

| Question | Answers   | Extra information                          | Mark |
|----------|---|--|------|
| 01.1     | the independent variable is thickness of insulation                                     |  | 1    |
|          | the dependent variable is the time for the water to cool between two fixed temperatures |  | 1    |
| 01.2     | two of:   |  | 2    |
|          | type of insulation  |  |      |
|          | starting temperature of the water   |  |      |
|          | volume of water   |  |      |
|          | size of temperature drop of the water   |  |      |
| 01.3     | +/- 1 °C  |  | 1    |
| 01.4     | correct straight line between points  |  | 1    |
| 01.5     | 2 minutes   |  | 1    |
| 01.6     | the thicker the insulation, the smaller the rate of energy transfer from the tank       |  | 1    |
|          | they are proportional   |  | 1    |
| 01.7     | any sensible suggestion (e.g., use a temperature probe, repeat the tests, etc.)         |  | 1    |
| 02.1     | 27.6 J  | 1 mark each for working and answer         | 2    |
| 02.2     | 499 W   | accept 500 W                               | 2    |
|          |   | 1 mark each for working and answer         |      |
| 02.3     | 106 Ω   | 1 mark each for working and answer         | 2    |
| 02.4     | to ensure the plates do not get too hot   |  | 1    |
| 02.5     | 35 °C   | 1 mark each for working and answer of 20°C | 3    |
|          |   | An answer of 35°C gains 3 marks            |      |
| 03.1     | 88 years (allow 87.5 – 88.5 years)  | 1 mark each for using graph                | 2    |
|          |   | 1 mark for correct answer                  |      |
| 03.2     | a helium nucleus (or 2 protons and 2 neutrons)  |  | 1    |

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| 03.3     | alpha radiation   |  | 1    |
|          | cannot penetrate skin   |  | 1    |
|          | but if ingested is highly ionising and can cause cancer   |  | 1    |
| 04.1     | same number of protons in the nucleus   |  | 1    |
|          | same number of electrons  |  | 1    |
|          | different number of neutrons in the nucleus   |  | 1    |
| 04.2     | <b>X</b> = 94, <b>Y</b> = 234, <b>Z</b> = He  |  | 3    |
| 05.1     | hydroelectric   |  | 1    |
| 05.2     | examples: <ul style="list-style-type: none"> <li>nuclear power and coal power stations provide 'base load' electricity</li> <li>nuclear power and coal power stations take a longer time to start up</li> <li>gas and renewable sources provide additional energy for peak times</li> <li>gas and renewable stations have shorter start up times</li> <li>burning fossil fuels contributes to global warming</li> <li>nuclear energy problems, such as high de-commissioning costs and disposal of nuclear waste</li> <li>renewable energy is not as reliable and costs more</li> </ul> | <p><b>1</b> or <b>2</b> marks for a simple statement(s)</p> <p><b>3</b> or <b>4</b> marks for a comparison of at least two of reliability of use or environmental issues or cost for at least two of the energy resources</p> <p><b>5</b> or <b>6</b> marks for a comparison of reliability of use and environmental issues and cost for at least two of the energy resources.</p> | 6    |
| 06.1     | gravitational potential   |  | 1    |
|          | kinetic   |  | 1    |
|          | thermal   |  | 1    |
|          | chemical  |  | 1    |

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| 06.2          | stored gravitational potential energy<br>transfers to kinetic energy<br>then transfers back to stored gravitational potential energy  |                                      | 5                   |
| 06.3          | energy is transferred as thermal and sound energy to surroundings by friction   |                                      | 1                   |
| 07.1          | 12.74 N   | 1 mark each for workings and answer. | 2                   |
| 07.2          | 101.9 J   | 1 mark each for workings and answer. | 2                   |
| <b>H</b> 07.3 | $101.9 = 0.5 \times 1.3 \times v^2$<br>$V^2 = 156.8$<br>$V = 12.5$<br>m/s   |                                      | 1<br>1<br>1<br>1    |
| 07.4          | although there is no direct relationship between the height and number of refills<br>the number of refills increases between 2 m and 6 m<br><b>or</b><br>the best height to hang bird feeder is between 6 m and 7 m<br>at 8m the bird feeder is too close to the branch so birds do not use because cats or squirrels |                                      | 1<br><br>1<br><br>1 |

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| <b>GCSE Physics only</b> |  |   |      |
| 08                       | when air is pumped into the tyre mechanical work is done on the air                    |   | 1    |
|                          | so the internal energy increases and therefore the temperature increases               |   | 1    |
|                          | pressure is caused by the air particles hitting the inside of the tyre                 |   | 1    |
|                          | the more air in the tyre the greater the number of air particles hitting the tyre wall |   | 1    |
|                          | So the pressure inside the tyre increases  |   | 1    |
| 09.1                     | the cable is 3-core and the plastic lawnmower does not need an earth wire              | allow: use a 2-core cable without an earth wire | 1    |
| 09.2                     | when the current exceeds the fuse rating,  |   | 1    |
|                          | fuse melts and cuts off the electricity supply   |   | 1    |
| 09.3                     | the outer casing is plastic/insulator  |   | 1    |
|                          | the wires are covered with insulation  |   | 1    |
| 09.4                     | touching the live wire produces a large potential difference across our body.          |   | 1    |
|                          | this causes a current to flow through our body to earth                                |   | 1    |
|                          | resulting in an electric shock   |   | 1    |

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#### GCSE Physics only

|      |  |  |   |
|------|--|--|---|
| 10.1 | correct circuit symbol                             |  | 1 |
| 10.2 | as the temperature decreases                       |  | 1 |
|      | the resistance increases                           |  | 1 |
| 10.3 | graph that starts straight and then curves upwards |  | 2 |

|               |   |  |   |
|---------------|---|--|---|
| 11.1          | technetium-99   |  | 1 |
|               | (because) it has a short half-life so does not remain in the body too long                                      |  | 1 |
|               | (and) emits gamma radiation which can be detected outside the body  |  | 1 |
| <b>H</b> 11.2 | 3.125%  |  | 2 |
| 11.3          | radioactive contamination is the unwanted presence of materials containing radioactive atoms on other materials |  | 2 |
| 11.4          | so that the findings can be checked by peer review  |  | 1 |

#### GCSE Physics only

|      |   |  |   |
|------|---|--|---|
| 12.1 | diagram showing at least one of the released neutrons being absorbed by Uranium-235 and new neutrons released   |  | 3 |
| 12.2 | absorbed  |  | 1 |
|      | uranium-236   |  | 1 |
|      | energy  |  | 1 |
|      | neutrons  |  | 1 |
|      | depth   |  | 1 |
| 13.1 | nuclear fusion is the joining of two light nuclei to form a heavier nucleus   |  | 2 |
| 13.2 | any <b>six</b> from:  |  | 6 |
|      | nuclear fusion reactors:  |  |   |
|      | <ul style="list-style-type: none"> <li>only produce small amounts of energy</li> <li>no radiation dangers and hence no radioactive waste to dispose</li> <li>could be sited locally to</li> </ul> |  |   |
|      |   |  |   |

|      |   |  |   |
|------|---|--|---|
|      | <p>provide energy to energy</p> <ul style="list-style-type: none"> <li>the fuel is readily available and easily extracted</li> </ul> <p>nuclear fission reactors:</p> <ul style="list-style-type: none"> <li>produce large amounts of energy from small quantities of fuel</li> <li>are radioactive and the radioactive waste is difficult to dispose of</li> <li>decommissioning costs are high</li> </ul> |  |   |
| 14.1 | light dependent resistor or LDR   |  | 1 |
| 14.2 | to set the amount of light required to turn on the light  | to change output voltage is insufficient | 1 |