CAMBRIDGE INTERNATIONAL AS & A LEVEL PHYSICS · 9702

PHYSICS



MARK SCHEME

1 PHYSICAL QUANTITIES AND UNITS

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Paper 1 Multiple Choice Answers: Physical Quantities and Units

Question	Paper	Q. No.	Answer
1	9702_m20_qp_12	1	C
2	9702_s20_qp_11	1	C
3	9702_s20_qp_12	1	D
4	9702_s20_qp_13	1	C
5	9702_s19_qp_13	4	B
6	9702_w19_qp_11	1	D
7	9702_w19_qp_12	1	D
8	9702_s18_qp_11	1	A
9	9702_s18_qp_12	1	C
10	9702_s18_qp_13	1	B
11	9702_w18_qp_11	1	D
12	9702_w18_qp_12	1	A
13	9702_w18_qp_13	1	C
14	9702_m17_qp_12	2	B
15	9702_s17_qp_11	1	D
16	9702_s17_qp_12	1	B
17	9702_s17_qp_13	1	B
18	9702_s16_qp_11	3	C
19	9702_s16_qp_12	1	C
20	9702_w16_qp_11	1	D
21	9702_w16_qp_13	1	D
22	9702_m20_qp_12	2	D
23	9702_s20_qp_11	2	B
24	9702_s20_qp_13	2	C
25	9702_m19_qp_12	2	B
26	9702_s19_qp_11	1	A
27	9702_s19_qp_11	2	C
28	9702_s19_qp_12	1	B
29	9702_s19_qp_12	2	D
30	9702_s19_qp_12	3	A
31	9702_s19_qp_13	1	C
32	9702_s19_qp_13	2	D
33	9702_w19_qp_11	2	A
34	9702_w19_qp_12	2	A
35	9702_w19_qp_13	1	C
36	9702_w19_qp_13	2	D
37	9702_m18_qp_12	1	B
38	9702_m18_qp_12	2	B
39	9702_s18_qp_12	2	B
40	9702_w18_qp_11	2	D
41	9702_w18_qp_12	2	B
42	9702_w18_qp_13	2	C
43	9702_m17_qp_12	1	C
44	9702_s17_qp_12	3	D
45	9702_s17_qp_13	3	D
46	9702_w17_qp_11	1	C

Paper 1 Multiple Choice Answers: Physical Quantities and Units (contin

Question	Paper	Q. No.	Answer
47	9702_w17_qp_12	1	D
48	9702_w17_qp_12	3	C
49	9702_w17_qp_13	1	C
50	9702_w17_qp_13	2	C
51	9702_m16_qp_12	1	C
52	9702_m16_qp_12	3	C
53	9702_s16_qp_11	2	C
54	9702_s16_qp_12	2	C
55	9702_s16_qp_13	1	D
56	9702_s16_qp_13	2	B
57	9702_w16_qp_11	2	B
58	9702_w16_qp_12	1	B
59	9702_w16_qp_12	2	D
60	9702_w16_qp_13	2	B
61	9702_s15_qp_11	1	C
62	9702_s15_qp_11	3	A
63	9702_s15_qp_12	1	C
64	9702_s15_qp_12	2	D
65	9702_s15_qp_13	1	C
66	9702_s15_qp_13	2	D
67	9702_m20_qp_12	3	D
68	9702_s20_qp_11	3	B
69	9702_s20_qp_12	2	C
70	9702_s20_qp_13	3	A
71	9702_s19_qp_12	4	C
72	9702_s19_qp_13	3	C
73	9702_w19_qp_11	3	A
74	9702_w19_qp_12	3	B
75	9702_w19_qp_13	3	C
76	9702_m18_qp_12	3	D
77	9702_m18_qp_12	5	B
78	9702_s18_qp_11	2	C
79	9702_s18_qp_11	3	C
80	9702_s18_qp_13	2	B
81	9702_s18_qp_13	3	A
82	9702_w18_qp_11	3	B
83	9702_w18_qp_12	3	B
84	9702_w18_qp_12	4	A
85	9702_w18_qp_13	3	C
86	9702_m17_qp_12	3	D
87	9702_s17_qp_11	2	D
88	9702_s17_qp_12	2	A
89	9702_s17_qp_13	2	B
90	9702_w17_qp_11	2	B
91	9702_w17_qp_11	6	C
92	9702_w17_qp_12	2	A

Paper 1 Multiple Choice Answers: Physical Quantities and Units (contin

Question	Paper	Q. No.	Answer
93	9702_w17_qp_13	3	A
94	9702_m16_qp_12	2	D
95	9702_s16_qp_11	1	B
96	9702_s16_qp_12	3	A
97	9702_s16_qp_13	3	C
98	9702_w16_qp_11	3	A
99	9702_w16_qp_12	3	D
100	9702_w16_qp_13	3	A
101	9702_s15_qp_11	2	B
102	9702_s15_qp_12	4	C
103	9702_s15_qp_13	3	D

Answers

1. 9702_m19_qp_22 Q: 1

	Answer	Mark
(a)	kilogram / kg	B1
	kelvin / K	B1
(b)	units for v: m s^{-1} and units for F: kg m s^{-2}	C1
	units for e: A s	C1
	units for μ: m s^{-1} A s / kg m s^{-2} = A kg^{-1} s^{2}	A1

2. 9702_s18_qp_22 Q: 1

	Answer	Mark
(a)	rate of change of momentum	B1
(b)	kg m s^{-2}	A1
(c)	units for Q: A s **and** for r: m	C1
	units for ε = (A s × A s)/(kg m s^{-2} × m^{2}) = A^{2} kg^{-1} m^{-3} s^{4}	A1

3. 9702_w17_qp_23 Q: 1

	Answer	Mark
(a)(i)	work (done) / time (taken) **or** energy (transferred) / time (taken)	B1
(a)(ii)	Correct substitution of base units of all quantities into any correct equation for power. Examples: ($P = E / t$ or W / t gives) kg m^{2} s^{-2} / s = kg m^{2} s^{-3} ($P = Fs / t$ or mgh / t gives) kg m s^{-2} m / s = kg m^{2} s^{-3} ($P = ½mv^{2} / t$ gives) kg (m s^{-1})^{2} / s = kg m^{2} s^{-3} ($P = Fv$ gives) kg m s^{-2} m s^{-1} = kg m^{2} s^{-3} ($P = VI$ gives) kg m^{2} s^{-2} A^{-1} s^{-1} A = kg m^{2} s^{-3}	A1
(b)(i)	units of A: m^{2} **and** units of T: K	C1
	units of k: kg m^{2} s^{-3} / m^{2} K^{4} = kg s^{-3} K^{-4}	A1
(b)(ii)	curve from the origin with increasing gradient	B1

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4. 9702_s15_qp_21 Q: 1

(a) power = work / time or energy / time or (force × distance) / time — B1

= $kg\,m\,s^{-2} \times m\,s^{-1} = kg\,m^2\,s^{-3}$ — A1 [2]

(b) power = VI [or V^2/R **and** $V = IR$ or I^2R **and** $V = IR$] — B1

(units of V:) $kg\,m^2\,s^{-3}\,A^{-1}$ — B1 [2]

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5. 9702_w15_qp_23 Q: 1

(a) energy or W: $kg\,m^2\,s^{-2}$
or
power or P: $kg\,m^2\,s^{-3}$ — M1

intensity or I: $kg\,m^2\,s^{-2}\,m^{-2}\,s^{-1}$ (from use of energy expression)
or
$kg\,m^2\,s^{-3}\,m^{-2}$ (from use of power expression)

indication of simplification to $kg\,s^{-3}$ — A1 [2]

(b) **(i)** ρ: $kg\,m^{-3}$, c: $m\,s^{-1}$, f: s^{-1}, x_0: m — M1

substitution of terms in an appropriate equation and simplification to show K has no units — A1 [2]

(ii) $I = 20 \times 1.2 \times 330 \times (260)^2 \times (0.24 \times 10^{-9})^2$ — C1

$= 3.1 \times 10^{-11}\ (W\,m^{-2})$ — C1

$= 31\ (30.8)\,pW\,m^{-2}$ — A1 [3]

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6. 9702_w19_qp_22 Q: 1

	Answer	Mark
(a)	scalar quantity has (only) magnitude	**B1**
	vector quantity has magnitude and direction	**B1**
(b)(i)	$E = F / Q$	**C1**
	$= kg\,m\,s^{-2} / A\,s = kg\,m\,A^{-1}\,s^{-3}$	**A1**
(b)(ii)	$b = Q / x^2 E$ $= A\,s / m^2\,kg\,m\,A^{-1}\,s^{-3}$	**C1**
	$= A^2\,s^4\,kg^{-1}\,m^{-3}$	**A1**

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7. 9702_s18_qp_21 Q: 1

	Answer	Mark
(a)	a scalar has magnitude (only)	B1
	a vector has magnitude and direction	B1
(b)	power: scalar temperature: scalar momentum: vector *(two correct 1 mark, all three correct 2 marks)*	B2
(c)(i)	arrow labelled R in a direction from 5° to 20° north of west	B1
(c)(ii)	$v^2 = 28^2 + 95^2 - (2 \times 28 \times 95 \times \cos 115°)$ **or** $v^2 = [(95 + 28\cos 65°)^2 + (28\sin 65°)^2]$	C1
	$v = 110\ \text{ms}^{-1}$ (109.8 ms^{-1})	A1
	or (scale diagram method)	
	triangle of velocities drawn	(C1)
	$v = 110\ \text{m s}^{-1}$ (allow 108–112 m s^{-1})	(A1)

8. 9702_s17_qp_23 Q: 1

	Answer	Mark
(a)(i)	$R = 7(.0)$ N	B1
(a)(ii)	$R = 13$ N	B1
(b)(i)	forces resolved: 18 sin 65° (vertical) **and** 55 + 18 cos 65° (horizontal) **or** scale drawing: correct triangle drawn for forces	B1
	$F = [(18 \sin 65°)^2 + (55 + 18 \cos 65°)^2]^{1/2} = 65\ (64.7)$ N **or** scale drawing: scale given, length of resultant given correctly, ± 1 N	A1
(b)(ii)	angle = $\tan^{-1}[18 \sin 65° / (55 + 18 \cos 65°)] = \tan^{-1}(16.3 / 62.6)$ **or** scale drawing: correct angle measured/direction correct on diagram below the 55 N force	C1
	angle = 15 (14.6)° (below the 55 N force) **or** scale drawing: angle = 15° ± 1°	A1
(c)	(resultant) force = mass × acceleration	C1
	$80 - 65 = 2.7a$	C1
	$a = 5.6\ \text{m s}^{-2}$ [5.7 if 64.7 N used from **(i)**]	A1

9. 9702_s16_qp_23 Q: 1

(a)	scalars: energy, power and time	A1	
	vectors: momentum and weight	A1	[2]
(b) **(i)**	triangle with right angles between 120 m and 80 m, arrows in correct direction and result displacement from start to finish arrow in correct direction and labelled R	B1	[1]
(ii) **1.**	average speed (= 200 / 27) = 7.4 $m s^{-1}$	A1	[1]
2.	resultant displacement (= $[120^2 + 80^2]^{1/2}$) = 144 (m)	C1	
	average velocity (= 144 / 27) = 5.3(3) $m s^{-1}$	A1	
	direction (= $\tan^{-1} 80/120$) = 34° (33.7)	A1	[3]

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10. 9702_w15_qp_22 Q: 1

(a)	$v = f\lambda$	C1	
	$\lambda = (3.0 \times 10^8)/(4.6 \times 10^{20})$	C1	
	$(= 6.52 \times 10^{-13} =)$ 0.65(2) pm	A1	[3]
(b)	$t = (8.5 \times 10^{16})/(3.0 \times 10^8)$	C1	
	$(= 2.83 \times 10^8 =)$ 0.28(3) Gs	A1	[2]
(c)	mass, power and temperature all underlined and no others	B1	[1]
(d) **(i)**	arrow in the direction 30° to 40° south of east	B1	[1]
(ii)	triangle of velocities completed (i.e. correct scale diagram) or correct working given e.g. $[14^2 + 8.0^2 - 2(14)(8.0) \cos 60°]^{1/2}$ **or** $[(14 - 8.0 \cos 60°)^2 + (8.0 \sin 60°)^2]^{1/2}$	C1	
	resultant velocity = 12(.2) (or 12.0 to 12.4 from scale diagram) $m s^{-1}$	A1	[2]

Physical Quantities and Units

Q.No	Answers
1	**B**
2	**B**
3	**A**
4	**B**
5	**B**
6	**B**
7	**C**
8	**A**
9	**C**
10	**B**
11	**A**
12	**A**
13	**C**
14	**C**
15	**C**
16	**D**
17	**B**
18	**C**
19	**C**
20	**B**
21	**C**
22	**D**
23	**B**
24	**D**
25	**D**
26	**B**
27	**D**
28	**A**
29	**C**
30	**D**
31	**A**
32	**D**
33	**C**
34	**A**
35	**B**
36	**C**
37	**C**
38	**B**
39	**A**
40	**C**
41	**D**
42	**C**
43	**A**
44	**C**
45	**C**
46	**B**
47	**D**
48	**D**
49	**A**
50	**A**
51	**B**
52	**D**
53	**A**
54	**C**
55	**B**
56	**C**
57	**A**
58	**B**
59	**A**
60	**B**
61	**C**
62	**C**
63	**C**
64	**C**
65	**B**
66	**A**
67	**C**
68	**C**
69	**C**
70	**B**
71	**D**
72	**C**
73	**B**
74	**C**
75	**D**
76	**D**
77	**C**
78	**D**
79	**A**
80	**C**
81	**D**
82	**C**
83	**D**
84	**D**
85	**C**
86	**A**
87	**D**
88	**B**
89	**C**
90	**D**
91	**B**
92	**A**
93	**B**
94	**C**
95	**B**
96	**B**
97	**D**
98	**B**
99	**C**
100	**D**
101	**C**
102	**B**
103	**A**
104	**B**
105	**B**
106	**A**
107	**C**
108	**A**
109	**C**
110	**B**
111	**B**
112	**D**
113	**A**
114	**D**
115	**B**
116	**D**
117	**C**
118	**A**
119	**B**
120	**A**
121	**B**
122	**C**
123	**D**
124	**A**
125	**A**
126	**C**
127	**C**
128	**C**
129	**D**
130	**A**
131	**C**
132	**D**
133	**C**
134	**B**
135	**A**