**M1.**(a)     (i)      electrical

*correct order only*

**1**

kinetic

**1**

sound

**1**

(ii)     transferred into surroundings / atmosphere

*accept warms the surroundings*

*allow released into the environment*

*becomes heat or sound is insufficient*

**1**

(b)     0.7 / 70 %

*an answer of 70 without % or with the wrong unit* ***or*** *0.7 with a unit gains* ***1*** *mark*

**2**

**[6]**

**M2.**          (a)     light

**1**

electrical

*correct order only*

**1**

(b)     (i)      0.2 **or** 1/5

*accept 20% for both marks*

*allow* ***1*** *mark for correct substitution answer of 0.2%****or*** *20 gains* ***1*** *mark
ignore units*

**2**

(ii)     wasted

*accept transformed to heat / other forms
accept transferred to the air / surroundings sound = neutral*

**1**

(c)     (i)      any **one** from:

•        can fly at night

*accept can fly when it is cloudy
accept as a back-up*

•        can stay in the air for longer

•        can fly in the winter

•        can fly faster

*increases power is neutral*

**1**

(ii)     any **one** from:

•        produces no (pollutant) gases

**or** no greenhouse gases

*accept named gas*

*accept no air pollution*

*do* ***not*** *accept no pollution*

*accept less global warming*

*accept harmful for pollutant*

*accept produces no carbon*

*do* ***not*** *accept environmentally friendly*

•        produces no / less noise

•        less demand for fuels

*accept any other sensible environmental advantage*

**1**

(iii)     accept any sensible suggestion eg, map the Earth’s surface / weather forecasting / spying / monitoring changes to the Earth’s atmosphere, etc

*do* ***not*** *accept ideas in terms of transporting*

*accept use as a satellite*

**1**

**[8]**

**M3.**          (a)     1800 (N)

*allow* ***1*** *mark for correct substitution ie 180 × 10 provided no further steps shown*

**2**

(b)     3780**or**their (a) × 2.1 correctly calculated

*allow* ***1*** *mark for correct substitution*

*ie 1800* ***or*** *their (a) × 2.1 provided no further steps shown*

**2**

joule

*accept J*

*accept any clear indication of correct answer*

**1**

(c)     0

*reason does not score if 0 not chosen*

**1**

work is only done when a force makes an object move

*accept distance moved is zero*

*accept no energy transfer (to the bar)*

*accept the bar is not moving/is stationary*

*‘it’ refers to the bar/weights*

**1**

**[7]**

**M4.**(a)    potential

**1**

(b)     (i)      13 200

*allow* ***1*** *mark for correct substitution, ie 660 × 20 provided no subsequent step shown*

**2**

(ii)     16.5

*allow 1 mark for correct*

**or**

  correctly calculated

*substitution, ie * ***or*** **

*provided no subsequent step shown*

**2**

**[5]**

**M5.**          (a)     generator

*accept dynamo
accept alternator*

**1**

(b)     (i)      1400

*ignore units*

**1**

(ii)     0.3 or 30%

*any incorrect unit penalise* ***1*** *mark
allow* ***1*** *mark for the correct use of 600****or*** *0.3%* ***or*** *30*

**2**

(c)     **1** mark for each correct link


*if more than 3 lines are drawn, mark only*

*3 lines starting with those that are incorrect*

**3**

(d)     (i)      110

*no tolerance*

**1**

(ii)     12

*no tolerance*

**1**

(iii)     wind speed may be too low to operate the generator

*accept wind may not always blow*

*accept power depends on wind speed*

*accept does not generate if wind speed is too high*

*accept does not generate if wind speed is above 12 (m/s)*

*accept does not generate if wind speed is below 1.6 (m/s)*

*accept it is unreliable*

*do* ***not*** *accept answers referring to cost only*

**1**

**[10]**

**M6.**          (a)     fan

**1**

drill

**1**

washing machine

*four circled including correct three scores* ***1*** *mark*

*five circled scores zero*

**1**

(b)      Appliances only transfer part of the energy usefully

**1**

The energy transferred by appliances makes the surroundings warmer

**1**

**[5]**

**M7.**          (a)     **B** or bungee cords

**1**

          **C** or springs or playground ride

*each additional answer loses* ***1*** *mark minimum mark zero*

**1**

          will go back to original shape/size

**1**

(b)     (i)      newton

**1**

(ii)     0 – 5 (N) or 5

*accept1 – 5 (N)
do* ***not*** *accept 4*

**1**

(iii)     16 (cm)

**1**

(iv)    2.5 (N)

*accept answer between 2.4 and 2.6 inclusive*

**1**

**[7]**

**M8.**(a)     electrical

**1**

chemical

**1**

light

**1**

(b)     25% **or** 0.25

*allow* ***1*** *mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown****or****answers of 25 with a unit* ***or*** *0.25 with a unit gain* ***1*** *mark
answers of 25 without a unit* ***or*** *0.25% gain* ***1*** *mark*

**2**

(c)     the information board can be used anywhere it is needed

**1**

**[6]**

**M9.**(a)     chemical

*correct order only*

**1**

kinetic

**1**

sound

**1**

(b)     37.5% or 0.375

*an answer rounded to 0.38 or 38% scores both marks*

*an answer of 0.375 with a unit gains* ***1*** *mark*

*an answer of 0.375% gains* ***1*** *mark*

*an answer of 37.5 with or without a unit gains* ***1*** *mark*

*allow* ***1*** *mark for an answer 3 / 8*

*3 / 8 with a unit scores 0*

**2**

**[5]**

**M10.**          (a)     iron

**1**

          hairdryer

**1**

          kettle

*answers can be in any order*

**1**

(b)     sound

**1**

(c)     is more efficient than

**1**

**[5]**

##

          (a)     60

(b)     15

(c)     5

*each for 1 mark
credit 1 mark for (a) +(b)+ (c) = 80****or*** *(a) > (b) > (c) to maximum of 3*

**[3]**

**M12.**          (a)     572

*allow* ***1*** *mark for correct substitution,*

*ie 220 × 2.6*

*allow* ***1*** *mark for*

*220 × 260 = 57 200*

***or***

*220 × 2600 = 572 000*

*but to score this mark the entire calculation must be shown*

***2***

*(b)     (i)      smooth curve drawn*

*accept a line that is extrapolated back to 0 degrees, but not through the origin*

*accept a straight line of best fit (point at 40 degrees can be treated as anomalous and line may stop at 30 degrees)*

*do* ***not*** *accept straight lines drawn ‘dot to dot’ or directly from first to last point or a line going through the origin*

***1***

*(ii)     increases*

*accept a positive correlation*

*do* ***not*** *accept proportional*

***1***

*(iii)    long plank*

*no mark for this, the marks are for the explanation*

*makes the angle small(er) (than a short plank)*

*accept increases the distance*

*accept small(er) slope*

***1***

*a small(er) force is needed****or****short plank*

*no mark for this, the marks are for the explanation*

*a large(r) force is used over a short(er) distance (1)*

*less work done (1)*

*accept less energy transfer*

***1***

***[6]***

***M13.****(a)      (i)     75 000*

*accept correct substitution for* ***1*** *mark*

*ie 7500 × 10*

***2***

*newtons / N*

*do* ***not*** *accept n*

*full credit for using g = 9.8* ***or*** *9.81*

***1***

*(ii)     60 000 000*

*accept for both marks*

*their (a)(i) × 800 correctly calculated*

*accept correct substitution for* ***1*** *mark*

*ie their (a)(i) × 800*

***2***

*(b)     (i)      arrow drawn parallel (to)* ***and*** *down (the) slope*

*accept arrow drawn anywhere on the diagram*

***1***

*(ii)     increases*

***1***

*GPE transformed to KE****or****speed increasing*

*accept is accelerating*

*however ‘speed increasing’ only scores if correctly linked to increasing kinetic energy*

***1***

*(c)     so more likely to wear one****or****they know wearing a helmet is likely to / will reduce (risk) head injury****or****so can make an (informed) choice (about wearing one)*

***1***

***[9]***

***M14.****900 000*

*correct with no working = 3 if answer incorrect, allow:*

*1 mark for K.E. =  × mass × speed2*

*2 marks for  × 5000 × 600 2*

*N.B. correct answer with the incorrectly recalled relationship*

* × weight × speed 2 = 2 marks*

***[3]***

***M15.****(a)     1 080 000*

*allow* ***1*** *mark for correct substitution*

*ie ½ × 15 000 × 12 × 12*

***2***

*(b)     any* ***one*** *from:*

*•        KE (of wind) more than doubles*

*•        mass of air (hitting blades) more than doubles*

*•        area swept out by blades more than doubles*

*do* ***not*** *accept blades are larger / have a bigger area*

*•        area swept out by blades increases × 4*

***1***

***[3]***

***M16.****(a)     100*

*gains 2 marks*

*else working*

*gains 1 mark*

***2***

*(b)     100   ecf*

*for 1 mark*

***1***

*(c)     rounds to 14 (accept 14.142 or 14.14) ecf*

*gains 3 marks*

*else working to v2 = 200*

*gains 2 marks*

*else initial working v = 200*

*gains 1 mark*

***3***

***[6]***

***M17.****(a)     W = 65 × 10
(allow a maximum of 3 marks if candidate uses g = 9.8N / Kg (as ecf))*

*gains 1 mark*

***but****W = 650 (N)
(allow**use of p.e.= m × g × h)*

*gains 2 marks*

***but****PE change = 650 × 1.25* ***or*** *65 × 10 × 1.25*

*gains 3 marks*

***but****PE change = 812.5 (J)    (allow 813J or 812J)*

*gains 4 marks*

***4***

*(b)     k.e. = p.e.*

*gains 1 mark*

***but****(speed)² = 812.5 × 2 / 65* ***or*** *812.5 = ½ × 65 × (speed)²     ecf*

*gains 2 marks*

***but****speed = 5 (m/s)            (allow 4.99 → 5.002)*

*(if answer = 25mls check working:  812.5 = ½ m × v gains 1 mark for
KE = PE)
(but if 812.5 = ½m × v² = ½ × 65 × v2 or v2 =  gains 2 marks)*

*25, with no working shown gains 0 marks*

*gains 3 marks*

***3***

***[7]***

***M18.****(i)      kinetic energy = *

*accept velocity for speed
accept KE =  mv2*

***1***

*(ii)      32 000*

*accept 32 kJ*

***1***

***[2]***