SCOTTISH QUALIFICATIONS AUTHORITY

2002 Physics
Intermediate 2
Section A and B
Detailed Marking Instructions

Strictly Confidential

These instructions are **strictly confidential** and, in common with the scripts entrusted to you for marking, they must never form the subject of remark of any kind, except to Scottish Qualifications Authority. Finalised Marking Instructions will be published on SQA's website in due course.

Markers' Meeting

You should use the time before the meeting to make yourself familiar with the question paper, instructions and any scripts which you have received. Do **not** undertake any final approach to marking until **after** the meeting. Please note any points of difficulty for discussion at the meeting.

Note: These instructions can be considered as final only after the markers' meeting when the full marking team has had an opportunity to discuss and finalise the document in the light of a wider range of candidates' responses.

Marking

The utmost care must be taken when entering and totalling marks. Where appropriate, all summations for totals must be carefully checked and confirmed.

Where a candidate has scored zero marks for any question attempted, "0" should be entered against the answer.

Recording of Marks

The mark for each **question**, where appropriate, should be entered **either** on the grid provided on the back page of the answer book, **or** in the case of question/answer books, on the grid (if provided) on the last page of the book. Where papers assess more than one element, care must be taken to ensure that marks are entered in the correct column.

The **Total** mark for each paper or element should be entered (in red ink) in the box provided in the top-right corner of the front cover of the answer book (or question/answer book).

Always enter the **Total** mark as a **whole number**, where necessary by the process of rounding up.

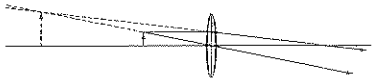
The transcription of marks, within booklets and to the Mark Sheet should always be checked.

Markers are reminded that they must not write comments on scripts.

22 May 2002

Physics Intermediate 2 2001 (contd.)

29. (*a*) (i)



(ii) P = 20 D

(*b*) Difficulty in seeing objects a short distance from the eyes
OR
Eye not powerful enough to focus close objects on retina
OR
Eye focuses close objects behind retina

30. (*a*) $1{\cdot}11 \times 10^{9}$ decays/disintegrations per second

(*b*) $H = 1{\cdot}17 \times 10^{-3}$ Sv or 1·17 mSv

(*c*) To ensure people are kept a safe distance from the source

31. (*a*) (i) To extract the heat energy

(ii) To slow down (fast) neutrons

(*b*) Some of the neutrons bombard other uranium nuclei and cause further fissions or splits. These fissions produce more neutrons and maintain the reaction process.

(*c*) (i) 28 ± 1 year

(ii) 76 ± 2 years

(iii) Any suitable storage method, e.g. underwater, in concrete, underground

Physics Intermediate 2 2002

Section A

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

Section B

21. (*a*) $E_p = 3\,355\,000$ J

(*b*) (i) $E_w = 76\,600\,000$ J

(ii) P = 42 560 W

(*c*) Potential energy lost by descending capsules

22. (*a*) horizontal motion is constant speed
vertical motion is (constant) acceleration
OR Speed increasing
OR Faster
OR Acceleration due to gravity
OR Force of gravity
OR Pull of gravity
OR Weight

22. (contd.)

(*b*) (i) Speed = 8 m/s

(ii) Light gate (at exit of firing device)
diameter of ball measured
time for ball to cut light beam measured

$$\text{speed} = \frac{\text{diameter}}{\text{time}}$$

OR $\text{speed} = \frac{\text{distance}}{\text{time}}$

if distance previously specified

(iii) Distance = 0·313 m

(*c*) v = 11·2 m/s

23. (*a*) $a = 1{\cdot}5 \text{m/s}^2$

(*b*) Friction force = 15 250 N

(*c*) Greater air resistance on bales
OR
Greater air friction on bales
frictional force will reach 15 250 N at lower speed

24. (*a*) $N_s = 200$

(*b*) E = 4500 J

(*c*) $E_H = 4053$ J

(*d*) Heat (energy) lost to surroundings/air/atmosphere/heating element

(*e*) Heat → electrical

25. (*a*) (i) $V_1 = 1{\cdot}8$ V
$V_2 = 1{\cdot}2$ V

(ii) $V_S = 3{\cdot}0$ V

(*b*) R = 3000 Ω

(*c*) Light intensity is decreasing
V_1 is increasing
Resistance (of LDR) is increasing

(*d*) V_2 is below 0·7 V between 20 s and 50 s
transistor is switched off

26. (*a*) I = 0·174 A

(*b*) R = 1323 Ω

(*c*) Position 1
Maximum voltage (across motor)
OR
Maximum current (in motor)
OR
230 V (across motor)
OR
No extra resistance to decrease current

(*d*) R = 200 Ω

27. (*a*) Movement of coil in magnetic field
OR
Movement of coil near magnet
change in direction of coil ⇒ a.c.

(*b*) Greater number of turns in the coil
stronger magnet/magnetic field
OR
more powerful magnet

(*c*) Gain = 250

2002 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
21. (*a*) $E_p = m\,g\,h$ (½) $E_p = 2750 \times 10 \times 122$ (½) $E_p = 3\,355\,000$ J (½) (½)		2
(*b*) (i) $E_w = F\,d$ (½) $E_w = 200\,000 \times 383$ (½) $E_w = 76\,600\,000$ J (½) (½)		2
(ii) $E = P\,t$ (½) $76\,600\,000 = P \times 1800$ (½) $P = 42\,560$ W (½) (½)	43000 W → 42556 W	2
(*c*) potential energy lost **(1)** by descending capsules **(1)**		2
NOTE: If in (*b*)(i) 200 N used this will give in (*b*)(ii) P = 43 W → 42·556 W NOTE: If in (*b*)(ii) 30 used for time this will give P = 2 553 333 W Deduct ½ for arithmetic Deduct for significant figures		**Total 8**

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Sample Answer and Mark Allocation	**Notes**	**Marks**
22. (*a*) horizontal motion is constant speed **(1)** vertical motion is (constant) acceleration **(1)** **OR** speed increasing **OR** faster **OR** acceleration due to gravity **OR** force of gravity **OR** pull of gravity **OR** weight		2
(*b*) (i) 8 m/s **(1) OR (0)**		1
(ii) light gate (at exit of firing device) **(1)** diameter of ball measured **(½)** time for ball to cut light beam measured **(½)** speed = $\frac{\text{diameter}}{\text{time}}$ **(1)** **OR** speed = $\frac{\text{distance}}{\text{time}}$ if distance previously specified		3
(iii) distance = area under graph **(½)** distance = $\frac{1}{2} \times 0{\cdot}25 \times 2{\cdot}5$ **(½)** distance = 0·313 m **(½) (½)**	0·3 m → 0·3125 m	2
(*c*) d = v t **(½)** 2·8 = v × 0·25 **(½)** v = 11·2 m/s **(½) (½)**		2
		Total 10

NOTES:

(*b*)(ii) 2 light gates gives zero marks

(*b*)(ii) If computer used then all inputs to the computer (diameter, time) must be mentioned.

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Sample Answer and Mark Allocation	Notes	Marks
23. (*a*) F = m a (½) 14 250 **(1)** = 9500 × a (½) a = 1·5 m/s^2 (½) (½)		3
(*b*) 15 250 N **(1) OR (0)**		1
(*c*) greater <u>air</u> resistance on bales **(1)** **OR** greater <u>air</u> friction on bales frictional force will reach 15 250 N at lower speed **(1)**		2
		Total 6

NOTES:

(*a*) Any other force value gives maximum formula mark.

(*c*) Accept greater wind resistance.
Do not accept less aerodynamic
less streamlined
But linking less aerodynamic with more friction is ok.

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Sample Answer and Mark Allocation	Notes	Marks
24. (*a*) $\frac{N_s}{N_p} = \frac{V_s}{V_p}$ (½) $\frac{N_s}{1840} = \frac{25}{230}$ (½) $N_s = 200$ (1) **OR** Turns ratio $= \frac{230}{25} = 9{\cdot}2$ (1) $\frac{1840}{9{\cdot}2} = 200$ (1) NOTE: ½ unit deduction for wrong unit.		2
(*b*) $E = P\,t$ (½) $E = 90 \times 50$ (½) $E = 4500\ J$ (½) (½)		2
(*c*) $E_H = c\,m\,\Delta T$ (½) $E_H = 386 \times 0{\cdot}03 \times 350$ (½) $E_H = 4053\ J$ (½) (½)		2
(*d*) heat energy lost **(1) OR** heat lost **OR** energy lost to surroundings **(1) OR** to air **OR** to atmosphere **OR** to heating element		2
(*e*) heat → electrical **(1)**		1
NOTES: (*d*) Do not accept Not 100% efficient (*e*) Do not accept heat → electricity		**Total 9**

2002 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
25. (*a*) (i) $V_1 = 1{\cdot}8\,V$ (½) $V_2 = 1{\cdot}2\,V$ (½)		1
(ii) $V_S = 3{\cdot}0\,V$ **(1)** Must be sum of (a)(i) ½ unit deduction		1
(*b*) $\frac{V_1}{V_2} = \frac{R_1}{R_2}$ (½) **OR** $V = IR$ (½) $1{\cdot}2 = I \times 2000$ $I = 0{\cdot}0006\,A$ (½) $\frac{1{\cdot}8}{1{\cdot}2} = \frac{R_1}{2000}$ (½) $R_1 = 3000\,\Omega$ (½) (½) $V = IR$ $1{\cdot}8 = 0{\cdot}0006 \times R$ $R = 3000\,\Omega$ (½) (½)	**OR** $V_1 = \frac{R_1}{R_2} \times V_s$ $1{\cdot}8 = \left(\frac{R_1}{R+2000}\right) \times 3$ $R_1 = 3000\,\Omega$ **OR** 1·2:2000 1·8:3000	2
(*c*) light intensity is decreasing **(1)** V_1 is increasing **(1)** resistance (of LDR) is increasing **(1)**		3
		2
NOTES : (*c*) Statement of intensity decreasing alone gets zero marks. (*c*) Statement of intensity decreasing followed by wrong explanation gets 1 mark. (*c*) V_1 increases (anywhere in answer) **(1)** $V_1 \uparrow \Rightarrow R \uparrow$ **OR** $V_1 \downarrow \Rightarrow R \downarrow$ **(1)** $R \uparrow \Rightarrow I \downarrow$ **OR** $R \downarrow \Rightarrow I \uparrow$ **(1)**		

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Sample Answer and Mark Allocation	**Notes**	**Marks**
25. (*d*) $\underline{V_2}$ is below 0·7 V between 20 s and 50 s **(1)** transistor is switched off **(1)**	Independent marks	2
		Total 9

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Sample Answer and Mark Allocation	Notes	Marks
26. (*a*) $P = IV$ (½) $40 = I \times 230$ (½) $I = 0{\cdot}174\,A$ (½) (½) $0{\cdot}2 \rightarrow 0{\cdot}1739\,A$		2
(*b*) $V = IR$ (½) **OR** $P = \frac{V^2}{R}$ (½) $230 = 0{\cdot}174 \times R$ (½) $R = 1322{\cdot}5\,\Omega$ (½) (½) $40 = \frac{230^2}{R}$ (½) $R = 1322{\cdot}5\,\Omega$ (½) (½)	**OR** $P = I^2R$ (½) $40 = (0{\cdot}174)^2R$ (½) $R = 1322{\cdot}5\,\Omega$ (½)(½)	2
(*c*) Position 1 **(1)** Maximum voltage (across motor) **(1)** **OR** maximum current (in motor) **OR** 230 V across motor **OR** no extra resistance to decrease current		2
(*d*) Voltage across $R_x = 230 - 180 = 50\,V$ **(1)** $V = IR$ (½) $50 = 0{\cdot}25 \times R$ (½) $R = 200\,\Omega$ (½) (½)		3
NOTES: (*c*) Position 1 (only) = zero marks Position 1 followed by wrong explanation = 1 mark Voltage <u>through</u> motor = zero marks (*d*) Any other voltage than 50 V is wrong physics and gets ½ formula mark only.		**Total 9**

2002 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
27. (*a*) movement of coil in magnetic field **(1)** **OR** movement of coil near magnet change in direction of coil ⇒ a.c. **(1)**		2
(*b*) greater number of turns in the coil **(1)** stronger magnetic field **(1)** **OR** stronger magnet **OR** more powerful magnet Do not accept bigger magnet louder sound bigger diaphragm Accept coils for turns		2
(*c*) voltage gain = $\frac{\text{output(voltage)}}{\text{input (voltage)}}$ **(½)** gain = $\frac{0{\cdot}5}{0{\cdot}002}$ **(½)** gain = 250 **(1)**	deduct ½ mark if unit given	2
		Total 6

2002 Physics Intermediate 2		
Sample Answer and Mark Allocation	**Notes**	**Marks**
28. (*a*) energy lost (on reflection) **(1)** **OR** sound absorbed by air/tube/end		1
(*b*) 6 ms **OR** 0·006 s **(½) (½)**		1
(*c*) d = vt **(½)** d = 340 × 0·006 **(½)** d = 2·04 m **(1)**		
length of the tube = $\frac{d}{2}$ = 1·02 m **(½) (½)**		3
(*d*) v = fλ **(½)** 340 = 1250 × λ **(½)** λ = 0·272 m **(½) (½)**		2
		Total 7

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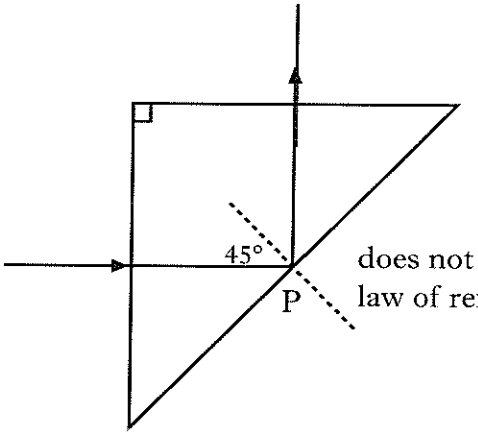
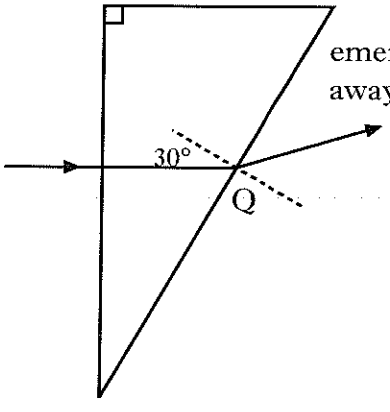
Sample Answer and Mark Allocation	Notes	Marks
29. (*a*)  does not emerge **(1)** law of reflection **(1)**	Ray must cross normal.	2
(*b*)  emerges **(1)** away from normal **(1)**	Ray must cross normal.	2
NOTE: (*b*) Accept partial internal reflection if refraction also shown.		**Total 4**

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Sample Answer and Mark Allocation	Notes	Marks
30. (*a*) No. of decays = activity × time **(½)** $N = 1600 \times 10^6 \times 30$ **(½)** $N = 4{\cdot}8 \times 10^{10}$ **(1)** ½ unit deduction		2
(*b*) R 1600 6 half lives 800 400 48 days **(1)** 200 100 50 25 S 80 1 half life 40 74 days **(1)** Source R will be first **(1)**	Both R and S working must be shown. Idea of halfing gets ½ mark if working incomplete. Graphs acceptable	3
(*c*) gloves any two **(1) (1)** tongs film badge shortest time of exposure etc		2
NOTES: (*b*) Deduct ½ mark if calculation for R only goes as far as 50 MBq (*c*) Accept / Do Not Accept Avoid contact with skin — Goggles Point away from people — Protective clothing (alone) Don't eat/drink — Storage Lead apron/suit — Shielding (alone) Wash hands		**Total 7**

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Sample Answer and Mark Allocation	Notes	Marks
31. (*a*) (i) fission **(1)**	Fussion ✗ Fision ✓	1
(ii) slow neutrons down **(1)**		1
(iii) lower control rods **(1)** **OR** more control rods **OR** drop control rods in		1
(*b*) advantage: no greenhouse gases; conserves fossil fuels; a lot of energy from a little fuel, etc; any one **(1)** disdvantage: radioactive waste; decomissioning stations; etc; any one **(1)**	Pollution answers must be <u>specific</u>	2

NOTES:

(*b*) ADVANTAGE

<u>Accept</u>	<u>Do Not Accept</u>
No smoke	Cleaner
No polluting gases	Cheaper
No SO_2	More efficient
Will last longer	Won't run out

DISADVANTAGE

<u>Accept</u>	<u>Do Not Accept</u>
Reactor accidents	Nuclear weapons
Toxic waste	Dangerous if a leak
Workers exposed to radiation	Produces radioactive sources

Total 5

[END OF MARKING INSTRUCTIONS]