Electricity and Energy Homework Booklet

**2018**



## Generation of Electricity

1. State what is meant by a “finite” energy resource

2. State what is meant by an “infinite” energy source.

3. State what is meant by the term “fossil fuel”

4. Identify “renewable” and “non-renewable” energy sources.

bio-gas coal hydro natural gas nuclear

oil peat solar tidal wave wind

|  |  |
| --- | --- |
| Renewable energy source | Non-renewable energy source |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

5. Choose 2 renewable energy sources and give one advantage and one disadvantage for each of them.

|  |  |  |
| --- | --- | --- |
| Renewable Energy source | Advantage | Disadvantage |
|  |  |  |
|  |  |  |

6. Choose 2 non-renewable energy sources and give one advantage and one disadvantage for each of them.

|  |  |  |
| --- | --- | --- |
| Non-renewable Energy source | Advantage | Disadvantage |
|  |  |  |
|  |  |  |

7. Label a diagram of a simple dynamo.

**The terminals**

**The Rotor**

**The Stator**

**Rotating shaft**

**Stator Coil**

**Rotor shaft hub**

**N**

#### **S**

* Soft iron core
* Cylindrical permanent magnet attached to the rotating shaft
* Electrical energy out
* Kinetic energy in
* Where the current is induced
* Spins the rotor

8. Name the main parts and the energy changes that take place in a fossil fuel power station.

B \_ \_ \_ \_ \_

T \_ \_ \_ \_ \_ \_

G\_ \_ \_ \_ \_ \_ \_ \_

C \_ \_ \_ \_ \_ \_ in the coal to h \_ \_ \_ in the steam

K \_ \_ \_ \_ \_ \_ of steam to K \_ \_ \_ \_ \_ \_ of the blades

K \_ \_ \_ \_ \_ \_ of the shaft to E \_ \_ \_ \_ \_ \_ \_ \_ \_ in the wires

.

9. Name the main parts and the energy changes that take place in a nuclear power station.

N \_ \_ \_ \_ \_ \_

R \_ \_ \_ \_ \_ \_

N \_ \_ \_ \_ \_ \_ in the atoms to h \_ \_ \_ in the coolant

B \_ \_ \_ \_ \_

T \_ \_ \_ \_ \_ \_

G\_ \_ \_ \_ \_ \_ \_ \_

Heat in the coolant to h \_ \_ \_ in the steam

K \_ \_ \_ \_ \_ \_ of steam to K \_ \_ \_ \_ \_ \_ of the blades

K \_ \_ \_ \_ \_ \_ of the shaft to E \_ \_ \_ \_ \_ \_ \_ \_ \_ in the wires

10. Name the main parts and the energy changes that take place in a hydroelectric power station

D \_ \_

T \_ \_ \_ \_ \_ \_

G\_ \_ \_ \_ \_ \_ \_ \_

G\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ in the water to k \_ \_ \_ \_ \_ \_ in the water

K\_ \_ \_ \_ \_ \_ in the water to K \_ \_ \_ \_ \_ \_ of the blades

K \_ \_ \_ \_ \_ \_ of the shaft to E \_ \_ \_ \_ \_ \_ \_ \_ \_ in the wires

11. Using the words step-up transformer, step-down transformer, power lines, pylons, underground cables, current and voltage, I can explain how electrical energy it transmitted to my house from the power station. (You can draw a diagram)

12. I can explain why step-up and step-down transformers are used in power transmission

13. Draw a labelled diagram of a transformer

14. I can use the transformer equation to solve problems

Ns

Np

Vs

Vp

=

A transformer has 25 turns on its Primary coil and 175 turns on its secondary coil. The Primary voltage is 4 V.

a. Is this a step-up or step-down transformer (and why)?

b. Calculate the size of the Secondary voltage?

15. List ways of making a house of reducing energy waste in houses and at work.

## Practical electrical and electronic circuits

1. What is meant by “electric current”?

What are the units of electric current?

Which device is used to measure electric current? Draw it’s symbol.

2. What is meant by “voltage”?

What are the units of voltage?

Which device is used to measure voltage? Draw its symbol.

3. Complete this circuit to show how the voltage across and the current through this resistor can be measured.

4. What is meant by the term “electrical resistance”?

What are the units of resistance?

What component is used to measure resistance? Draw its symbol.

Complete this circuit to show how the device can be used to measure the resistance of a resistor.

What happens to the resistance of a wire as the length of the wire increases?

What happens to the resistance of a wire as the thickness increases?

5. Write down the equation for Ohm’s Law

Complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Quantity | Symbol | Unit | Symbol |
| Voltage |  |  |  |
|  | I |  |  |
|  |  | Ohms |  |

A resistor has a voltage across it of 15 V and a current through it of 3 A. Calculate the resistance of the resistor.

5. Draw a series circuit containing one cell, and two bulbs.

Write down the rule for current in a series circuit.

Write down the rule for voltages in a series circuit.

Fill in the missing meter readings on this diagram.

12 V

7 V

3 A V

6. Draw a parallel circuit containing one cell, and two bulbs.

Write down the rule for currents in a parallel circuit.

Write down the rule for voltages in a parallel circuit.

Fill in the missing meter readings on this diagram.

12 V

3 A V

2 A V

7 State an example from everyday life where switches are wired in series.

State an example from everyday life where bulb are connected in parallel. 8. Name the three parts of an electronic circuit.

Complete the table below for a thermocouple, a microphone ad a solar cell.

|  |  |  |  |
| --- | --- | --- | --- |
| Input device | Input energy | Symbol | Analogue / Digital |
|  | Sound |  |  |
|  | Light |  |  |
|  | Heat |  |  |

Complete the following table for a thermistor and an LDR

|  |  |  |  |
| --- | --- | --- | --- |
| Input device | Senses | Symbol | Analogue / Digital |
|  | Heat |  |  |
|  | Light |  |  |
|  | ON / OFF |  |  |

What do LURD and TURD stand for?

9. Complete the following table for a bulb, an LED, a motor, a relay, a solenoid, loudspeaker

|  |  |  |  |
| --- | --- | --- | --- |
| Output device | Output energy | Symbol | Analogue / Digital |
|  | Rotational kinetic |  |  |
|  | Light |  |  |
|  | Kinetic |  |  |
|  | Light and heat |  |  |
|  | Linear kinetic |  |  |
|  | Sound |  |  |

10. Draw the symbol and the truth table for a NOT gate.

Draw the symbol and the truth table for an OR gate

Draw the symbol and the truth table for an AND gate.

11. Design a circuit that will operate an alarm when either the temperature gets too hot (hot =1 cold = 0) or the light level is too low. (Dark =1 Light =0)

## Electromagnetism

1. On which pole of a magnet do magnetic field lines start?

2. Draw the magnetic field line patterns around the following magnets.

N S

N S

N S

S N

N S

3. Label the solenoid using the terms, “soft iron core” “source of current” and “coils of wire”

Draw on the magnetic field pattern around the solenoid

4. Name three ways in which the magnetic field strength of an electromagnet can be increased.

1.

2.

3.

5. What is the main difference between a permanent magnet and an electromagnet?

6. Name one everyday example of where a permanent magnet may be used and explain why you would not use an electromagnet to do the same job.

7. Name one everyday example of where an electromagnet may be used and explain why you would not use a permanent magnet to do the same job.

## Electrical Power

1. Name nine forms that energy can take.

1. 2.

3. 4.

5. 6.

7. 8.

9.

2. Complete the following energy transfer diagrams

Electric fire \_\_\_\_\_\_\_\_ energy 🡺 \_\_\_\_\_\_\_\_ energy

Light bulb \_\_\_\_\_\_\_\_ energy 🡺 \_\_\_\_\_\_\_\_ energy + \_\_\_\_\_\_\_\_ energy

TV \_\_\_\_\_\_\_\_ energy 🡺 \_\_\_\_\_\_\_\_ energy + \_\_\_\_\_\_\_\_ energy

Electric drill \_\_\_\_\_\_\_\_ energy 🡺 \_\_\_\_\_\_\_\_ energy

3. Complete the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| Quantity | Symbol | Unit | Symbol |
| Power |  |  |  |
|  | E |  |  |
|  |  | seconds |  |

4. Write down the equation that links Power energy and time.

÷

x

5. Complete the following sentence

One Watt = \_\_\_\_\_\_\_ Joule every \_\_\_\_\_\_\_\_\_\_\_\_

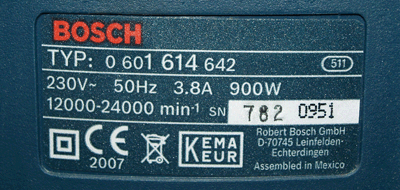
6. A light bulb uses 210 Joules of energy in 3.5 s.

Calculate the Power rating of the bulb?

7. Which of these appliances use the most energy every second? Explain your answer

100W light bulb 2kW kettle 850 W microwave oven.

8. Look at the following rating plate and match each letter to its correct label.



A

B

C

D

E

G

E

|  |  |
| --- | --- |
| European safely mark | E |
| Power rating |  |
| Double insulation symbol |  |
| Voltage |  |
| Current |  |
| Frequency |  |
| Model number |  |

9. Write down the equation for finding the % energy efficiency of an appliance.

10. Calculate the % energy efficiency of a light bulb which has an input energy of 120 J and an output energy of 30 J.

11. Write down the equation for finding the % power efficiency of an appliance

12. Calculate the % power efficiency of a power station which has an input power of 350 MW and an output power of 75 MW

13. Which type of electricity generating station is the most energy efficient? Explain your answer.

## Gas Laws and Kinetic Model

1. Describe, in terms of particles, how gas pressure is produced.

2. Boyle’s law is the relationship between the Pressure and the Volume of a fixed mass of gas at a constant Temperature

What happens to the pressure of a gas as its volume decreases?

In terms of particles, why does this happen?

3. The Pressure law is the relationship between the Pressure and the Temperature of a fixed mass of gas with a constant Volume

What happens to the pressure of a gas as its temperature increases?

In terms of particles, why does this happen?

4. Charles’ law is the relationship between the Volume and the Temperature of a fixed mass of gas at a constant Pressure

What happens to the pressure of a gas as its temperature is increased?

In terms of particles, why does this happen?

5. What happens to the volume of a helium balloon as it rises into the air?

In terms of particles, why does this happen?