SCOTTISH QUALIFICATIONS AUTHORITY

2003 Physics

Intermediate 2

Finalised Marking Instructions

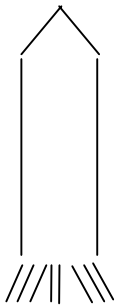
2003 Physics Intermediate 2

Marking scheme

Section A

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

Sample Answer and Mark Allocation	Notes	Marks	
21. (a) $E_p = mgh$ **(½)** $E_p = 1400 \times 10 \times 30$ **(½)** $E_p = 420\,000$ J **(½) (½)**	Allow $g = 9{\cdot}8$ N/kg	**2**	**7**
(b) (i) $a = \frac{v-u}{t}$ **(½)** $a = \frac{20-0}{5}$ **(½)** $a = 4$ m/s^2 **(½) (½)**		**2**	
(ii) d = area under graph **(½)** $d = (½ \times 5 \times 20) + (½ \times 3 \times 20)$ **(½)** $d = 80$ m **(½) (½)** **OR** $d = \bar{v}t$ **(½)** $d = 10 \times 8$ **(½)** $d = 80$ m **(½) (½)**		**2**	
(iii) Less friction **(1)** **OR** Less resistive force **OR** Smaller unbalanced force		**1**	

Sample Answer and Mark Allocation	Notes	Marks	
22. (a) (i) $W = mg$ **(½)** $W = 2{\cdot}5 \times 10^6 \times 8{\cdot}4$ **(½)** $W = 2{\cdot}1 \times 10^7$ N **(½) (½)**		**2**	**9**
(ii)  Engine force **OR** thrust **(1)** Weight **OR** gravity force **(1)**	• Two upward forces or two downwards forces loses 1 mark • Name of force must match its direction	**2**	
(iii) $F = 3{\cdot}8 \times 10^7 - 2{\cdot}1 \times 10^7 = 1{\cdot}7 \times 10^7$(N) **(1)** $F = ma$ **(½)** $1{\cdot}7 \times 10^7 = 2{\cdot}5 \times 10^6 \times a$ **(½)** $a = 6{\cdot}8$ m/s^2 **(½) (½)**		**3**	
(b) Acceleration on Y is less **(1)** Smaller unbalanced force **(1)** **OR** greater weight **OR** because of air resistance **OR** greater gravitational field strength		**2**	

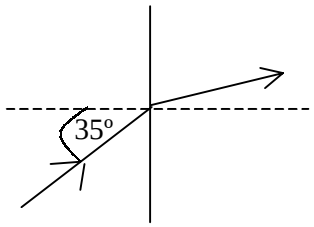
Sample Answer and Mark Allocation			Notes	Marks	
23. (a) (i)	$d = vt$	**(½)**			**9**
	$0{\cdot}1 = v$ x $0{\cdot}05$	**(½)**			
	v = 2 m/s	**(½) (½)**		**2**	
(ii)	momentum before = $1{\cdot}6\ v$	**(½)**			
	momentum after = $2{\cdot}6$ x 2	(½)			
	$1{\cdot}6\ v = 5{\cdot}2$				
	$v = 3{\cdot}25$ m/s	**(½) (½)**		**2**	
(b) (i)	$E_k = ½\ mv^2$	**(½)**			
	$= 0{\cdot}5$ x $2{\cdot}6$ x 4^2	**(½)**			
	= 20·8 J	**(½) (½)**		**2**	
(ii)	$E_k = Fd$	**(½)**			
	$20{\cdot}8 = 2{\cdot}6$ x d	**(½)**			
	d = 8 m	**(½) (½)**		**2**	
(c)	So that the speed is measured before it changes **OR** because there will be friction **OR** before friction slows it down **OR** before friction affects it **OR** before cars slow down **OR** to get the fastest speed	**(1)**		**1**	

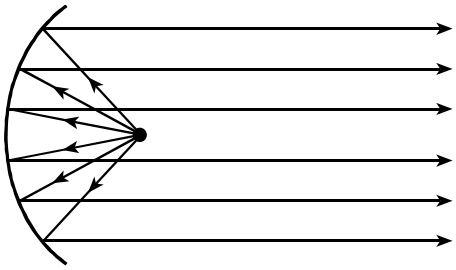
Sample Answer and Mark Allocation	Notes	Marks	
24. (a) $P = \frac{V^2}{R}$ **(½) OR** $P = IV$ $11{\cdot}5 = I$ x 23 $I = 0{\cdot}5$A **(1)** $11{\cdot}5 = \frac{23^2}{R}$ **(½)** $V = IR$ $23 = 0{\cdot}5$ x R $R = 46\ \Omega$ **(1)** $R = 46\ \Omega$ **(½) (½)**	Can start with 46 Ω and proceed to 11·5 W	**2**	**9**
(b) (i) $\frac{230}{10}$ **(½)** = 23 V **(½)**		**1**	
(ii) If one lamp breaks, the others go out **(1)** **OR** non independent switching		**1**	
(c) (i) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots\ldots\ldots$ **(½)** $\frac{1}{R_T} = \frac{1}{46} + \frac{1}{46} + \ldots\ldots\ldots$ **(½)** $\frac{1}{R_T} = \frac{10}{46}$ $R_T = 4{\cdot}6\ \Omega$ **(½) (½)**		**2**	
(ii) (A) Turns ratio = 10 : 1 **(1)** $\frac{V}{230} = \frac{1}{10}$ **(½)** $V = 23$V **(½)**		**2**	
(B) All bulbs in parallel have <u>23V</u> across them so they operate at normal brightness **(1)**		**1**	

Sample Answer and Mark Allocation			Notes	Marks	
25.	(a)	$V = IR$ $0{\cdot}8 = 0{\cdot}005 \times R$ $R = 160\ \Omega$ **(1)** $V = IR$ $1{\cdot}6 = 0{\cdot}02 \times R$ $R = 80\ \Omega$ **(1)** As voltage increases R decreases **(1)**	Any two points on the graph correctly used	**3**	**7**
	(b)	(i) 1·6 V **(1)**		**1**	
		(ii) Voltage across R = 3·4 V **(1)** $V = IR$ **(½)** $3{\cdot}4 = 0{\cdot}02 \times R$ **(½)** $R = 170\ \Omega$ **(½) (½)**	Voltage used must be 5 – b (i) answer. Any other voltage is wrong physics ½ maximum	**3**	

Sample Answer and Mark Allocation					Notes	Marks	
26.	(a)	(i)	$E_H = \ell m$ $E_H = 3{\cdot}34 \times 10^5 \times 0{\cdot}05$ $E_H = 16\ 700$ J	**(½)** **(½)** **(½) (½)**		**2**	**8**
		(ii)	$E = Pt$ $16700 = P \times 300$ $P = 55{\cdot}7$ W	**(½)** **(½)** **(½) (½)**		**2**	
	(b)	(i)	Transistor	**(1)**	Not MOSFET	**1**	
		(ii)	Resistance increases	**(1)**		**1**	
		(iii)	Voltage across thermistor rises above 0·7 V Transistor switches on current passes through warning light	**(½)** **(½)** **(½)** **(½)**		**2**	

Sample Answer and Mark Allocation					Notes	Marks	
27.	(a)	(i)	Protons + neutrons	**(1) or (0)**		**1**	**6**
		(ii)	Fission (NOT chain reaction)	**(1)**		**1**	
		(iii)	Uranium or fuel is used up	**(1)**		**1**	
		(iv)	Radioactive waste **OR** they are radioactive **OR** they give out radiation	**(1)**		**1**	
	(b)		$E_H = c\ m \Delta T$ $166 \times 10^6 = 830 \times 2000 \times \Delta T$ $\Delta T = 100^oC$	**(½)** **(½)** **(½) (½)**		**2**	

Sample Answer and Mark Allocation	Notes	Marks	
28. (a) (i) 35^o **(1)** ½ unit deduction		**1**	**7**
(ii)  any smaller angle **(1)** But not 0^o		**1**	
(b) B **(½)** C **(½)** Angle of incidence must be smaller than the critical angle **(1)**	If A mentioned then zero marks	**2**	
(c) (i) Diverging **OR** concave **(1)**		**1**	
(ii) $P = \frac{1}{f}$ **(½)** $P = \frac{1}{-0 \cdot 2}$ **(½)** $P = -5\,\text{D}$ **(½)** Choose lens Q **(½)**	no unit deduction unless wrong unit	**2**	

Sample Answer and Mark Allocation					Notes	Marks	
29.	(a)	(i)	Solar cell	**(1)**	Not solar panel	**1**	**9**
		(ii)	$Q = I\,t$ $Q = 4{\cdot}5 \times 300$ $Q = 1350$ C	**(½)** **(½)** **(½) (½)**		**2**	
	(b)	 Shape **(1)** Arrows **(1)**				**2**	
	(c)	P	X rays	**(½)**		**1**	
		Q	Infrared	**(½)**			
	(d)	Correct frequency = 8×10^9 Hz $v = f\,\lambda$ $3 \times 10^8 = 8 \times 10^9 \times \lambda$ $\lambda = 3{\cdot}75 \times 10^{-2}$ m		**(1)** **(½)** **(½)** **(½) (½)**		**3**	

Sample Answer and Mark Allocation	Notes	Marks	
30. (a) (i) The number of decays per second **(1)** **OR** radioactive emissions per second **OR** disintegrations per second **OR** nuclei which break up per second		**1**	**9**
(ii) 20000 10000 halfing **(½)** 5000 4 half lives **(½)** 2500 1250 activity = 1250 Bq **(½) (½)**		**2**	
(b) gamma **(1)** <u>beta</u> absorbed by aluminium **(1)**		**2**	
(c) (i) $D = \frac{E}{m}$ **(½)** $5 \times 10^{-5} = \frac{E}{0 \cdot 5}$ **(½)** $E = 2 \cdot 5 \times 10^{-5}$ J **(½) (½)**		**2**	
(ii) $H = DQ$ **(½)** $H = 5 \times 10^{-5} \times 20$ **(½)** $H = 1 \times 10^{-3}$ Sv **(½) (½)**	More than one radiation used gives ½ only	**2**	

[END OF MARKING INSTRUCTIONS]