Question number			Answer	Notes	Marks
3	(a)	(i)	B – consumption of alcohol by the driver; A is incorrect because condition of tyres only affects braking distance C is incorrect because mass of vehicle only affects braking distance D is incorrect because wet road only affects braking distance		1
		(ii)	D – speed of the vehicle; A is incorrect because condition of brakes only affects braking distance B is incorrect because condition of road only affects braking distance C is incorrect because mass of vehicle only affects braking distance		1
	(b)	(i)	work done = force × distance;	allow correct rearrangements allow standard symbols i.e. W/E/WD for work done, F/f for force, d/D/s for distance	1
		(ii)	substitution; rearrangement; evaluation; e.g. 590000 = 46000 × distance d = 590000/46000 d = 13 (m)	allow subs and re-arrange in either order allow 12.8 (m), 12.83 (m) etc	3
	(c)	(i)	thermal;		1
		(ii)	mechanic(ally);		1

Total for Question 3 = 8 marks

Question number	Answer	Notes	Marks
5 (a)	substitution into given equation $v^2 = u^2 + (2 \times a \times s)$; evaluation of v^2; evaluation of v to 3sf or more i.e. 16.1 (m/s); e.g. $v^2 = u^2 + (2 \times a \times s)$ $v^2 = 0^2 + (2 \times 10 \times 13)$ $v^2 = 260$ $v = \sqrt{260} = 16.1$ (m/s)	accept $mgh = 1/2mv^2$ accept use of g = 9.8(1) m/s^2 giving v = 16.0, 15.97 etc.	3
(b)	any FIVE from: MP1 ball has weight; MP2 ball accelerates; MP3 drag increases (while accelerating); MP4 resultant force decreases; MP5 (so) acceleration decreases; MP6 drag = weight / resultant = 0 / forces balanced; MP7 terminal velocity/constant speed /acceleration=0;	allow 'has gravitational force' REJECT 'has gravity' REJECT 'balls slows down' allow 'air resistance' for 'drag'	5

Total for Question 5 = 8 marks

Question number	Answer	Notes	Marks
11 (a)	any THREE from: MP1 walls further apart; MP2 fewer collisions between particles and walls per second/lower frequency of collisions; MP3 means (average) force on walls lower; MP4 lower force means lower pressure for same wall surface area;	reject unqualified 'fewer collisions' accept idea that force per collision is the same ignore references to particles colliding with each other accept	3
(b)	substitution into given equation "$p_1 \times V_1 = p_2 \times V_2$"; rearrangement to give p_2; evaluation of p_2; e.g. $101 \times 110 = p_2 \times 140$ $p_2 = 101 \times 110 / 140$ $p_2 = 79\,000$ (Pa)	allow 79357.1… (Pa), 79(.4) kPa , standard form	3
(c)	any THREE from: MP1 pressure outside balloon is lower than inside balloon; MP2 pressure difference causes a force; MP3 force is outwards on balloon; MP4 force causes extension of balloon;	accept 'stretching'	3

Total for Question 11 = 9 marks

Question number			Answer	Notes	Marks
12	(a)		A – arrangement W; B cannot be correct as arrangement X would give a downwards force C and D cannot be correct because at the position of the wire, the magnetic field is zero, so there cannot be a magnetic force on the wire		1
	(b)	(i)	substitution into "W = mg"; evaluation; e.g. W = 0.0065 × 10 W = 65 (mN)	ignore POT for this mark accept use of g = 9.8(1) m/s^2 giving 63.7 or 63.8 (mN)	2
		(ii)	resultant force is difference between weight and magnetic force; resultant force = 31 mN; substitution in "F=ma"; re-arrangement; evaluation; e.g. resultant force = 65 – 34 = 31 mN resultant force = 31 × 10^{-3} = 6.5 × 10^{-3} × a a = 31 × 10^{-3} / 6.5 × 10^{-3} a = 4.8 (m/s^2)	allow ecf from (b)(i) POT error gives 1 mark penalty 5.2(3) scores 3 MAX (no evidence of resultant idea) allow 4.76(9) (m/s^2) use of g = 9.81 m/s^2 gives 4.57 (m/s^2)	5
		(iii)	EITHER • increase the current; • by increasing the voltage of power supply; OR • increase the magnetic field strength; • by using stronger magnets/moving the poles closer together;	ignore unqualified reference to increasing the turns/creating a coil	2
		(iv)	use a.c. rather than d.c.; since a.c. current has alternating/changing current direction;		2

Total for Question 12 = 12 marks