**Y11 Combined Physics 1**

**PPE 2 - Foundation**

**The topics below will be assessed in your next PPE**

**Energy**

* RPA – Specific heat capacity
* Efficiency
* National and global resources
  + evaluate renewable and non-renewable energy

**Electricity**

* RPA – Resistance in wires/filament lamps
* National grid – Transformers
* Series and parallel circuits

**Particles**

* Particle motion in gases

**Atomic structure**

* Nuclear equations
* Radioactive contamination

**Exam Practice**

The following pages contain past exam questions that should attempt.

The grade for each question is indicated by:



Remember: to get Grade 4-5 you still have to be able to answer the 1-3 questions!

**Use your revision guide to help you answer the questions in this booklet.**

**The revision guide also has extra questions you can complete.**

**For each topic, there are questions in the Revision Guide that will help you choose what to revise. The page numbers you need are listed below.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Topic** | **Questions**  Page Title | | **Support**  Pages | **☺** | **😐** | **☹** |
| RPA: Specific heat capacity | 192 | Specific Heat Capacity | 171 |  |  |  |
| Efficiency | 192 | Power and Efficiency | 172-174 |  |  |  |
| National and global resources | 192 | Energy Resources and Trends in their Use | 175-179 |  |  |  |
| Resistance in wires | 192 | Circuit Basics | 180-187 |  |  |  |
| National Grid | 192 | Power and the National Grid | 189-191 |  |  |  |
| Series and parallel circuits | 192 | Circuit Basics | 180-187 |  |  |  |
| Particle motion in gases | 202 | The Particle Model and Motion in Gases | 193 |  |  |  |
| Nuclear equations | 202 | Nuclear Decay and Half-life | 198-200 |  |  |  |
| Radioactive contamination | 202 | Irradiation and Contamination | 201 |  |  |  |

**Energy**

**Q1.**

Different energy sources are used to generate electricity.

(a)     Use words from the box to match the correct energy source to each of the descriptions given in the table.

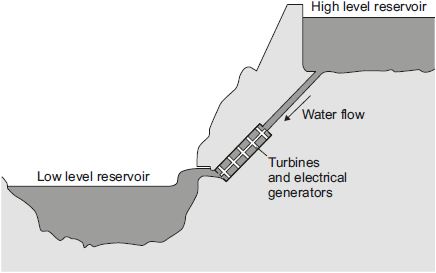
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **biofuel** | **coal** | **geothermal** | **nuclear** | **waves** |

|  |  |
| --- | --- |
| **Description** | **Energy source** |
| Energy from the Earth’s core is used to heat water. |  |
| Fission of uranium nuclei is used to heat water. |  |
| Gases from rotting plant material are burned to heat water. |  |

**(3)**

(b)     Energy can be stored in a pumped storage power station.

The figure shows a pumped storage power station.



When electricity is needed, the water in the high level reservoir is allowed to flow to the low level reservoir. The flowing water generates electricity.

Use the correct answer from the box to complete each sentence.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **electrical** | **gravitational potential** | **kinetic** | **nuclear** | **sound** |

The water in the high level reservoir stores \_\_\_\_\_\_\_\_\_\_\_\_ energy.

The flowing water has \_\_\_\_\_\_\_\_\_\_\_\_ energy.

The water turns the turbine which is connected to the generator.

The generator produces some \_\_\_\_\_\_\_\_\_\_\_\_, this is wasted energy.

**(3)**

(c)     The total power input to a pumped storage power station is 600 MW.

The useful power output is 540 MW.

(i)      Calculate the efficiency of this pumped storage power station.

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Efficiency = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     Calculate how much power is wasted by the pumped storage power station.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Power = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ MW

**(1)**

(iii)    How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

**(Total 10 marks)**

**Energy**

**Q2.**

Iceland is a country that generates most of its electricity using geothermal power stations and hydroelectric power stations.

(a)     (i)      Complete the following sentences to describe how some geothermal power stations work.

In regions where volcanoes are active, the ground is hot.

Cold \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is pumped down into the ground

and is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by hot rocks.

It returns to the surface as steam. The steam is used to turn a turbine.

The turbine drives a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce electricity.

**(3)**

(ii)     Which **one** of the following statements about geothermal power stations is true?

Tick () **one** box.

|  |  |
| --- | --- |
| Geothermal power stations use fossil fuels. |  |
| Geothermal power stations produce carbon dioxide. |  |
| Geothermal power stations provide a reliable source of electricity. |  |

**(1)**

(b)     What is needed for a hydroelectric power station to be able to generate electricity?

Tick () **one** box.

|  |  |
| --- | --- |
| Falling water |  |
| A long coastline |  |
| Lots of sunny days |  |

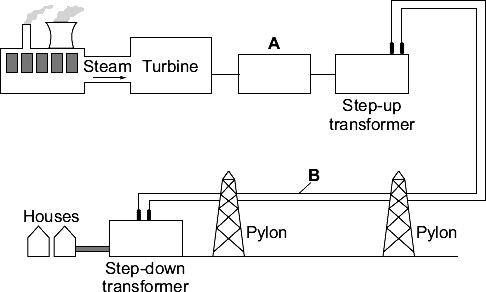
**(1)**

**(Total 5 marks)**

**National Grid**

**Q3.**

The diagram shows how electricity is generated, and transmitted by the National Grid.



(a)     Name the parts labelled **A** and **B**.

(i)      Part **A** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Part **B** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The step-up transformer makes changes to the electricity supplied by the power station.

Use words from the box to complete each sentence.

|  |  |  |  |
| --- | --- | --- | --- |
| **current** | **energy** | **power** | **voltage** |

The step-up transformer increases the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the supply.

The step-up transformer decreases the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the supply.

**(2)**

(c)     Information about five different types of power stations is given in the table.

|  |  |  |
| --- | --- | --- |
| **Power station** | **Start-up time** | **Power output in MW** |
| Biomass | Medium | 20 |
| Geothermal | Medium | 30 |
| Nuclear | Long | 1200 |
| Hydroelectric | Short | 2000 |
| Wind turbine | Short | 5 |

(i)      Which power station would be best to meet peak demands for electricity?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Which power station uses a non-renewable energy resource?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(iii)    Wind turbines are used to generate electricity.

Give **one** advantage and **one** disadvantage of using wind turbines to generate electricity.

Advantage \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Disadvantage \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

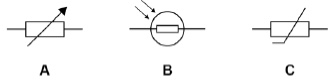
**(Total 8 marks)**

**Series and parallel circuits**

**Q4.**

**Figure 1** shows the circuit symbol for three different components.

**Figure 1**

****

(a)     Which component is a variable resistor?

Tick **one** box.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** |  | **B** |  | **C** |  |

**(1)**

(b)     Which component is a thermistor?

Tick **one** box.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** |  | **B** |  | **C** |  |

**(1)**

(c)     In which component will the resistance decrease when the temperature increases?

Tick **one** box.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** |  | **B** |  | **C** |  |

**(1)**

(d)     In which component will the resistance decrease when the light intensity increases?

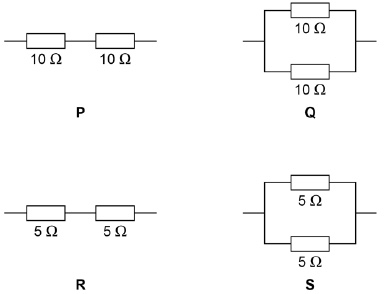
Tick **one** box.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** |  | **B** |  | **C** |  |

**(1)**

**Figure 2** shows four different arrangements of resistors.

**Figure 2**

****

(e)     Two of the arrangements are in series and two are in parallel.

Describe the difference between a series and a parallel arrangement.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(f)      Which arrangement has a resistance of 10 Ω?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **P** |  | **Q** |  | **R** |  | **S** |  |

**(1)**

(g)     Which arrangement has the highest resistance?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **P** |  | **Q** |  | **R** |  | **S** |  |

**(1)**

(h)     A student connects a resistor to a cell for 60 seconds.

The current through the resistor is 0.97 A

Calculate the charge flow.

Use the equation:  
 charge flow = current × time

Give your answer to 2 significant figures.  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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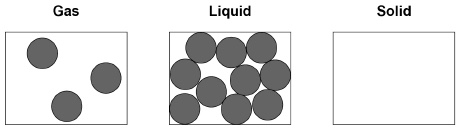
Charge flow = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ C

**(3)**

**(Total 11 marks)**

**Particle theory****Q5.**

The diagram shows a model of the particles in a gas and in a liquid.



(a)     Complete the diagram to show the arrangement of particles of the same substance as a solid.

**(2)**

(b)     What is the name of the process when a substance changes from a gas to a liquid?

Tick **one** box.

|  |  |
| --- | --- |
| Condensing |  |
| Evaporating |  |
| Freezing |  |
| Melting |  |

**(1)**

(c)     The substance in the diagram has a:

•        melting point of 98 °C

•        boiling point of 883 °C

What is the state of the substance at 20 °C?

Tick **one** box.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Gas |  | Liquid |  | Solid |  |

**(1)**

(d)     What type of change is a change of state?

Tick **one** box.

|  |  |
| --- | --- |
| Chemical |  |
| Kinetic |  |
| Permanent |  |
| Physical |  |

**(1)**

(e)     Which **two** statements are correct about the particles when a liquid turns into a gas?

Tick **two** boxes.

|  |  |
| --- | --- |
| Particles are bigger |  |
| Particles are lighter |  |
| Particles have more chemical energy |  |
| Particles have more kinetic energy |  |
| Particles move faster |  |

**(2)**

(f)      Which **two** quantities are needed to calculate the energy required to turn a liquid into a gas with no change in temperature?

Tick **two** boxes.

|  |  |
| --- | --- |
| Mass of the liquid |  |
| Specific heat capacity of the gas |  |
| Specific latent heat of vaporisation |  |
| Time the liquid is heated |  |

**(2)**



**Specific heat capacity**

(g)     A mass of 2.0 kg of water is heated.

The temperature increase of the water is 80 °C

The specific heat capacity of water is 4200 J / kg °C

Calculate the change in thermal energy when the water is heated.

Use the equation:

change in thermal energy = mass × specific heat capacity × temperature change

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Change in thermal energy = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ J

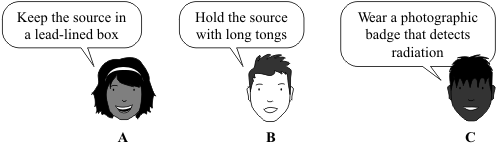
**(2)**

**(Total 11 marks)**

**Atomic structure**

**Q6.**

Before using a radioactive source, a teacher asked her students to suggest safety procedures that would reduce her exposure to the radiation. The students made the following

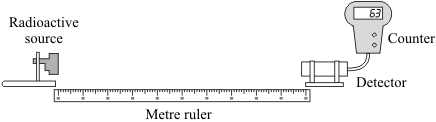


(a)     Which suggestion, **A**, **B** or **C**, would **not** reduce the exposure of the teacher to radiation?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The diagram shows how the teacher measured the distance that the radiation traveled from the source. The count-rate at different distances from the source was measured and recorded in the table.



|  |  |
| --- | --- |
| **Distance from source to detector in cm** | **Count-rate in counts per minute** |
| 20 | 85 |
| 40 | 81 |
| 60 | 58 |
| 80 | 53 |
| 100 | 23 |

          What type of radiation was the source emitting, alpha, beta or gamma?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

       Explain the reasons for your choice.

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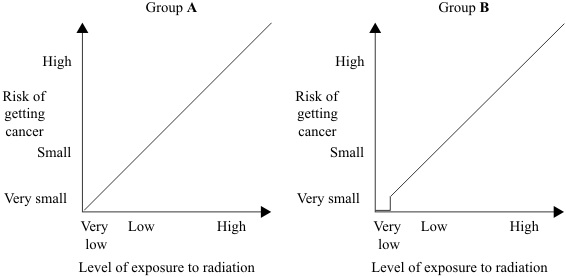
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**(3)**

(c)     The graphs show how two groups of scientists, **A** and **B**, link exposure to radiation and the risk of getting cancer.



(i)      Complete the following sentence using a word or phrase from the box.

|  |
| --- |
| **decreases**          **has no effect on**               **increases** |

         Both groups of scientists agree that a high level of exposure to radiation

         \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the risk of getting cancer.

**(1)**

(ii)     Use the graphs to describe carefully how the two groups of scientists disagree when the level of exposure to radiation is very low.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

**(Total 7 marks)**

**Atomic structure**

**Q7.**

(a)     The diagram represents 3 atoms, **K**, **L** and **M**.



(i)      Which **two** of the atoms are isotopes of the same element?

\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Give a reason why the **two** atoms that you chose in part (a)(i) are:

(1) atoms of the same element \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2) different isotopes of the same element. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     The table gives some information about the radioactive isotope thorium-230.

|  |  |
| --- | --- |
| mass number | 230 |
| atomic number | 90 |

(i)      How many electrons are there in an atom of thorium-230?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     How many neutrons are there in an atom of thorium-230?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     When a thorium-230 nucleus decays, it emits radiation and changes into radium-226.



What type of radiation, alpha, beta or gamma, is emitted by thorium-230?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain the reason for your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

**(Total 8 marks)**