fitted with a catalytic convertor.

(c) The burning of fossil fuels releases sulphur dioxide into the atmosphere. Why is this a problem? (3)

National 5 Questions

1. Equations are used to represent chemical reactions.

A	$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$
B	$C_2H_5OH(\ell) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(\ell)$
C	$SO_2(g) + H_2O(\ell) \longrightarrow 2H^+(aq) + SO_3^{2-}(aq)$
D	$H^+(aq) + OH^-(aq) \longrightarrow H_2O(\ell)$
E	$SO_4^{2-}(aq) + 2H^+(aq) + 2e^- \longrightarrow SO_3^{2-}(aq) + H_2O(\ell)$

(a) Identify the equation which represents the formation of acid rain.
(b) Identify the equation which represents combustion. (2)

2. The car industry and the Government have taken a number of steps to reduce the emissions of pollutant gases from cars.
(a) Catalytic converters reduce the emission of carbon monoxide by converting it to a harmless gas. Name this harmless gas. (1)
(b) Car tax is based on the mass of carbon dioxide gas produced per kilometre travelled by a car

(i) The volume of carbon dioxide produced by a car is measured and then converted into mass using the following equation.

$$\text{Mass of carbon dioxide gas (g)} = \frac{100 \times \text{volume of carbon dioxide gas (l)}}{56\cdot3}$$

Calculate the mass of carbon dioxide gas which is produced by a car emitting 70.4 litres of carbon dioxide gas. (1)

(ii) Information about car tax bands is shown in the tables.

Car tax band	Mass of carbon dioxide gas emitted per kilometre (g)
A	Up to 100
B	101–110
C	111–120
D	121–130
E	131–140
F	141–150
G	151–165

Car tax band	12 month rate (£)
A	0·00
B	20·00
C	30·00
D	95·00
E	115·00
F	130·00
G	165·00

What would it cost to tax a car, for 12 months, which emits 146g of carbon dioxide per kilometre travelled? (1)

3. Which of the following alkanes (hydrocarbons) will produce 3 moles of carbon dioxide when 1 mole of it is completely burned?

A ethane C_2H_6 B propane C_3H_8
C butane C_4H_{10} D pentane C_5H_{12} (1)

4. 1 mole of a hydrocarbon burns completely in oxygen to produce 2 moles of carbon dioxide and 2 moles of water.
   The formula for the hydrocarbon is

A C_2H_4 B C_2H_6
C C_4H_{10} D C_4H_8 (1)

5. Nonane is a member of the alkane family. It can be used as a fuel.
   The equation for the burning of nonane is:

   $$C_9H_{20} \quad + \quad 14O_2 \longrightarrow 9CO_2 \quad + \quad 10H_2O$$

   Calculate the mass of water produced when 6.4g of nonane is burned.   (3)
   Show your working clearly

6. The equation for the complete combustion of ethanol is

   $$CH_3CH_2OH \quad + \quad 3O_2 \longrightarrow 2CO_2(g) \quad + \quad 3H_2O$$

   Calculate the mass of carbon dioxide produced when 80g of ethanol is burned completely in excess oxygen.   (3)
   Show your working clearly.

7. Octane burns in a plentiful supply of air to produce carbon dioxide and water.

   $$C_8H_{18} \quad + \quad 12\tfrac{1}{2}O_2 \longrightarrow 8CO_2 \quad + \quad 9H_2O$$

   Calculate the mass of carbon dioxide produced by the burning of 57 tonnes of octane.
   Show your working clearly.   (3)

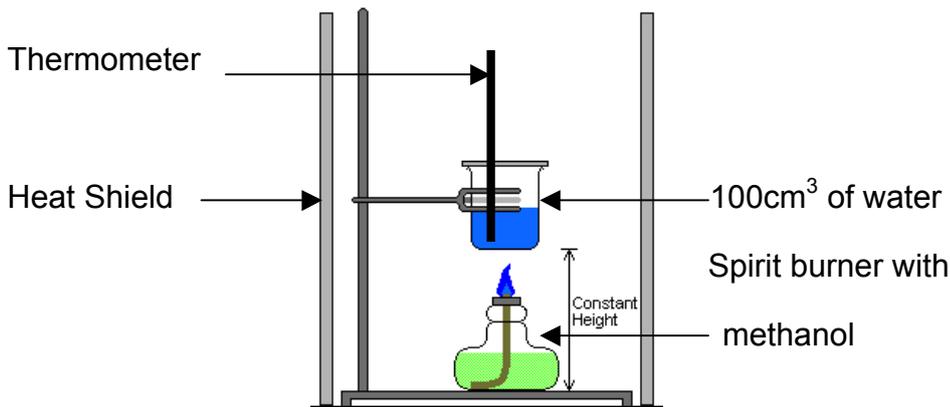8. $$4Al\,(s) \quad + \quad 3O_2(g) \longrightarrow 2Al_2O_3\,(s)$$

   Calculate the mass of oxygen required to react with 2.7g of aluminium.
   Show your working clearly.   (3)

9. A pupil set up the following experiment to calculate the energy given out by burning a certain mass of methanol.

Thermometer

Heat Shield ─────► 100cm³ of water

Constant Height

Spirit burner with methanol

Initial temperature = 22.5°C and final temperature =32.5°C

(a) What is the main purpose of the heat shield? (1)
(b) Calculate the energy released during this reaction. (3)
(c) A more accurate value could
   be obtained using the bomb calorimeter.

electrical supply to ignite the methanol

thermometer

oxygen gas

   One reason for the more accurate value is that less heat is lost to the surroundings.

methanol

platinum dish

thick walled 'bomb' container

   Give one other reason for the value being more accurate in the bomb calorimeter method.
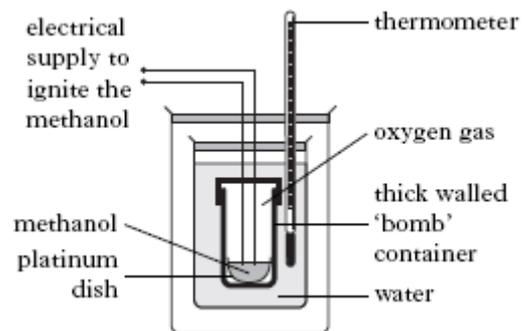
water

(1)

10. A value for the energy released when 1g of butan-2-ol (C₄H₉OH) burns can be determined experimentally. The following measurements were obtained:
    volume of water heated = 200cm³
    temperature rise of water = 40°C

   Use these results to calculate the energy released during this reaction. (3)

11. When 2.24 litres of a gas were burned, the heat produced warmed 2 litres of water from 12°C to 38°C.
    Calculate the energy released during this reaction. (3)