# Specimen Paper

| Centre Number | | Candidate Number | |
|---|---|---|---|
| Surname | | | |
| Other Names | | | |
| Candidate Signature | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| TOTAL | |

General Certificate of Secondary Education
Higher Tier

# Additional Science

**Unit Physics P2**

# Physics 2H

# Physics

**Unit Physics P2**

# H

**For this paper you must have:**

- a ruler
- the Equations Sheet (enclosed).

You may use a calculator.

Time allowed

- 60 minutes

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2(c) should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

## Advice

- In all calculations, show clearly how you work out your answer.

**There are no questions printed on this page**

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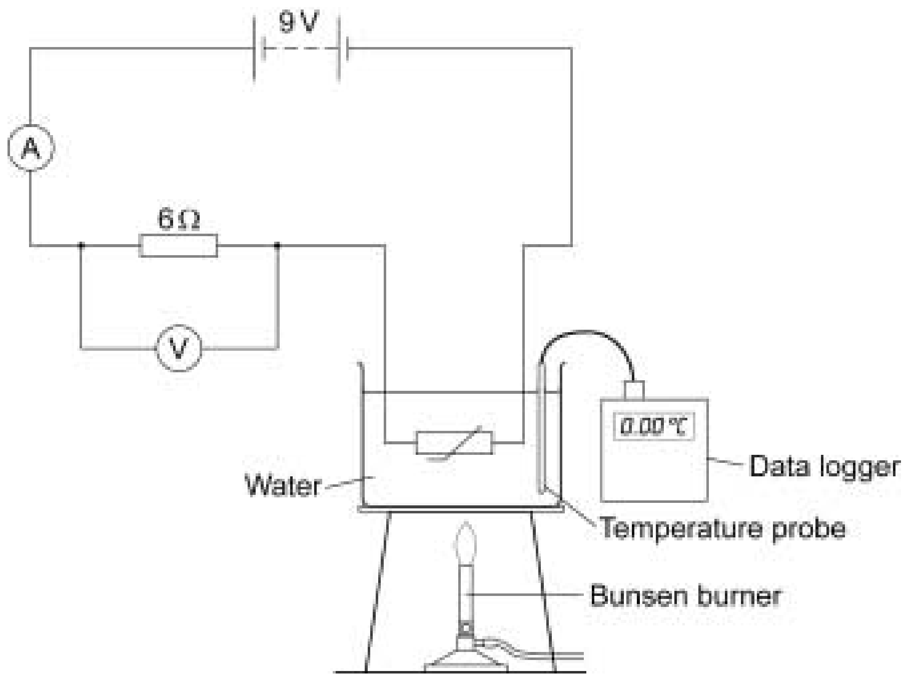
**ANSWER IN THE SPACES PROVIDED**

Answer **all** questions in the spaces provided.

**1** A student designed the circuit below to measure temperature using a thermistor.




To calibrate the thermistor to measure temperature, the student placed the thermistor in a beaker of water at 0 °C and took the voltmeter reading. The student then heated the water slowly with a Bunsen burner. The student recorded the reading on the voltmeter every 10 °C.

**1 (a) (i)** Before calibrating the thermistor the student completed a risk assessment.

Write down **one** possible hazard that the student should have written in the risk assessment and what the student should do to reduce the risk of the hazard causing an injury.

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*(2 marks)*

**Question 1 continues on the next page**

**Turn over▶**

**1 (a) (ii)** At 0 °C the reading on the ammeter is 0.5 A.

Calculate the reading on the voltmeter at 0 °C.

Write down the equation you use, and then show clearly how you work out your answer.

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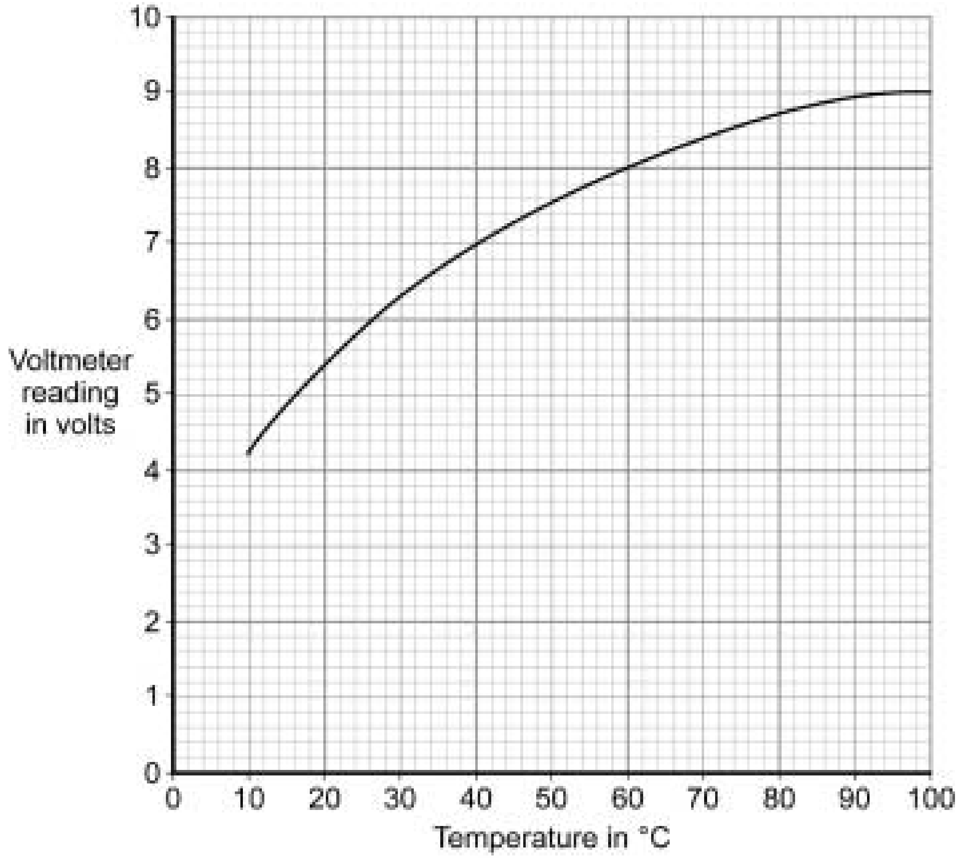
Voltmeter reading = .......................................... V

*(2 marks)*

**1 (b)** Most of the readings taken by the student are displayed in the graph.



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**1 (b) (i)** Explain why the reading on the voltmeter changes when the temperature of the water increases.

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*(3 marks)*

**1 (b) (ii)** What is the temperature interval that can be measured with this circuit?

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*(1 mark)*

**1 (b) (iii)** Once calibrated, between which temperatures would this circuit give the greatest resolution for temperature readings?

Tick (✓) **one** box.

20 °C to 40 °C ☐

40 °C to 60 °C ☐

60 °C to 80 °C ☐

Give a reason for your answer.

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*(2 marks)*

**1 (c)** Thermistors have many practical uses, including being used as a thermometer to measure temperature.

Give **one** other practical use for a thermistor.

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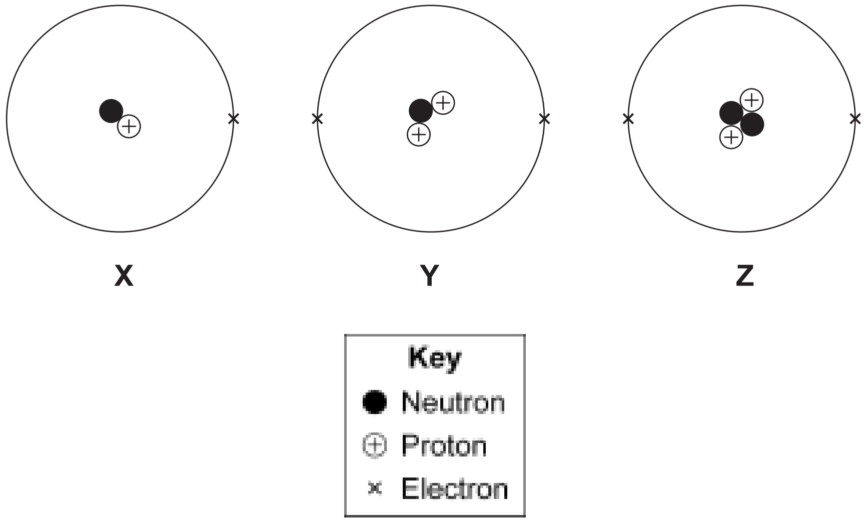
*(1 mark)*

11

**Turn over▶**

**2 (a)** The diagrams represent three atoms, **X**, **Y** and **Z**.




Which of these atoms are isotopes of the same element?

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Give a reason for your answer.

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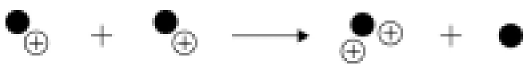
*(2 marks)*

**2 (b)** In a star, nuclei of atom **X** join to form nuclei of atom **Y**.



Complete the sentences.

The process by which nuclei join to form a larger nucleus is called

nuclear ................................................................ .

This is the process by which a star releases ................................................................... .

*(2 marks)*

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**2 (c)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A star goes through a life cycle.

Describe the life cycle of a star like the Sun.

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*(6 marks)*

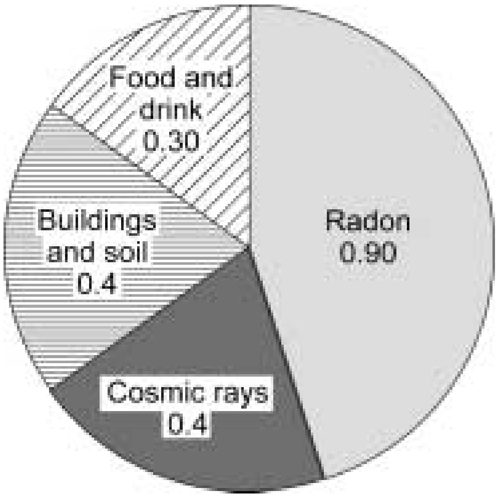
**10**

**Turn over for the next question**

**Turn over▶**

**3** The pie chart shows the average radiation dose that a person in the UK receives each year from natural background radiation.

The doses are measured in millisieverts (mSv).




**3 (a)** Some types of job increase the radiation dose a worker receives.
People working as aircrew receive an increased radiation dose due to flying at high altitude.

**3 (a) (i)** The radiation dose from which source of background radiation is increased by flying?

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*(1 mark)*

**3 (a) (ii)** The following table gives the average additional radiation dose received by aircrew flying to various destinations from London.

| Destination | Flight time in hours | Average additional radiation dose in mSv |
|---|---|---|
| **Edinburgh** | 1 | 0.004 |
| **Istanbul** | 5 | 0.025 |
| **Toronto** | 8 | 0.050 |
| **Los Angeles** | 11 | 0.065 |
| **Tokyo** | 13 | 0.075 |

What is the relationship between flight time and average additional radiation dose?

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*(1 mark)*

**3 (a) (iii)** A flight from London to Jamaica takes 10 hours.

Estimate the likely value for the average additional radiation dose received by people on this flight.

Average additional radiation dose = ........................... mSv

Give a reason for your answer.

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*(2 marks)*

**Question 3 continues on the next page**

**Turn over▶**

**3 (b)** The following table gives the effects of different radiation doses on the human body.

| Radiation dose in mSv | Effects |
|---|---|
| 10 000 | Immediate illness; death within a few weeks |
| 1 000 | Radiation sickness; unlikely to cause death |
| 100 | Lowest dose with evidence of causing cancer |

A businessman makes 10 return flights a year from London to Tokyo.

Explain whether the businessman should be concerned about the additional radiation dose received during the flights.

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*(2 marks)*

**3 (c)** In a study of 3900 aircrew it was found that 169 had developed leukaemia, a form of cancer. In a similar sized sample of non-aircrew the number of leukaemia cases was 156.

Suggest why it would be difficult to be certain that the leukaemia developed by the aircrew was caused by flying.

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*(2 marks)*

**8**

**Turn over for the next question**

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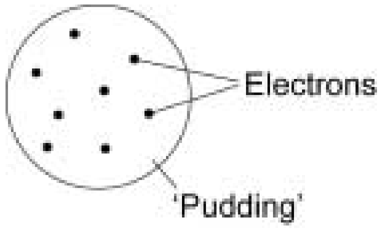
**ANSWER IN THE SPACES PROVIDED**

**Turn over▶**

**4** In the early part of the 20th century scientists used the 'plum pudding' model to explain the structure of the atom.




**4 (a)** What did scientists think that the 'pudding' part of the atom was?

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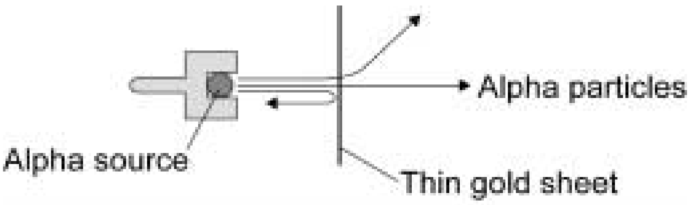
*(1 mark)*

**4 (b)** The scientists Geiger and Marsden devised an experiment to test the 'plum pudding' model. They fired positively charged alpha particles at a very thin sheet of gold foil. They then measured the different paths taken by the alpha particles.



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**List A** gives some of the observations from the experiment. **List B** gives the conclusions reached from the observations.

Draw **one** line from each observation in **List A** to the conclusion reached in **List B**.

| **List A Observation** | **List B Conclusion** |
| --- | --- |
| Most of the alpha particles go straight through the gold foil | Most of the atom is empty space |
| Some alpha particles are deflected through a big angle | The nucleus of the atom is very small |
| Only a very small number of alpha particles rebound backwards | The nucleus has a large positive charge |

*(2 marks)*

**4 (c)** Following the work of Geiger and Marsden, the 'plum pudding' model of the atom was replaced by the 'nuclear model' of the atom.

Explain why it is sometimes necessary for scientists to replace a scientific model.

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*(2 marks)*

**5**

**Turn over for the next question**

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**5** The diagram shows the horizontal forces acting on a car of mass 1200 kg.


**5 (a)** Calculate the acceleration of the car at the instant shown in the diagram.

Write down the equation you use, and then show clearly how you work out your answer and give the unit.

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Acceleration = ................................

*(4 marks)*

**5 (b)** Explain why the car reaches a top speed even though the thrust force remains constant at 3500 N.

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*(3 marks)*

**5 (c)** The diagram shows a car and a van.


The two vehicles have the same mass and identical engines.

Explain why the top speed of the car is greater than the top speed of the van.

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*(4 marks)*

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**Turn over ▶**

**6** In the UK mains electricity is a 230 volt a.c. supply.

**6 (a)** What is the frequency of the a.c. mains electricity in the UK?

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*(1 mark)*

**6 (b) (i)** What is an electric current?

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*(1 mark)*

**6 (b) (ii)** Explain the difference between an a.c. (alternating current) electricity supply and a d.c. (direct current) electricity supply.

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*(2 marks)*

**6 (c)** A householder has a 10.8 kW electric shower installed in the bathroom.

**6 (c) (i)** Calculate the current drawn from the mains electricity supply by the shower.

Write down the equation you use, and then show clearly how you work out your answer.

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Current = ........................................................ A

*(2 marks)*

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**6 (c) (ii)** The table gives the maximum current that can safely pass through electric cables of different cross-sectional area.

| Cross-sectional area in $mm^2$ | Maximum safe current in amps |
|---|---|
| 1.0 | 11.5 |
| 2.5 | 20.0 |
| 4.0 | 27.0 |
| 6.0 | 34.0 |
| 10.0 | 46.0 |
| 16.0 | 62.0 |

The existing power sockets in the house are wired to the mains electricity supply using 2.5 $mm^2$ cable.

Use the data in the table to explain why the shower must **not** be connected to the mains electricity supply using 2.5 $mm^2$ cable.

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*(2 marks)*

**6 (c) (iii)** The circuit connecting the shower to the mains electricity supply must include a residual current circuit breaker (RCCB) and not a fuse.

Give **two** advantages of using a RCCB to protect a circuit rather than a fuse.

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2 ......................................................................................................................

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*(2 marks)*

**10**

**Turn over▶**

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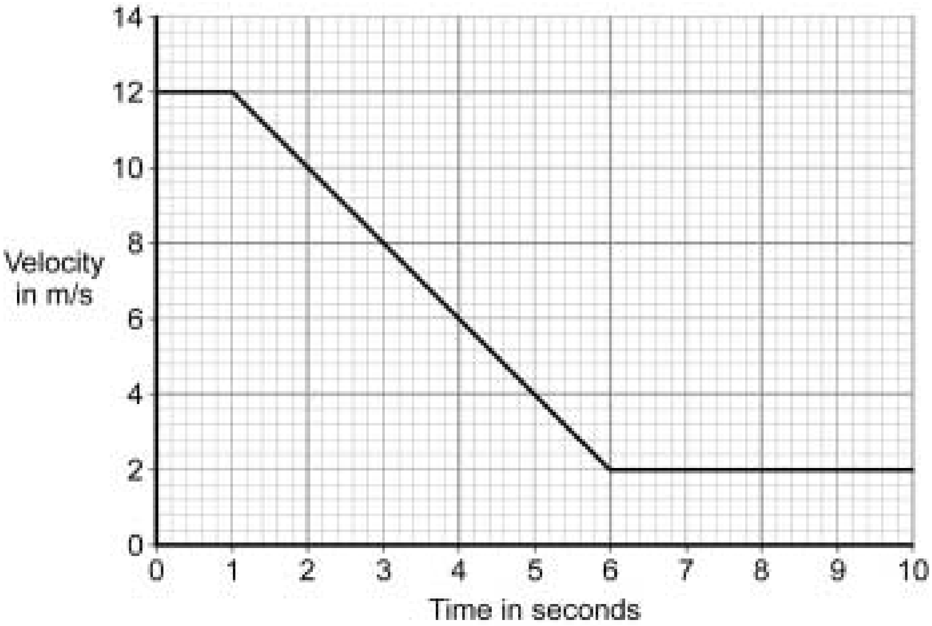
**7** A car is driven along a straight, snow covered, road. The graph shows how the velocity of the car changes from the moment the driver sees a very slow moving queue of traffic ahead.




**7 (a)** Use the graph to calculate the distance the car travels while it is slowing down.

Show clearly how you work out your answer.

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Distance = ............................................m

*(3 marks)*

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**7 (b)** The car has a mass of 1200 kg.

Calculate the kinetic energy of the car when it travels at a speed of 12 m/s.

Write down the equation you use, and then show clearly how you work out your answer.

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Kinetic energy = .................................. J

*(2 marks)*

**5**

**END OF QUESTIONS**

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**ANSWER IN THE SPACES PROVIDED**

## GCSE Physics Equations Sheet

### Unit 2 H

| | |
|---|---|
| $a = \frac{F}{m}$ or $F = m \times a$ | *F* resultant force<br>*m* mass<br>*a* acceleration |
| $a = \frac{v - u}{t}$ | *a* acceleration<br>*v* final velocity<br>*u* initial velocity<br>*t* time taken |
| $W = m \times g$ | *W* weight<br>*m* mass<br>*g* gravitational field strength |
| $F = k \times e$ | *F* force<br>*k* spring constant<br>*e* extension |
| $W = F \times d$ | *W* work done<br>*F* force applied<br>*d* distance moved in the direction of the force |
| $P = \frac{E}{t}$ | *P* power<br>*E* energy transferred<br>*t* time taken |
| $E_p = m \times g \times h$ | $E_p$ change in gravitational potential energy<br>*m* mass<br>*g* gravitational field strength<br>*h* change in height |
| $E_k = {}^1/_2 \times m \times v^2$ | $E_k$ kinetic energy<br>*m* mass<br>*v* speed |

| | |
|---|---|
| $p = m \times v$ | *p* momentum<br>*m* mass<br>*v* velocity |
| $I = \frac{Q}{t}$ | *I* current<br>*Q* charge<br>*t* time |
| $V = \frac{W}{Q}$ | *V* potential difference<br>*W* work done<br>*Q* charge |
| $V = I \times R$ | *V* potential difference<br>*I* current<br>*R* resistance |
| $P = \frac{E}{t}$ | *P* power<br>*E* energy<br>*t* time |
| $P = I \times V$ | *P* power<br>*I* current<br>*V* potential difference |
| $E = V \times Q$ | *E* energy<br>*V* potential difference<br>*Q* charge |