CHAPTER 2 TEST REVIEW -- MARKSCHEME

1.	D	**5.**	C	**9.**	A	**13.**	B	**17.**	C
2.	B	**6.**	C	**10.**	B	**14.**	C	**18.**	A
3.	B	**7.**	C	**11.**	C	**15.**	B	**19.**	B
4.	D	**8.**	B	**12.**	D	**16.**	D	**20.**	C

21. (a) 11 m s^{-2}; 1

(b) $\Delta v = 236$;

$a = \left(\frac{236}{8} =\right) 29.5 (\text{m s}^{-2})$;

$(F = 1.1 \times 10^4 \times 29.5) = 3.2 \times 10^5$N; 3

*Award **[2 max]** for omission of initial speed* (*answer is 390 kN).*

(c) phase 1 distance 88 m / phase 2 distance 1296 m;
total 1400 m; 2

Watch for significant figure penalty in this question (1384 m).

*Award **[1 max]** for* $\frac{1}{2}at^2$ *substituted correctly for first phase, if no distances evaluated and answer incorrect.*

*Award **[1 max]** for correct addition of incorrect phase 1 and/or 2 distance*(*s).*

22. (a) attempt to equate gpe and ke;

$v = \sqrt{9.8 \times 6.0 \times 2}$; 2

11 m s^{-1}

*Award **[0]** for use of* $v^2 = 2as$. *Allow use of g = 10 N* kg^1

(b) $F = \frac{m\Delta v}{\Delta t}$;

40 N ; 2

(c) (i) ball accelerates towards centre of circular path / *OWTTE*;
therefore force towards centre / upwards;
that adds to tension; 3

(ii) $F = \left(\frac{mv^2}{r} = \frac{0.55 \times 11^2}{7.5} =\right) 8.9$ N;

weight = ($mg = 0.55 \times 0.98$) = 5.4N;
total = 14N; 3

Allow use of g = 10 N kg^{-1}.

23. Mechanical power

(a) the rate of working / work ÷ time; 1

If equation is given, then symbols must be defined.

(b) $P = \frac{W}{t} = \frac{F \times d}{t}$;

$v = \frac{d}{t}$ therefore, $P = Fv$; 2

(c) (i) $t = \frac{d}{v}$;

$= \frac{4800}{16} = 300\,\text{s}$; 2

(ii) $W = mgh = 1.2 \times 10^4 \times 300 = 3.6 \times 10^6\,\text{J}$; 1

(iii) work done against friction = $4.8 \times 10^3 \times 5.0 \times 10^2$;

total work done = $2.4 \times 10^6 + 3.6 \times 10^6$;

total work done = $P \times t = 6.0 \times 10^6$;

to give $P = \frac{6.0 \times 10^6}{300} = 20\,\text{kW}$; 4

(d) (i) $\sin\theta = \frac{0.30}{6.4} = 0.047$;

weight down the plane = $W \sin\theta = 1.2 \times 10^4 \times 0.047 = 5.6 \times 10^2$ N;

net force on car $F = 5.6 \times 10^2 - 5.0 \times 10^2 = 60$ N;

$a = \frac{F}{m}$;

$\frac{60}{1.2 \times 10^3} = 5.0 \times 10^{-2}\ \text{m s}^{-2}$; 5

(ii) $v^2 = 2as = 2 \times 5.0 \times 10^{-2} \times 6.4 \times 10^3$;

to give $v = 25\ \text{m s}^{-1}$; 2

(e) 5.6×10^2 N; 1

24. (a) equation is for constant acceleration;
force varies and so acceleration changes; 2

(b) (i) average force = 2100 N;

acceleration = $\left(\frac{2100}{0.0320} =\right)$ $= 6.6 \times 10^4\ \text{m s}^{-2}$ 2

(ii) uses area under the line;
1 square is equivalent to 0.125Ns;
area is 68 → 72 squares;
(to give momentum change 8.5 → 9.0Ns) 3

(c) (i) use of $\Delta p = m\Delta v$;

$v = \left(\frac{8.8}{0.032} =\right)$ $280\ \text{m s}^{-1}$; 2

Allow value for momentum change from (b)(ii).

(ii) use of power = $\frac{\text{change in kinetic energy}}{\text{time taken}}$;

change in kinetic energy = $\frac{1}{2} \times 0.032 \times 280^2$;

$\left(\frac{1300}{5\times10^{-3}}\right)$ = power = 0.26 MW; 3

or

use of $E = \frac{p^2}{2m}$;

$\frac{8.8^2}{2\times0.032}$;

power = 0.24 MW;

*Award **[0]** for solution from P = Fv.*

(d) N3 states that action and reaction are equal and opposite;
so force on gun and force on bullet are action and reaction pair;
so force on gun is opposite direction to bullet/backwards; 3