Tutorial 1

WORK

1. (a) 3 750 J (b) 2 080 000 J (c) 125 N

   (d) 27.51 N (e) 271 m (f) 16 111 m

2. 5 000 J

3. 200 m

4. 30 N

5. 133.33 N

6. 3 400 m

7. 6 500 000 J

8. 1 818 m

9. 7.5×10^{7} J

10. (a) 433.33 N (b) 54.17 N

11. 4 750 m

12. (a) 52 500 J (b) 52 500 J

    (c) (i) Peter - 8, John – 4 (ii) Peter

13. 60 J

14. 4 800 J

15. 690 000 J

16. (a) 16 250 N (b) 1 625 kg

17. (a) 40 N (b) 4 kg (c) 10 books

18. (a) 750 N (b) 112 500 J

19. (a) 820 N (b) 8 200 J

20. (a) 675 N (b) 945 J (c) 405 J

Tutorial 2

POWER, ENERGY AND TIME

1. (a) 50 W (b) 5 W (c) 60 000 J

   (d) 2 400 J (e) 40 s (f) 10 s

2. 12 s

3. 150 W

4. 4 000 J

5. 9.5 W

6. 1 440 000 J

7. 15 minutes

8. 2 900 W

9. 1 200 s

10. 950 W

11. 33.75 W

12. 13 s

13. 11.67 W

14. 70 s

Tutorial 3

POTENTIAL ENERGY

1. (a) 3675 J (b) 13 230 J (c) 1.31 (d)3.6 m

   (e) 2.45 kg (f) 10.74 kg

2. (a) 2 352 J (b) 147 000 J (c) 3 675 J

3. (a) 1.36 kg (b) 7.85 kg (c) 19.13 kg

4. (a) 1 m (b) 2 m (c) 3 m (d) 4 m

5. 41 160 J

6. 470 400 J

7. 66.3 kg

8. 0.59 J

9. 102 m

10. (a)366 500 J (b) 158 270 J

11. 1 000 J

12. 540 000 J

13. 120 000 J

14. 21.25 m

15. 100 N

Tutorial 4

1. (a) 720 000 J (b) 144 N

2. (a) 130 000 J (b) 722.22 W

3. (a) 18 600 000 J (b) 4 745 kg

Tutorial 5

KINETIC ENERGY

1. (a) 9 J (b) 56.25 J (c) 36 J (d) 50 J
   (e) 12 J (f) 400 000 J

2. 135 000 J

3. 2.25 J

4. 19.36 J

5. (a) 250 000 J (b) 1 440 000 J

6. 1 020.6 J

7. 1.82×10^{-16} J

8. (a) 20 m/s (b) 1×10^{7} J

9. 3.75×10^{-3} J

10. 8.09×10^{10} J

11. 10 m/s

12. 0.125 kg

13. 22 m/s

14. (a) 5 000 m/s (b) 4 800 kg

15. (a) 226 625 J (b) 9.52 m/s

16. (a) 0.53 m/s (b) 0.11 J

17. 4 people

18. (a) 140 000 J (b) 18 m/s (c) 313 600 J

19. 4.77 m/s

20. 9 m/s

Tutorial 6

EFFICIENCY

1. (a) 50 % (b) 20 % (c) 960 J (d) 3 333 J

   (e) 180 J (f) 24 000 J

2. 58.8 %

3. 20 %

4. 14.26 %

5. 29.5 %

6. 20 kJ

7. 750 MW

8. 781.25 MW

9. 96 000 kW

10. 45 %

11. 22.22 MW

12. 1 575 000 J

13. 360 W

14. 444.4 m

15. 9 MJ

Tutorial 7

ENERGY CONSERVATION

1. (a) 58.8 J (b) 58.8 J (c) 7.67 m/s

2. (a) 3.92 J (b) 3.92 J (c) 3.96 m/s

3. (a) 0.88 J (b) 0.88 J (c) 2.97 m/s

4. (a) 0.6 J (b) 0.6 J (c) 0.2 m

5. (a) 812.5 J (b) 812.5 J (c) 1.28 m

6. (a) 1 568 J (b) 19.8 m/s

7. 14.85 m/s

8. 14. m/s

9. 326.5 m

10. 1.98 m/s

11. (a) 164 640 J (b) 4 116 J (c) 168 756 J

    (d) 28.35 m/s

12. 1 148 m

13. (a) 1 920 J
(b) It got converted into Gravitational potential energy
(c) 1 470 J (d) 450 J

14. (a) 294 000 J (c) 243 000 J (d) 51 000 J

15. (a) 441 000 J (b) 96 000 J (c) 339 000 J

(d) 11.5 m

Tutorial 8

Series Circuits

1. 5 V

2. 3 V

3. (a) 24 V (b) 3 A

4. (a) 0×05 A (b) 10 V

5. (a) 0×2 V (b) 1×7 A

Tutorial 9

Parallel Circuits

1. (a) 12 V (b) 12 V (c) 0×5 A

2. (a) 6 V (b) 0×4 A

3. (a) 230 V (b) 0×6 A (c) 0×9 A

4. (a) 12 V (b) 12 V (c) 6 A (d) 16 A

5. (a) A & B (b) 5 A (c) A, B & C (d) 7 A
(e) 3 A (f) 230 V

Tutorial 10

Current, Charge & Time

1.

(a) 150 C (b) 18 C (c) 2 s (d) 12 s
(e) 30 A (f) 9×4 A

2. 60 C

3. 4×2 A

4. 1 200 s

5. 630 C

6. 0×25 A

7.

(a) 10 800 s

8. 180 s

9. 105 000 C

10. 4×6 A

Tutorial 11

Potential Dividers

1. (a) HIGH (b) LOW (c) LOW

2. (a) V_{out} = $R_1/(R_1 + R_2) \times V_s$ = 10/20 x 5 = **2.5V**

(b) V_{out} = $R_1/(R_1 + R_2) \times V_s$ = 20/30 x 6 = **4V**

(c) V_{out} = $R_1/(R_1 + R_2) \times V_s$ = 500/6000 x 12= **1V**

3. (a) (i) HIGH (ii) LOW

(b) (i) 1000 x ¼ = **250Ω**
(ii) 10 x ¼ = **2.5 V**

4. (a) The thermistors resistance also changes.

(b) The buzzer would sound when the temperature gets too cold

(c) Change the value of the variable resistor

5. (a) When it gets dark the resistance of the LDR INCREASES. Therefore the voltage across the LDR INCREASES. When the input voltage reaches 0.7 V the transistor switches on. This allows a current to flow through the relay which becomes a magnetic field. This attracts the switch which completes the circuit and the floodlights come on.

(b) The transistor can not provide a large enough current.
(c) It will need to be even darker before the floodlights come on.

Section 3 - Resistance

Voltage, Current & Resistance

1.
(a) 525 V
(b) 200 V
(c) 1·84 A
(d) 0·04 A
(e) 10 Ω
(f) 960 Ω
2.
(a) 50 V
(b) 640 V
(c) 24 V
3.
(a) 2 A
(b) 0·24 A
(c) 0·09 A
4.
(a) 960 Ω
(b) 400 000 Ω
(c) 72 727 Ω
5. 2 400 Ω
6. 0·15 A
7. 3·6 V
8. 230 V
9. 15 333 Ω
10. 0·16 A

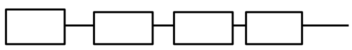
Resistance in Series Circuits

1.
(a) 5575 Ω
(b) 405 Ω
(c) 3000 Ω
(d) 400 Ω
(e) 310 Ω
(f) 80 Ω
2. 9 000 Ω
3. 1 550 Ω

Resistance in Parallel Circuits

1.
(a) 40 Ω
(b) 10 Ω
(c) 60 Ω
(d) 48 Ω
(e) 60 Ω
(f) 320 Ω
(g) 200 Ω
(h) 100 Ω
(i) 600 Ω
2.
(a) 200 Ω
(b) 1 kΩ
(c) 240 Ω
(d) 140 kΩ
(e) 100 Ω
(f) 321·43 Ω
3. 140 Ω
4. 225 Ω
5. 360 Ω

Combination Circuits

1.
(a) 20 Ω
(b) 70 Ω
(c) 25 Ω
(d) 20 Ω
2.
(a) 125 Ω
(b) 280 Ω
(c) 405 Ω
3. 274·29 Ω
4. network B
5.
(a)

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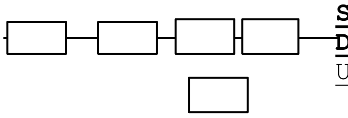
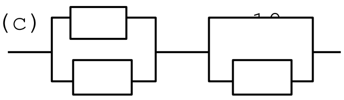


(c)

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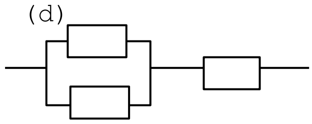


2 - Output Devices

The L.E.D.

1. a) 0.4V
b) 2Ω, 4Ω
c) No, R changing.
2.
(a) 4 V, 400 Ω
(b) 10 V, 1 000 Ω
(c) 6·2 V, 387·5 Ω
(d) 18·4 V, 2 300 Ω
(e) 2·5 V, 125 Ω
(f) 9 V, 750 Ω
3.
(a) 190 Ω
(b) 600 Ω
(c) 980 Ω
(d) 400 Ω
(e) 1 000 Ω
(f) 500 Ω
(g) 650 Ω
(h) 50 Ω
4.
(a) 3·2 V
(b) 1·9 V
5. 11 V
6. 425 Ω
7. 0·005 A

Section 3 - Input Devices

Using V = I R

3.
(a) (i) 200 Ω
(ii) 2500 Ω
(b) circuit (ii)
4.
(a) 4 000 Ω
5.
(a) 0·2 kΩ
(b) 0·005 A
(c) bright sunlight
6.
(a) 60 ^{0}C
(b) cold
(c) 20 ^{0}C
(d) 0·03 A

7. a) Position C
b) Increases
c) Decreases
d) Higher R, longer time. Due to lower current so less charge per second.

<u>Tutorial ?</u>

<u>SPECIFIC HEAT CAPACITY</u>

1. (a) 546 000 J (b) 74 415 J (c) 3.89 ^{0}C
(d) 500 J/kg^{0}C (e) 533.3 J/kg^{0}C (f) 192 J

2. 27 060 J

3. 5.86 ^{0}C

4. 2.5 kg

5. 9 200 J/kg^{0}C

6. 211 500 J

7. 3 667 J

8. 2 400 J/kg^{0}C

9. B

10. 0.05 kg

11. 846.15 J/kg^{0}C

12. 80.58 ^{0}C

13. 11.65 ^{0}C

14. 93.73 ^{0}C

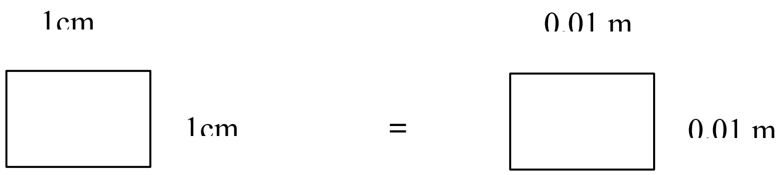
15. 21.56 ^{0}C

CONSERVATION OF ENERGY

1. 11 704 s
2. 100.32 s
3. 117.19 ^{0}C
4. 836 W
5. (a) 65 ^{0}C (b) 300 s
6. (a) 10 000 J (b) 55.56 W (c) 0.24 A
7. Copper
8. (a) 10 350 J (b) 8 460 J (c) 1890 J

Pressure, Force and Area

1.



1. x 0.01 = 0.0001 = $1x10^{-4}$ m^2

2. (a) 1×10^{-3} m^2 (b) $7.5 \times 10^{-3} m^2$ (c) $2 \times 10^{-2} m^2$

3.

	Pressure	Force	Area
(a)	2000 Pa	100 N	0.05 m^2
(b)	1.5×10^4 Pa	1.5×10^3 N	0.1 m^2
(c)	1×10^5 Pa	15N	1 cm^2
(d)	1×10^5 Pa	3N	30 mm^2
(e)	20 kPa	1,250 N	625cm^2

4. Nm^{-2}

5. 6 x 10^{4} N

6. II and III

Pressure and volume (constant temperature)

1.

0.13m^{3}

2.5 x 10^{6} Pa

17 cm^{3}

5 x 10^{5} Pa

1 kPa

2. (a) 2 x 10^{5} Pa (b) 5 x 10^{5} Pa

3. 375 cm^{3}

4. 100 m^{3}

5. 40cm

6. (a) 900 litres (b) 36 mins

Pressure and temperature (constant volume)

1. (a) 0 K (b) 123 K (c) 273 K (d) 3300 K
(e) 423 K

2. (a) – 263 ^{0}C (b) -250 ^{0}C (c) -173 ^{0}C (d) 77 ^{0}C
(e) 100 ^{0}C

3.

	Pressure P_1	Temperature T_1	Pressure P_2	Temperature T_2
(a)	2×10^5 Pa	400 K	**3 x 10^5 Pa**	600 K
(b)	100 kPa	300 K	200 kPa	**600 K**
(c)	1.2×10^5 Pa	**267 K or – 6.3^{0}C**	1.8×10^5 Pa	127 °C
(d)	**27 KPa**	27 °C	100 kPa	846 °C
(e)	3×10^5 Pa	600 K	**0 Pa**	0 K

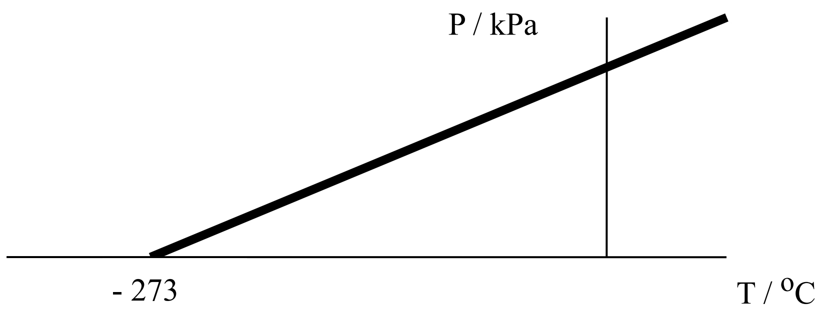
4. 2.7 x 10^6 Pa

5. 46.2 kPa

6. 360 K (or 87 ^{0}C)

7. 750 K (or 477 ^{0}C)

8. (a) see Pressure law notes
(b)



(i) It is not a straight line through the origin
(ii) Change the temperature scale to Kelvin

(c) (i) As the temperature decreases the molecules have less kinetic energy and have less speed. This means that they hit the sides of the container less often **and** with less force.
(ii) When the volume increases the molecules have further to travel and hit the sides of the container less often.
(iii) The molecules stop moving

Tutorial ?

Volume and temperature (constant pressure)

1. (a) + (b) see Charles's law notes
   (c) Plot graph of vol against temp in Kelvin. Straight line through origin tells us that they are directly proportionally

2.

	Volume V_1	Temperature T_1	Volume V_2	Temperature T_2
(a)	0.5 m^3	200 K	2m^3	800 K
(b)	6 litres	1200 K	1.5 litres	300 K
(c)	4 litres	27 °C	38 litres	127 °C
(d)	2 .5 m^3	27 °C	5 m^3	327 °C
(e)	4 litres	0 °C	30 litres	1775 ^oC

3. 300 K (or 27 ^0C)

4. 0.12 cm^3

5. 53.4 cm^3 (Kelvin temperature does not double)

Tutorial ?

General gas equation

1. If P α T and P α 1/V
   Then:
   P α T/V so
   P = constant x T/V therefore

   PV/T = constant.

2. (a)40 cm^3 (b)977 K (c)2.2 x 10^5 Pa (d) 188 K

3. 5.1 x 10^5 Pa

4. (a) Pressure x 4 (b) no change in pressure (c) pressure x 12

5. (a) Volume x 4(b) no change in volume (c) volume x 12

6. Pressure - Volume

As the volume decreases the molecules hit the sides of the container more often (as they have a shorter distance to travel) ;
this increases the pressure

Pressure – Volume

As the temperature increases the molecules gain more kinetic energy and move faster; they hit the sides of the container more often **and** with a greater force: this increases the pressure.

Volume – Temperature

As the temperature increases the molecules gain kinetic energy and move faster; they would hit the sides of the container more often and with a greater force: in order to maintain a constant pressure the volume must increase.

7. E

8. E

9. II