Work and Energy

****1 June 02 P1 Q17** C Work done by a gas , $W = p\ \Delta V$

****2 June 02 P1 Q18** B Loss in g.p.e. = gain in k.e. + work done against friction, 50 kJ = gain in k.e. + 10 kJ
Hence gain in k.e. = 40 kJ. Since initial k.e. = 5 kJ, Hence final k.e. = 5 + 40 KJ

***3 Nov 02 P1 Q17** D Since speed is constant , hence k.e. is constant.

****4 Nov 02 P1 Q19** C 60% of g.p.e. is converted into k.e. Hence $\frac{1}{2} mv^2 = 0.60\ mgh$

****5 June 03 P1 Q17** C Work is done to increase the g.p.e. = mgh where h is the vertical heigth. Hence work done = Wq

****6 June 03 P1 Q18** D Loss in k.e. = work done. $\frac{1}{2} mv^2 = F.s$ For m and F constant, $v^2 \propto s$

****7 Nov 03 P1 Q17** D Total work done = increase in k.e. + increase in g.p.e. Power = Work done / time

****8 June 04 P Q16** B

****9 June 04 P1 Q17** A k.e. $E_k = \frac{1}{2} mv^2$. For car X, $E_X = \frac{1}{2} (2m)(\frac{1}{2} v)^2$
For car Y: $E_Y = \frac{1}{2} mv^2$.

****10 June 04 P1 Q18** C. Work done = increase in g.p.e. = mgh

****11 Nov 04 P1 Q15** A Initial k.e. $E = \frac{1}{2} mv^2$. Final k.e. $4E = \frac{1}{2} m\ v_2^2$

****12 Nov 04 P1 Q16** A Net work done = increase in k.e.. Hence Net force x distance = increase in k.e.
(90 – 50) x 6.0 = increase in k.e.

****13 Nov 04 P1 Q18** A Work done by force, $W = F.s = (9.0 \times 10^3) \times 40$. Increase in g.p.e. = mgh = Wh = $20 \times 10^3 \times 12$. Work done = heat dissipated + increase in g.pe.

****14 June 05 P1 Q15** B Speed constant, hence k.e. is constant. g.p.e. = mgh. Hence g.p.e. $\propto$ h

****15 June 05 P1 Q17** B Increase in g.p.e. = mgh = $(V\rho)\ gh = 0.50^3 \times (2.0 \times 10^3) \times 9.81 \times 3.0$

****16 Nov 05 P1 Q14** C k.e. = $\frac{1}{2} mv^2$

*****17 Nov 05 P1 Q15** A g.p.e = mgh. G.p.e. $\propto$ h

****18 Nov 05 P1Q16** B Work done = increase in g.p.e. Increase in height = $5.0 \sin 30^o$

***19 Nov 06 P1 Q16** D

****20 June 06 Q17** D Same as **June 03 P1 Q18**

*****21 June 06 P1 Q18** A gain in g.p.e. = mgh where h = vertical height

****22 Nov 06 P1 Q16** D g.p.e. = mgh = 80 x 9.81 x(2.5 x 6)

****23 Nov 07 P1 Q15** B Change in k.e. = initial k.e. – final k.e.

***24 Nov 07 P1 Q16** C

*****25 June 08 P1 Q18** B

****26 Nov 08 P1 Q15** A

****27 Nov 08 P1 Q16** A

****28 Nov 08 P1 Q17** C Conservation of energy: $mgy = \frac{1}{2} mv^2$

*****29 June 09 P1 Q15** B Initial g.p.e. = mg(½ h). Final g.p.e. = mg(1/4 h)

Section B

***1 June* 02 P2 Q5**(a) increase the height
(b) compress gas by pushing piston inwards to increase its temperature
(c) Expand or compress the gas

2 Nov 02 P2 Q4 (a) Work = force x displacement, and the displacement occurs in the direction of the force.
(b) Work done to overcome the weight = W. $\Delta h = mg\,\Delta h$. Work done is converted into increase in g.p.e. Hence $\Delta E_p = mg\,\Delta h$

3 Nov 05 P2 Q8 (a) Same Q2(a)
(b)(i) k.e. increases with h fallen, but it increase at a decreasing rate until it reaches a constant value at h_o. Hence its velocity increases with h at a decreasing rate until it attains a constant velocity called terminal velocity.
(ii) A straight line, with negative gradient. At h = 0, $E_p > \max E_k$, and $E_p = 0$ at $h = h_o$

4 Nov 07 P2 Q3

3	(a)	(i)	potential energy: stored energy available to do work	B1	[1]
		(ii)	gravitational: due to height/position of mass OR distance from mass OR moving mass from one point to another	B1	
			elastic: due to deformation/stretching/compressing	B1	[2]

(b) (i) height raised = (61 – {61 cos18} =) 3.0 cm C1
energy = (mgh = 0.051 × 9.8 × 0.030 =) 1.5×10^{-2} J A1 [2]

(ii) moment = force × perpendicular distance
= 0.051 × 9.8 × 0.61 × sin18 C1
= 0.094 N m A1 [2]

Power and Efficiency

***1 June 02 P1 Q16** D Efficiency = ratio of output to input

****2 June 02 P1 Q19** D Apply P = F.v. $24 \times 10^3 = 600$ v

***3 Nov 02 P1Q16** C

****4 Nov 02 P1 Q18**

***5 June 03 P1 Q16** C

***6 Nov 03 P1 Q18** B Power = F.v where the force exerted by the boat is to overcome the frictional drag F.

***7 June 04 P1 Q15** D

****8 Nov 04 P1 Q17** B Power , $P = F.v = F.\frac{s}{t}$.

*****9 June 05 P1 Q16** C power = rate of energy tranfered = gradient of graph. For power maximum, gradient is maximum

****10 Nov 06 P1 Q17** A Total electrical energy supplied = 93 + 7 = 100 J

****11 Nov 06 P1 Q18** C Efficiency = output / input. Input = 0.8 x output.
Hence 0.8 x (25×10^3 I) = 4.0×10^6

***12 June 07 P1 Q14**

****13 June 08 P1 Q19**

****14 Nov 08 P1 Q18**

****15 June 09 P1 Q14**

Section B

1 Nov 06 P2 Q1 (a) (i) Same as 2(a)
(ii) power = rate of work done
(b) power $P = \frac{W}{t} = \frac{F.s}{t} = F.v$
(c)(i) Average rate at which k.e. is supplied = average rate of increase in k.e.

$$= \text{increase in k.e. / time} = \frac{\frac{1}{2}mv^2 - 0}{t} =$$

(ii) Power P = F.v. For P constant, $F \propto \frac{1}{v}$

As car accelerated, v increase, hence F decreases and acceleration decreases.

2 June 08 P2Q3

3 **(a)** **(i)** $v^2 = 2as$		
$1.2^2 = 2 \times a \times 1.9$	M1	
$a = 0.38\ \text{m s}^{-2}$	A1	[2]
(ii) $F = ma$		
$= 42 \times 0.38$	M1	
$= 16\ \text{N}$	A0	[1]
(b) *power* = *Fv*	C1	
$= 16 \times 1.2$		
$= 19\ \text{W}$	A1	[2]
(c) **(i)** component = $42 \times 9.8 \times \sin 2.8$	C1	
$= 20.1\ \text{N}$	A1	[2]
(ii) accelerating force = $20.1 - 16 = 4.1\ \text{N}$	C1	
acceleration of trolley = $4.1 / 42 = 0.098\ \text{m s}^{-2}$	C1	
$s = \frac{1}{2}at^2$		
$3.5 = \frac{1}{2} \times 0.098 \times t^2$	C1	
$t = 8.5\ \text{s}$	A1	[4]
(d) *either* allows plenty of time to stop runaway trolley		
or speed of trolley increases gradually		
or trolley will travel faster	B1	[1]
(answer must be unambiguous when read in conjunction with question)		