**Equation 1**

**For all questions gravitational field strength is 10 N / kg.**

1. Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.
2. Calculate the gravitational potential energy (J) for the following:

***Show all of your workings***

* 1. mass = 15 kg height = 6 m
	2. mass = 4.3 kg height = 41 m
	3. mass = 7 kg height = 23 m
	4. mass = 26 kg height = 16 m
	5. mass = 4 kg height = 79 m
1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. GPE = 312 J height = 4 m
	2. GPE = 221 J height = 17 m
	3. GPE = 39 J height = 13 m
	4. GPE = 216 J height = 9 m
	5. GPE = 6650 J height = 7 m
1. Calculate the height (m) for the following:

***Show all of your workings***

* 1. GPE = 645 J mass = 43 kg
	2. GPE = 140 J mass = 3.5 kg
	3. GPE = 228 J mass = 7.6 kg
	4. GPE = 66.3 J mass = 0.17 kg
	5. GPE = 32.5 J mass = 0.25 kg

5. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

1. Calculate the gravitational potential energy for a mass of 22 g at a height of 8 m above the ground.
2. A mass of 600 kg has 882 kJ of gravitational potential energy. Calculate its height above the ground.
3. An object with 35.1 J of gravitational potential is 45 m above the ground. Calculate its mass in grams.
4. Calculate the gravitational potential energy for a mass of 9 kg at a height of 410 mm above the ground.
5. An object with 3.4 J of gravitational potential is 500 mm above the ground. Calculate its mass in grams.

**Equation 2**

1. Write down the equation that links kinetic energy, mass and speed.
2. Calculate the kinetic energy (J) for the following:

***Show all of your workings***

* 1. mass = 7 kg speed = 6 m/s
	2. mass = 50 kg speed = 5 m/s
	3. mass = 12 kg speed = 2 m/s
	4. mass = 0.5 kg speed = 2.6 m/s
	5. mass = 7.5 kg speed = 1.8 m/s
1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. kinetic energy = 150 J speed = 10 m/s
	2. kinetic energy = 30 J speed = 5 m/s
	3. kinetic energy = 940 J speed = 20 m/s
	4. kinetic energy = 57 J speed = 2.5 m/s
	5. kinetic energy = 400 J speed = 8 m/s
1. Calculate the speed (m/s) for the following:

***Show all of your workings***

* 1. kinetic energy = 280 J mass = 35 kg
	2. kinetic energy = 585 J mass = 5.2 kg
	3. kinetic energy = 220 J mass = 17.6 kg
	4. kinetic energy = 72 J mass = 16 kg
	5. kinetic energy = 294 J mass = 3 kg
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Calculate the kinetic energy for a mass of 240 kg moving at a speed of 180 m/min.
	2. A falling object of mass of 12 g has 0.15 J of kinetic energy. Calculate its speed.
	3. An object with 4.8 x 10-4 J of kinetic energy moves at 0.4 m/s. Calculate its mass in grams.
	4. Calculate the kinetic energy for a mass of 14 kg moving at 9 km/hr.
	5. A mass of 240 kg moves at 90 km/hr. Calculate its kinetic energy in kJ.

**Equation 3**

1. Write down the equation that links power, energy transferred and time.
2. Calculate the power (W) for the following:

***Show all of your workings***

* 1. energy = 156 J time = 12 s
	2. energy = 132 J time = 3 s
	3. energy = 224 J time = 7 s
	4. energy = 104 J time = 13 s
	5. energy = 840 J time = 14 s
1. Calculate the energy (J) for the following:

***Show all of your workings***

* 1. power = 20 W time = 11 s
	2. power = 3 W time = 24 s
	3. power = 500 W time = 12 s
	4. power = 12 W time = 21 s
	5. power = 560 W time = 4 s
1. Calculate the time (s) for the following:

***Show all of your workings***

* 1. power = 63 W energy = 441 J
	2. power = 45 W energy = 405 J
	3. power = 142 W energy = 2698 J
	4. power = 234 W energy = 8658 J
	5. power = 11 W energy = 308 J
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A device transfers 15.6 kJ of energy in 12 seconds. Calculate the power output of this device.
	2. A device has a power rating of 2.5 kW. Calculate the energy transferred (in kJ) in 90 seconds.
	3. A device produces a power output of 600 W. Calculate the time taken to transfer 18 kJ of energy.
	4. A device transfers 6300 kJ of energy in 2.5 hours. Calculate the power output of this device.
	5. A device has a power rating of 35 W. Calculate the energy transferred in 24 hours.

**Equation 4**

1. Write down the equation that links power, work done and time.
2. Calculate the power (W) for the following:

***Show all of your workings***

* 1. work done = 520 J time = 4 s
	2. work done = 1050 J time = 42 s
	3. work done = 138 J time = 3 s
	4. work done = 936 J time = 26 s
	5. work done = 243 J time = 4.5 s
1. Calculate the energy (J) for the following:

***Show all of your workings***

* 1. power = 16 W time = 5 s
	2. power = 39 W time = 60 s
	3. power = 17 W time = 30 s
	4. power = 10 W time = 7.2 s
	5. power = 45 W time = 15 s
1. Calculate the time (s) for the following:

***Show all of your workings***

* 1. power = 2.9 W work done = 20.3 J
	2. power = 3 W work done = 234 J
	3. power = 86 W work done = 215 J
	4. power = 56 W work done = 504 J
	5. power = 28 W work done = 112 J
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A device does 246 kJ of work in 30 seconds. Calculate the power output of this device in kW.
	2. A device has a power rating of 4.7 kW. Calculate the work done in 2.5 minutes.
	3. A device has a power output of 580 W. Calculate the time taken in minutes for 302.4 kJ of work to be done.
	4. A device does 302.4 kJ of work in 1.2 hours. Calculate the power output of this device.
	5. A device has a power rating of 190 W. Calculate the work done in 21 mins.

**Equation 5**

1. Write down the equation that links efficiency, useful output energy transfer and total input energy transfer.
2. Calculate the efficiency for the following:

***Show all of your workings***

* 1. useful output energy transfer = 153 J total input energy transfer = 340 J
	2. useful output energy transfer = 228 J total input energy transfer = 456 J
	3. useful output energy transfer = 165 J total input energy transfer = 250 J
	4. useful output energy transfer = 62.2 J total input energy transfer = 80 J
	5. useful output energy transfer = 19.14 J total input energy transfer = 87 J
1. Calculate the total input energy transfer (J) for the following:

***Show all of your workings***

* 1. efficiency = 0.87 useful output energy transfer = 838 J
	2. efficiency = 0.20 useful output energy transfer = 507 J
	3. efficiency = 0.59 useful output energy transfer = 3400 J
	4. efficiency = 0.25 useful output energy transfer = 230 J
	5. efficiency = 0.45 useful output energy transfer = 650 J
1. Calculate the useful output energy transfer (J) for the following:

***Show all of your workings***

* 1. efficiency = 0.35 total input energy transfer = 105 J
	2. efficiency = 0.77 total input energy transfer = 1155 J
	3. efficiency = 0.15 total input energy transfer = 67.5 J
	4. efficiency = 0.32 total input energy transfer = 288 J
	5. efficiency = 0.71 total input energy transfer = 42.6 J
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A device is supplied with 45 kJ of energy and has an output of 7200 J. Calculate the efficiency of the device.
	2. A device is 8% efficiency. Calculate the total energy input in kJ if the device output is 6.4 kJ.
	3. A device is 60% efficient. Calculate the useful energy output in MJ if the device input is 4800 kJ.
	4. A device is supplied with 78 kJ of energy and has an output of 64740 J. Calculate the percentage efficiency of the device.
	5. A device has an efficiency rating of 0.18. Calculate the useful energy output if the device input is 12.3 MJ.

**Equation 6**

1. Write down the equation that links efficiency, useful power output and total power input.
2. Calculate the efficiency for the following:

***Show all of your workings***

* 1. useful power output = 8.1 W total power input = 18 W
	2. useful power output = 30.36 W total power input = 92 W
	3. useful power output = 0.76 W total power input = 76 W
	4. useful power output = 58.74 W total power input = 66 W
	5. useful power output = 7.37 W total power input = 11 W
1. Calculate the total power input (W) for the following:

***Show all of your workings***

* 1. efficiency = 0.65 useful power output = 400 W
	2. efficiency = 0.75 useful power output = 31 W
	3. efficiency = 0.42 useful power output = 950 W
	4. efficiency = 0.66 useful power output = 1300 W
	5. efficiency = 0.75 useful power output = 91W
1. Calculate the useful power output (W) for the following:

***Show all of your workings***

* 1. efficiency = 0.85 total power input = 51 W
	2. efficiency = 0.34 total power input = 12.24W
	3. efficiency = 0.85 total power input = 48.45 W
	4. efficiency = 0.95 total power input = 703 W
	5. efficiency = 0.05 total power input = 1.25 W
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A device is supplied with 68 MW of power and has an output of 4760 KW. Calculate the percentage efficiency of the device.
	2. A device has an efficiency of rating of 0.31. Calculate the useful power output in kW if the device input is 3.2 MW
	3. A device is 30 % efficient. Calculate the total power input in kW if the device output is 234 W.
	4. A device is supplied with 1.2 kW of power and has an output of 528 W. Calculate the percentage efficiency of the device.
	5. A device has an efficiency of rating of 0.07. Calculate the total power input in MW if the device output is 6930 kW.

**Equation 8**

1. Write down the equation that links charge flow, current and time.
2. Calculate the charge flow (C) for the following:

***Show all of your workings***

* 1. current = 0.15 A time = 15 s
	2. current = 2.5 A time = 30 s
	3. current = 5 A time = 90 s
	4. current = 0.02 A time = 300 s
	5. current = 3.5 A time = 20 s
1. Calculate the current (A) for the following:

***Show all of your workings***

* 1. charge flow = 77 C time = 55 s
	2. charge flow = 385 C time = 77 s
	3. charge flow = 975 C time = 39 s
	4. charge flow = 1080 C time = 36 s
	5. charge flow = 476 C time = 34 s
1. Calculate the time (s) for the following:

***Show all of your workings***

* 1. charge flow = 23.2 C current = 0.4 A
	2. charge flow = 234 C current = 13 A
	3. charge flow = 4250 C current = 5 A
	4. charge flow = 0.9 C current = 0.01 A
	5. charge flow = 720 C current = 12 A
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A current of 5 mA is switched on for 90 s. Calculate how much charge flows.
	2. 468 C of charge flows past a point in a circuit for 3 minutes. Calculate the current in the circuit.
	3. There is a current of 0.05 A in a circuit. Calculate how many hours it will take for 1170 C to flow past a point in the circuit.
	4. In 3.5 minutes a charge of 252 C flows past a point in a circuit. Calculate the current.
	5. There is a current of 55 $μ$A in a circuit. Calculate how many hours it will take for 9.504 C to flow past a point in the circuit.

**Equation 9**

1. Write down the equation that links potential difference, current and resisitance.
2. Calculate the potential difference (V) for the following:

***Show all of your workings***

* 1. current = 1.2 A resisitance = 15 $Ω$
	2. current = 0.02 A resisitance = 40 $Ω$
	3. current = 3.5 A resisitance = 60 $Ω$
	4. current = 1.6 A resisitance = 25 $Ω$
	5. current = 33 A resisitance = 6 $Ω$
1. Calculate the current (A) for the following:

***Show all of your workings***

* 1. potential difference = 171 V resisitance = 18 $Ω$
	2. potential difference = 9.75 V resisitance = 65 $Ω$
	3. potential difference = 1.25 V resisitance = 250 $Ω$
	4. potential difference = 140 V resisitance = 56 $Ω$
	5. potential difference = 11 V resisitance = 44 $Ω$
1. Calculate the resisitance ($Ω$) for the following:

***Show all of your workings***

* 1. potential difference = 195 V current = 7.5 A
	2. potential difference = 0.7 V current = 0.05 A
	3. potential difference = 10.4 V current = 0.13 A
	4. potential difference = 60 V current = 5 A
	5. potential difference = 69 V current = 3 A
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. In a circuit, there is current of 28 mA and a resistance of 330 $Ω$. Calculate the potential difference in the circuit.
	2. In a circuit, there is potential difference of 0.792 V and a resistance of 4400 $Ω$. Calculate the current in $μ$A.
	3. In a circuit, there is potential difference of 175 V and a current of 350 mA. Calculate the resisitance in the circuit.
	4. In a circuit, there is current of 340 mA and a resistance of 77 $Ω$. Calculate the potential difference in the circuit.
	5. In a circuit, there is potential difference of 2.76 V and a resistance of 920 $Ω$. Calculate the current in mA.

**Equation 10**

1. Write down the equation that links power, potential difference and current.
2. Calculate the power (W) for the following:

***Show all of your workings***

* 1. potential difference = 230 V current = 11 A
	2. potential difference = 30 V current = 0.4 A
	3. potential difference = 15 V current = 0.4 A
	4. potential difference = 110 V current = 6 A
	5. potential difference = 14 V current = 0.08 A
1. Calculate the current (A) for the following:

***Show all of your workings***

* 1. power = 110 W potential difference = 20 V
	2. power = 396 W potential difference = 660 V
	3. power = 1250 W potential difference = 250 V
	4. power = 2.62 W potential difference = 6.55 V
	5. power = 18 W potential difference = 12 V
1. Calculate the potential difference (V) for the following:

***Show all of your workings***

* 1. power = 2100 W current = 15 A
	2. power = 0.475 W current = 0.05 A
	3. power = 105 W current = 0.3 A
	4. power = 0.028 W current = 0.2 A
	5. power = 280 W current = 5 A
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Calculate the power in kW for a device that has a current of 25 A and a potential difference of 4400 V.
	2. Calculate the potential difference for a device that has a current of 0.5 mA and a power of 0.165 W.
	3. Calculate the current of a device that has a potential difference of 230 V and a power of

13.8 kW.

* 1. Calculate the power of a device that has a current of 8 mA and a potential difference of 75 V.
	2. Calculate the current in mA for a device that has a potential difference of 18 V and a power of 0.0054 W.

**Equation 11**

1. Write down the equation that links power, current and resisitance.
2. Calculate the power (W) for the following:

***Show all of your workings***

* 1. current = 2 A resisitance = 60 $Ω$
	2. current = 4 A resisitance = 12 $Ω$
	3. current = 3 A resisitance = 44 $Ω$
	4. current = 0.65 A resisitance = 200 $Ω$
	5. current = 5 A resisitance = 15 $Ω$
1. Calculate the current (A) for the following:

***Show all of your workings***

* 1. power = 980 W resisitance = 20 $Ω$
	2. power = 315 W resisitance = 140 $Ω$
	3. power = 0.8 W resisitance = 80 $Ω$
	4. power = 422.5 W resisitance = 250 $Ω$
	5. power = 1.21 W resisitance = 25 $Ω$
1. Calculate the resistance ($Ω$) for the following:

***Show all of your workings***

* 1. power = 12.5 W current = 0.5 A
	2. power = 324 W current = 6 A
	3. power = 112 W current = 0.4 A
	4. power = 810 W current = 3 A
	5. power = 2.6 W current = 0.2 A
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Calculate the power in kW for a device that has a current of 20 A and a resisitance of 1.5 k$Ω$.
	2. Calculate the current of a device that has a resisitance of 0.25 k$Ω$ and a power of 625 kW.
	3. Calculate the resistance in k$Ω$ of a device that has a current of 3 A and a power of 7.2 kW.
	4. Calculate the power in kW for a device that has a current of 5 A and a resisitance of 50 $Ω$.
	5. Calculate the resisitance of a device that has a current of 60 mA and a power of 0.252 W.

**Equation 12**

1. Write down the equation that links energy transfer, power and time.
2. Calculate the energy transfer (J) for the following:

***Show all of your workings***

* 1. power = 5 W time = 30 s
	2. power = 6 W time = 4 s
	3. power = 120 W time = 25 s
	4. power = 30 W time = 15 s
	5. power = 2 W time = 60 s
1. Calculate the power (W) for the following:

***Show all of your workings***

* 1. energy transfer = 108 J time = 4 s
	2. energy transfer = 112 J time = 14 s
	3. energy transfer = 425 J time = 17 s
	4. energy transfer = 52.5 J time = 4 s
	5. energy transfer = 450 J time = 90 s
1. Calculate the time (s) for the following:

***Show all of your workings***

* 1. energy transfer = 416 J power = 32 W
	2. energy transfer = 144 J power = 18 W
	3. energy transfer = 369.6 J power = 66 W
	4. energy transfer = 222.5 J power = 89 W
	5. energy transfer = 720 J power = 450 W
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Calculate the energy transferred in kJ by a 9.8 kW device in 30 s.
	2. A device transfers 241.2 kJ of energy in 6 minutes. Calculate the power of the device.
	3. Calculate the power of a device that transfers 3204 kJ in 1 hour.
	4. A device transfers 216 kJ of energy in 18 s. Calculate the power of the device in kW.
	5. Calculate the power of a device that transfers 42.75 kJ in 1.25 minutes.

**Equation 13**

1. Write down the equation that links energy transfer, charge flow and potential difference.
2. Calculate the energy transfer (J) for the following:

***Show all of your workings***

* 1. charge flow = 12 C potential difference = 3 V
	2. charge flow = 15 C potential difference = 7 V
	3. charge flow = 0.2 C potential difference = 1.5 V
	4. charge flow = 16 C potential difference = 98 V
	5. charge flow = 17 C potential difference = 9 V
1. Calculate the charge flow (C) for the following:

***Show all of your workings***

* 1. energy transfer = 180 J potential difference = 15 V
	2. energy transfer = 4160 J potential difference = 160 V
	3. energy transfer = 1920 J potential difference = 64 V
	4. energy transfer = 29.4 J potential difference = 98 V
	5. energy transfer = 52.2 J potential difference = 18 V
1. Calculate the potential difference (V) for the following:

***Show all of your workings***

* 1. energy transfer = 107.5 J charge flow = 43 C
	2. energy transfer = 351 J charge flow = 27 C
	3. energy transfer = 132 J charge flow = 33 C
	4. energy transfer = 76 J charge flow = 4 C
	5. energy transfer = 360 J charge flow = 30 C
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A charge of 400 C flows through an electrical device with a potential difference of 110 V. Calculate the energy in kJ transferred by the device.
	2. A device with a potential difference of 50 V transfers 165 kJ of energy. Calculate the charge flowing through the device.
	3. A device transfers 3.4 x 10-5 kJ of electrical energy per second. If a charge of 0.0003 C flows through the device each second, calculate the potential difference.
	4. A charge of 14100 C flows through an electrical device with a potential difference of 310 V. Calculate the energy in kJ transferred by the device.
	5. A device with a potential difference of 78 V transfers 4.6 kJ of energy. Calculate the charge flowing through the device.

**Equation 14**

1. Write down the equation that links density, mass and volume.
2. Calculate the density (kg/m3) for the following:

***Show all of your workings***

* 1. mass = 10.8 kg volume = 4 m3
	2. mass = 25.2 kg volume = 3 m3
	3. mass = 72.8 kg volume = 7 m3
	4. mass = 55.2 kg volume = 8 m3
	5. mass = 135.5 kg volume = 12 m3
1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. density = 1.74 kg/m3 volume = 9 m3
	2. density = 2.2 kg/m3 volume = 4 m3
	3. density = 0.25 kg/m3 volume = 0.4 m3
	4. density = 0.67 kg/m3 volume = 60 m3
	5. density = 2.7 kg/m3 volume = 12 m3
1. Calculate the volume (m3) for the following:

***Show all of your workings***

* 1. density = 21.5 kg/m3 mass = 635.5 kg
	2. density = 8.63 kg/m3 mass = 129.45 kg
	3. density = 18.7 kg/m3 mass = 411.4 kg
	4. density = 6.9 kg/m3 mass = 0.207 kg
	5. density = 19.3 kg/m3 mass = 0.0386 kg
1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Calculate the density of a 426 kg object with a volume of 60 m3.
	2. A 9 g block has a volume of 0.006 m3. Calculate its density.
	3. A 2 g block has a density of 2.8 kg/m3. Calculate its volume.
	4. Calculate the mass of a 9.1 kg object with a volume of 3.5 m3.
	5. A 8.4 × 105 kg block has a density of 2800 kg/m3. Calculate its volume.

**Answers**

**Equation 1**

**1** gravitational potential energy (J) = mass (kg) × gravitational field strength (g) × height (m)

$$Ep = m g h$$

**2 (a)** $900 J$

 **(b)** $1763 J$

 **(c)** $1610 J$

 **(d)** $4160 J$

 **(e)** $3160 J$

3 **(a)** 7.8 kg

 **(b)** 1.3 kg

 **(c)** 0.3 kg

 **(d)** 2.9 kg

 **(e)** 95 kg

4 **(a)** 1.5 m

 **(b)** 4 m

 **(c)** 3 m

 **(d)** 39 m

 **(e)** 13 m

5 **(a)** 1.76 kJ

 **(b)** 147 m

 **(c)** 78 g

 **(d)** 36.9 J

 **(e)** 680 g

**Equation 2**

**1** kinetic energy (J) = 0.5 × mass (kg) × speed2 (m/s)

$$E\_{k}= \frac{1}{2} m v^{2}$$

**2 (a)** 126 J

 **(b)** 625 J

 **(c)** 24 J

 **(d)** 1.69 J

 **(e)** 12.15 J

3 **(a)** 3 kg

 **(b)** 2.4 kg

 **(c)** 4.7 kg

 **(d)** 18.24 kg

 **(e)** 12.5 kg

4 **(a)** 4 m/s

 **(b)** 15 m/s

 **(c)** 5 m/s

 **(d)** 3 m/s

 **(e)** 14 m/s

5 **(a)** 1080 J

 **(b)** 5 m/s

 **(c)** 6 g

 **(d)** 43.75 J

 **(e)** 75 kJ

**Equation 3**

**1** $power (W)= \frac{energy (J)}{time (t)}$

$$P= \frac{E}{t}$$

**2 (a)** 13 W

 **(b)** 44 W

 **(c)** 32 W

 **(d)** 8 W

 **(e)** 60 W

3 **(a)** 220 J

 **(b)** 7 J

 **(c)** 6000 J

 **(d)** 252 J

 **(e)** 2240 J

4 **(a)** 7 s

 **(b)** 9 s

 **(c)** 19 s

 **(d)** 37 s

 **(e)** 28 s

5 **(a)** 13 W

 **(b)** 225 kJ

 **(c)** 30 s

 **(d)** 700 W

 **(e)** 3024 kJ

**Equation 4**

**1** $power (W)= \frac{work done (J)}{time (t)}$

$$P= \frac{W}{t}$$

**2 (a)** 130 W

 **(b)** 25 W

 **(c)** 46 W

 **(d)** 36 W

 **(e)** 54 W

3 **(a)** 80 J

 **(b)** 2340 J

 **(c)** 510 J

 **(d)** 72 J

 **(e)** 675 J

4 **(a)** 7 s

 **(b)** 78 s

 **(c)** 2.5 s

 **(d)** 9 s

 **(e)** 4 s

5 **(a)** 8.2 kW

 **(b)** 705 J

 **(c)** 7.5 min

 **(d)** 70 W

 **(e)** 239.4 J

**Equation 5**

**1** $efficiency= \frac{useful output energy transfer (J)}{total output energy transfer (J)}$

**2 (a)** 0.45

 **(b)** 0.50

 **(c)** 0.66

 **(d)** 0.78

 **(e)** 0.22

3 **(a)** 33.21 J

 **(b)** 101.4 J

 **(c)** 2006 J

 **(d)** 57.5 J

 **(e)** 292.5 J

4 **(a)** 300 J

 **(b)** 1500 J

 **(c)** 450 J

 **(d)** 900 J

 **(e)** 60 J

5 **(a)** 0.16

 **(b)** 80 kJ

 **(c)** 4800 kJ

 **(d)** 83 %

 **(e)** 2214 kJ

**Equation 6**

**1** $efficiency= \frac{useful power output (W)}{total power output (W)}$

**2 (a)** 0.45

 **(b)** 0.33

 **(c)** 0.01

 **(d)** 0.89

 **(e)** 0.67

3 **(a)** 260 J

 **(b)** 23.25 J

 **(c)** 399 J

 **(d)** 858 J

 **(e)** 68.25 J

4 **(a)** 60 J

 **(b)** 36 J

 **(c)** 57 J

 **(d)** 740 J

 **(e)** 25 J

5 **(a)** 7 %

 **(b)** 992 kW

 **(c)** 0.78 kW

 **(d)** 44 %

**(e)** 99 MW

**Equation 8**

**1** $charge flow \left(C\right)= current \left(A\right) × time (s)$

 $Q=I ×t$

**2 (a)** 2.25 C

 **(b)** 75 C

 **(c)** 450 C

 **(d)** 6 C

 **(e)** 70 C

3 **(a)** 1.4 A

 **(b)** 5 A

 **(c)** 25 A

 **(d)** 30 A

 **(e)** 14 A

4 **(a)** 58 s

 **(b)** 18 s

 **(c)** 850 s

 **(d)** 90 s

 **(e)** 60 s

5 **(a)** 0.45 C

 **(b)** 2.6 A

 **(c)** 6.5 hours

 **(d)** 1.2 A

**(e)** 55 $μ$A

**Equation 9**

**1** $potential difference \left(V\right)= current \left(A\right) × resisitance (Ω)$

 $V=I ×R$

**2 (a)** 1.8 V

 **(b)** 0.8 V

 **(c)** 210 V

 **(d)** 40 V

 **(e)** 198 V

3 **(a)** 95 A

 **(b)** 0.15 A

 **(c)** 0.005 A

 **(d)** 2.5 A

 **(e)** 0.25 A

4 **(a)** 26 $Ω$

 **(b)** 14 $Ω$

 **(c)** $80$ $Ω$

 **(d)** 12 $Ω$

 **(e)** 23 $Ω$

5 **(a)** 9.24 V

 **(b)** 180 $μ$A

 **(c)** 500 $Ω$

 **(d)** 26.18 V

**(e)** 3 mA

**Equation 10**

**1** $power \left(W\right)= potential difference \left(V\right) × current (A)$

 $P =V×I$

**2 (a)** 2530 W

 **(b)** 12 W

 **(c)** 6 W

 **(d)** 660 W

 **(e)** 1.12 W

3 **(a)** 5.5 A

 **(b)** 0.6 A

 **(c)** 5 A

 **(d)** 0.4 A

 **(e)** 1.5 A

4 **(a)** 140 V

 **(b)** 9.5 V

 **(c)** 350 V

 **(d)** 0.14 V

 **(e)** 56 V

5 **(a)** 110 kW

 **(b)** 330 V

 **(c)** 60 A

 **(d)** 0.6 W

**(e)** 0.3 mA

**Equation 11**

**1** $power \left(W\right)= \left(current (A)\right)^{2} × resisitance (Ω)$

 $P =I^{2}×R$

**2 (a)** 240 W

 **(b)** 192 W

 **(c)** 369 W

 **(d)** 84.5 W

 **(e)** 375 W

3 **(a)** 7 A

 **(b)** 1.5 A

 **(c)** 0.1 A

 **(d)** 1.3 A

 **(e)** 0.22 A

4 **(a)** 50 $Ω$

 **(b)** 9 $Ω$

 **(c)** 700 $Ω$

 **(d)** 90 $Ω$

 **(e)** 65 $Ω$

5 **(a)** 600 kW

 **(b)** 50 A

 **(c)** 0.8 k$Ω$

 **(d)** 1.25 kW

**(e)** 70 $Ω$

**Equation 12**

**1** $energy transferred \left(J\right)= power (W) × time (s)$

 $E =P × t$

**2 (a)** 150 J

 **(b)** 24 J

 **(c)** 3000 J

 **(d)** 450 J

 **(e)** 138 J

3 **(a)** 30 W

 **(b)** 8 W

 **(c)** 25 W

 **(d)** 15 W

 **(e)** 5 W

4 **(a)** 13 s

 **(b)** 8 s

 **(c)** 6 s

 **(d)** 3 s

 **(e)** 2 s

5 **(a)** 294 kJ

 **(b)** 670 W

 **(c)** 890 W

 **(d)** 12 kW

**(e)** 570 W

**Equation 13**

**1** $energy transferred \left(J\right)= charge flow \left(Q\right)× potential difference (V)$

 $E =Q × V$

**2 (a)** 36 J

 **(b)** 105 J

 **(c)** 0.3 J

 **(d)** 1568 J

 **(e)** 153 J

3 **(a)** 12 C

 **(b)** 26 C

 **(c)** 30 C

 **(d)** 0.3 C

 **(e)** 2.9 C

4 **(a)** 2.5 V

 **(b)** 13 V

 **(c)** 4 V

 **(d)** 19 V

 **(e)** 12 V

5 **(a)** 44 kJ

 **(b)** 3300 C

 **(c)** 113 V

 **(d)** 4371 V

**(e)** 60 C

**Equation 14**

**1** $density (kg/m^{3})= \frac{ mass (kg)}{volume (m^{3})}$

*ρ =* $\frac{m}{V}$

**2 (a)** 2.7 kg/m3

 **(b)** 8.4 kg/m3

 **(c)** 10.4 kg/m3

 **(d)** 6.9 kg/m3

**(e)** 11.3 kg/m3

3 **(a)** 15.66 kg

 **(b)** 8.8 kg

 **(c)** 0.1 kg

 **(d)** 40.2 kg

 **(e)** 32.4 kg

4 **(a)** 17 m3

 **(b)** 15 m3

 **(c)** 22 m3

 **(d)** 0.03 m3

 **(e)** 0.002 m3

5 **(a)** 7.1 kg/m3

 **(b)** 1.5 kg/m3

 **(c)** 0.00084 m3

 **(d)** 9.1 kg

**(e)** 300 m3