Mark scheme

Forces and momentum

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

66

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	7	5	6	6	6	7	7	8	9	**66**

Question 1 [5]

1(a)(i)	constant speed/velocity	**B1**
1(a)(ii)	75 N	**B1**
	forwards	**B1**
1(b)	friction	**B1**
	two surfaces rubbing together owtte	**B1**
	Total	**5**

Question 2 [7]

2(a)(i)	(length of spring with 8.0 N load =) 20 (cm)	**B1**
2(a)(ii)	(load for length of 21 cm =) 9.3 (N)	**A2**
	(extension of 7 cm = length of) 21 cm	**(C1)**
2(b)	shape	**B1**
2(c)	(m =) 0.88 (kg)	**A3**
	(m =) 8.6 ÷ 9.8	**(C2)**
	W = mg OR (m =) W ÷ g	**(C1)**

Question 3 [5]

3(a)	(–) 3.5 kgm / s	**A2**
	(Δp =) $m(\Delta)u$ **OR** $m\{v - u\}$ **OR** 0.14 × {25 (– 0)}	C1
3(b)	360 N	**A3**
	0.0097 (s) **OR** 9.7×10^{-3} (s) **OR** 3.6×10^{n}	C1
	(F =) (Δ)p / t **OR** 3.5 / 0.0097	C1

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Question 4 [6]

4(a)	50 000 N / m **OR** 5.0 × 10^4 N / m	**A2**
	(k =) $F \div x$ **OR** k is (determined from) the gradient (of the line in Fig. 1.1)	C1
4(b)	Any one from: • The graph is a straight line (through the origin) • The slope / gradient is constant • The graph / line does not curve	**B1**
4(c)	1300 N	**B1**
	any negative number **OR** indication that force is in opposite direction	**B1**
4(d)	(Force is a) vector quantity. Forces have (both magnitude / size and) direction	**B1**

Question 5 [6]

5(a)	momentum before collision = momentum after collision	**B1**
	(initial momentum (p) =) 800 × 2 OR 1600 (kg m / s)	**B1**
	(v =) (1600 – 1300) / 800 OR 300 / 800 OR 0.38 (m / s)	**B1**
5(b)(i)	(impulse =) change in momentum	**C1**
	1300 Ns	**A1**
5(b)(ii)	same value as **(b)(i)** OR 1300 (Ns)	**B1**

Question 6 [6]

6(a)	(Impulse =) force × time (for which force acts)	**B1**
6(b)(i)	$F\Delta t = \Delta\{mv\}$ **OR** (F =) $\Delta\{mv\} / \Delta t$ **OR** (F =) $\Delta p / t$	**M1**
	{2800 × 1400} (/ 1) = 3 920 000 N **OR** {2800 × 1400} (/ 1) = 3920 kN	**A1**
6(b)(ii)	4.0 × 10^5 kg **OR** 400 000 kg	**A3**
	(at maximum mass) force = weight of rocket **OR** F = mg	(C1)
	(m=) F / g **OR** 3.9 × 10^6 / 9.8 **OR** 4(.0) × 10^N (kg)	(C1)

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Question 7 [7]

7(a)	hang mass / weight on the bottom of the spring	**B1**
	use a ruler / metre rule ***AND*** measure / calculate extension	**B1**
	use of $k = F / x$ to calculate the spring constant ***OR*** k is the gradient of load-extension graph	**B1**
	any **one** of: • repeat measurements using different masses / weights and plot a load against extension graph • measure final length and initial length of spring and subtract to obtain (magnitude of) extension / change in length • use a pointer on the bottom of spring to obtain more accurate measurements on ruler	**B1**
7(b)(i)	maximum load that can be applied when the extension is proportional to load ***OR*** the maximum force up to which the extension is proportional to the load	**B1**
7(b)(ii)	(extension of spring Q =) 15 cm or 0.15 m ***AND*** (extension of spring R =) 110 cm or 1.1 m	**B1**
7(b)(iii)	Q ***AND*** extension produced by Q is the right length to allow baby to just reach the floor with feet ***OR*** Q ***AND*** extension produced by R is too big (for gentle bounces in the space provided) ***OR*** R would make the baby collapse on floor (so unsafe) ***OR*** bouncer would have to be hung higher if R was used	**A1**

Question 8 [7]

8(a)	(statement momentum is) zero / 0 **AND** (explanation) momentum is mass × velocity **OR** the velocity (of B) is zero	**B1**
8(b)	1.1 kg	**A3**
	Conservation of momentum **OR** momentum after (collision) = momentum before (collision) **OR** {0.75 × 0.44} = {0.75 + m} × 0.18	C1
	momentum before collision = 0.75 × 0.44 (+ m ×0 = 0.33) **OR** momentum after collision = (0.75 + m) × 0.18	C1
8(c)(i)	0.13 N	**A2**
	$(F =) \Delta p \div (\Delta)t$ **OR** (0.75 + 1.1) × 0.18 ÷ 2.6 **OR** (F =) 0.33 ÷ 2.6 $(F =)\{0.75 + \mathbf{2(b)}\} \times 0.18 \div 2.6$	C1
8(c)(ii)	(time taken) Increases **AND** use of $F(\Delta)t = \Delta\{mv\}$ **OR** $F \propto 1 / (\Delta)t$ **OR** same momentum change required	**B1**

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Question 9 [8]

9(a)(i)	7400 N	**A3**
	$a = \Delta v / \Delta t$ **OR** $a = \{22 - 13\} / 4.5$ **OR** 2.0 (m / s^2) SEEN	C1
	(F =) ma **OR** 3700 × 2.0	C1
9(a)(ii)	air resistance **OR** drag	**B1**
	friction (between tyres and road)	**B1**
9(b)(i)	arrow from car pointing towards the centre of the circle	**B1**
9(b)(ii)	any **two** from: • car has higher speed • less friction (between car and track) **OR** not enough friction • larger mass	**B2**

Question 10 [9]

10(a)	(F = 2.0 × 4.0 =) 8.0 N	**A2**
	(F =) ma in any form	C1
10(b)	(F = 30 – 12 =) 18 N	**A3**
	resultant force on 3 kg mass (3 × 4 =) 12 (N)	C1
	(weight of 3 kg mass = 3 × 10) = 30 (N)	C1
10(c)(i)	(Δv =) 4.0 × 0.80 (= 3.2 m / s)	**A2**
	(Δ)v = at in any form	C1
10(c)(ii)	(t = 0.020 / 3.2 =) 0.0063 s OR 6.3 × 10^{-3} s	**A2**
	(t =) d / v in any form	C1

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