G.C.E. (Advanced Level) Examination - August 2008
PHYSICS - I
Provisional Scheme of Marking

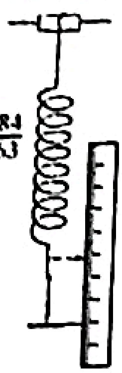
2008 - Answers

Q	1	2	3	4	5
01	X	2	3	4	5
02	1	2	X	4	5
03	1	2	3	X	5
04	1	2	X	4	5
05	1	X	3	4	5
06	1	X	3	4	5
07	1	2	3	X	5
08	X	2	3	4	5
09	X	X	X	X	X
10	1	2	3	4	X
11	1	2	X	4	5
12	1	2	3	X	5
13	X	2	3	4	5
14	1	X	3	4	5
15	X	2	3	4	5
16	1	2	3	4	X
17	1	2	X	4	5
18	1	X	3	4	5
19	1	2	3	4	X
20	X	2	3	4	5
21	1	2	3	4	X
22	1	2	X	4	5
23	1	2	3	X	5
24	1	2	3	4	X
25	1	2	3	X	5
26	1	2	X	4	5
27	1	X	3	4	5
28	1	2	3	4	X
29	1	2	X	4	5
30	1	2	3	X	5
31	X	2	3	4	5
32	1	2	3	4	X
33	1	X	3	4	5
34	1	2	3	X	5
35	1	2	X	4	5
36	1	X	3	4	5
37	1	X	3	4	5
38	1	2	3	4	X
39	1	2	3	X	5
40	X	X	X	X	X
41	1	X	3	4	5
42	1	2	X	X	5
43	1	2	X	4	5
44	1	2	3	X	5
45	1	2	X	4	5
46	1	X	X	4	5
47	X	2	3	4	5
48	1	2	3	X	5
49	1	X	3	4	5
50	1	2	X	4	5
51	1	X	3	4	5
52	X	2	3	4	5
53	1	2	3	X	5
54	1	2	3	X	5
55	1	2	3	X	5
56	X	2	3	4	5
57	1	2	3	4	X
58	1	2	3	X	5
59	1	2	X	4	5
60	1	2	3	X	5

G.C.E. (Advanced Level) Examination - August 2008
PHYSICS - II
Provisional Scheme of Marking

A - PART

01.(a) Rular should be placed just by the side of the pointer. The zero mark or the top edge of the ruler should be just at the pointer. 01



(b) (i) Gradient of the graph $= \frac{(9.3 - 0.9) \times 10^{-2}}{(72 - 9) \times 10^{-3}} = \frac{84}{63}$

$K = \frac{1}{\text{Gradient}}$

$K = \frac{63}{84}$

$K = 0.75\ \text{kgm}^{-1}$ 01

(ii) When indicating two points on the graph:
the lower point should be ≤ 20.0 (M)
(6.0,0.5), (9.0,0.9), (12.0,1.3), (15.0,1.7), (18.0,2.1)

upper point should have one of the following sets of coordinates.
upper point should be ≥ 60 (M)
(60.0,7.7), (63.0,8.1), (66.0,8.5), (69.0,8.9),(72.0,0.93)

(c) (i) $T^2 = 4\pi^2\left(\frac{M + m/3}{kg}\right)$

$T^2 = \left(\frac{4\pi^2}{kg}\right)M + \frac{4\pi^2 m}{kg\,3}$ 01

$y = m\ x + c$

(ii) Stop watch 01

(iii) g : From the gradeint 01
m : From the intercept
OR the gradeint and intarcept
OR the gradeint and a coordinate of a point
- 01

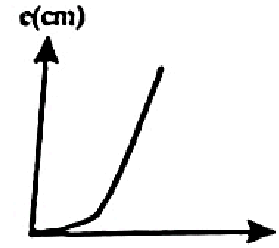
(d) n - the number of vibrations.
T_1 - measured total time
T_1 - nT

$\frac{2\Delta T}{T} = \frac{2 \times 0.1}{n \times 2}$ 01

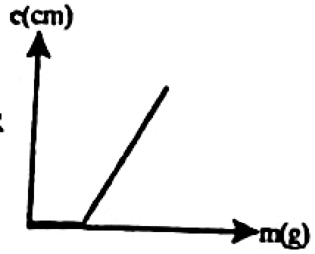
$= 0.01$ (1%)

n = 10 OR (n = 5) 01

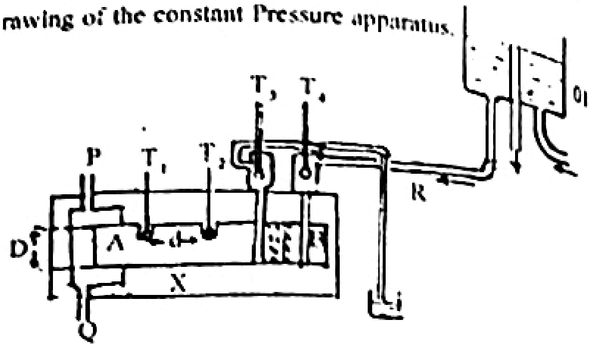
(e)



OR



02.(a) Drawing of the constant Pressure apparatus.



(b) (i) Steam generator
(ii) Eelectroinc /chemical / triple beam / four beam balance
(iii) Stop watch
(iv) Vernier caliper
(v) Meter ruler

All correct 02
Any three 01

(c) (i) In order to make sure that the end (A) of the metel bar reaches 100 °C OR
In order to incrase the contact time between steam and the end (A) OR
To fill the steam containter with steam so that the end (A) of the metel bar reaches 100 °C.

(ii) To avoid the blocking of the steam in the inlet tube OR
The condensed water will leave the outlet Q with out blocking the incoming flow of steam.

Any one 01

(d) By observing that the thermometer readings are steady OR
By observing that the thermometer readings donot change with time
01

(e) By adding mercury into the holes which contain Thermometers. 01

(f) $\frac{Mc(\theta_3 - \theta_4)}{\Delta t} = \frac{KA(\theta_1 - \theta_2)}{d}$

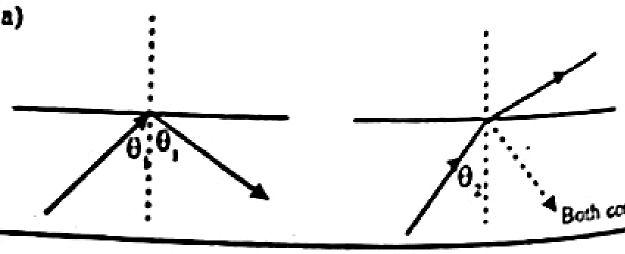
$\frac{400 \times 10^{-3} \times 4200 \times (37 - 28)}{3 \times 60} = \frac{k \times 12 \times 10^{-4} \times (75 - 61)}{8 \times 10^{-2}}$

L.H.S 01
R.H.S 01

$k = 400\ \text{wm}^{-1}\text{k}^{-1}$ 01

(g) Heat loss due to convection is higher from air OR
Heat will be lost due to convection currents. 01

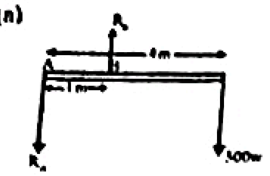
03. (a)



Both correct 01

PART - II

01.(a)



moments about B

G_B $R_A \times 1 - 500 \times 3 = 0$

$R_A = 1500N \downarrow$ (downward) 01

$\uparrow Y = 0$

$R_B - R_A - 500 = 0$

$R_B = R_A + 500$

$R_B = 2000N \uparrow$ (upward) 01

Both directions correct 02

(b) U_x - horizontal component
U_y - Vertical component of the initial velocity.

(i) Applying $\uparrow h = ut + \frac{1}{2}gt^2$

$-4 = u_y 2 - \frac{1}{2} \times 10 \times 4$ 01

$u_y = 8 ms^{-1}$ 01

Applying $\rightarrow S = ut$

$2 = u_x \times 2$

$u_x = 1ms^{-1}$ 01

(ii) Applying $\uparrow$ $v^2 = u^2 + 2as$

$0 = 64 - 2 \times 10 \times h$ 01

$h = 3.2 m$

Maximum height from the water Surface
$= 4 + 3.2m$
$= 7.2 m$ 01

(iii) (1) Kinetic Energy $= \frac{1}{2} mV^2$

$= \frac{1}{2} \times 50 \times 1$

$= 25J$ 01

(2) Potential energy $= mgh$

$= 50 \times 10 \times 7.2$

$= 3600J$ 01

(c) (i) Angular Velocity ω_1 $= 2\pi f$

$= 2 \times 3 \times 0.5 rads^{-1}$

$= 3.0 rads^{-1}$ 01

(ii) Angular Velocity ω_2;

Total period in fully tucked position = 1.0s

$\omega_2 = 2\pi f$

$= 2 \times 3 \times 2$ 01

$= 12 rads^{-1}$ 01

(12.5 - 12.6)

(iii) $I_1\omega_1 = I_2\omega_2$

$20 \times 3.0 = I_2 \times 12$ (or $20 \times 0.5 = I_2 \times 2$)

$I_2 = 5kgm^2$ (4.7 - 5.1)

(iv) Rotational kinetic energy in fully extended position $= \frac{1}{2} I_1\omega_1^2$ 01

$= \frac{1}{2} \times 20 \times 9$

$= 90 J$

(90 - 99) 01

02. (a) Because the ear converts the energy of sound wave into electrical energy. 01

(b) (i) $3000H_z$ 01

(ii) $f = v/\lambda, \lambda = 4l$

$f = \frac{V}{4l}$

$f = \frac{330}{4 \times 2.5 \times 10^{-2}}$ 01

$f = 3300 H2$ 01

(iii) Pressure Variation is maximum at the ear drum.

(A displaccement node - at a closed end) Corresponds fo a Pressure antionode) 01

(C) (i) $I = \frac{P_m^2}{2\upsilon\rho}$

$P_m = \sqrt{2 I \upsilon \rho}$

$P_m = \sqrt{2 \times 10^{-12} \times 330 \times 1.25}$ 01

$P_m = 2.75 \times 10^{-5} Pa$ 01

$(2.7 - 2.9) \times 10^{-5} Pa$

(ii) $F_e = (2.75 \times 10^{-5}) \times 80 \times 10^{-6}$

$F_e = 2.2 \times 10^{-9} N$

$(2.2 - 2.3) \times 10^{-9}N$ 01

(iii) Taking moments, $F_0 = 2 \times (2.2 \times 10^{-9})$ 01

$F_0 = 4.4 \times 10^{-9}N$ 01

$(4.4 - 4.6) \times 10^{-9}N$

(iv) $P_0 = \frac{4.4 \times 10^{-9}}{4 \times 10^{-6}}$

$P_0 = 1.1 \times 10^{-3} Pa$ 01

$(1.1 - 1.2) \times 10^{-3} Pa$

Factor of amplification $= \frac{1.14 \times 10^{-3}}{2.75 \times 10^{-5}}$

$= 40$ 01

(40 - 41)

(d) (i) 160dB 01

(ii) $160 = 10\log I/10^{-12}$

$I = 10^4 Wm^{-2}$ 01

(c) $V = \sqrt{T/m}$ and $f = v/\lambda$

For stiff strings, tension is high OR T is high.

Therefore velocity of transverse waves v is large For Short strings wavelegth λ is small. 01

Both will contribute to high resonant frequencies Similarly for flexible and long strings is v small but λ is large. 01

there fore these strings respond to low frequencies.

03. Poiseuille's equation $\frac{Q}{t} = \frac{\pi r^4 \Delta P}{8\eta l}$

Q/t = Rate of volume flow of liquid (flow of liquid volume per second / Per unit time)

ΔP = Pressure difference across the tube.

l = length of the tube (or $\Delta P/l$ - Pressure gradient)

r = Internal radius of the tube

η = Viscosity of the liquid. all correct 01

(a) $\frac{[M]\ [L]^4}{[T]^2 [L]} \quad \frac{1}{\frac{[M]}{[L]\,[T]}} \quad \frac{1}{[L]} = \frac{[L]^3}{[T]}$

(correct L. H. S) 01

If L . H. S is correct and the simplification is correct of get R. H. S. 01

(b) (i) $\frac{Q}{t}$ = speed x area

$V \times \pi r^2 = \frac{\pi \Delta P r^4}{8\eta l}$

$1 \times \pi (20 \times 10^{-2})^2 = \frac{\pi \Delta P (20 \times 10^{-2})^4}{8 \times 0.9 \times 1000}$ L. H. S. -01 R. H. S. -01

$\Delta P = 1.8 \times 10^5\ Nm^{-2}$ (Pa) 01

(ii) Power $= \Delta P . A \times V$

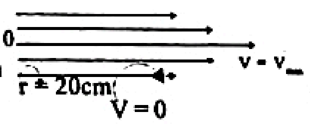
$= (18 \times 10^4) \times \pi (20 \times 10^{-2})^2 \times (1.0)$ 01

$= 2.16 \times 10^4 w$ 01

$(2.1 - 2.3) \times 10^4$ W

(iii) Maximum speed at r = 0

Minimum speed at r = 20 cm



Minimum speed V = 0 01 - 02

(c) Q , l and η are same

$\Delta P_1 r_1^4 = \Delta P_2 r_2^4$

$\Delta P_1 r_1^4 = \Delta P_2 \left(\frac{90}{100} r_1\right)^4$ 01

$\Delta P_1 = \left(\frac{9}{10}\right)^4 \Delta P_2$

$\Delta P_2 = \left(\frac{10}{9}\right)^4 \Delta P_1$

$\Delta P_2 = 1.11^4 \Delta P_1$

Percentage increase $= \frac{1.11^4 \Delta P_1 - \Delta P_1}{\Delta P_1} \times 100\%$

$= (1.11^4 - 1) \times 100\%$

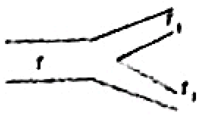
$= 0.518 \times 100\%$

$= 51.8\%\ (52\%)$ 01

$[(51.5 - 52.5)\%]$

(d) Rate of flow $Q = Q_1 + Q_2$

ΔP, η and r are same for all tubes



$\therefore\ r^4 = r_1^4 + r_2^4 = 2r_1^4$ 01

$r_1 = \frac{r}{\sqrt[4]{2}} = \frac{20 \times 10^{-2}}{\sqrt[4]{2}} = 1.68 \times 10^{-1}m$ 01

04. (a) Gravitational Potential $= Ep = \frac{-GM}{h}$ (01 mark negative Sign)

(b) (i) Total mechanical energy of the object $E = \frac{1}{2}mv_i^2 - \frac{GMm}{h}$ 01

(ii) From the conservation of energy

$\frac{1}{2}mv_i^2 - \frac{GMm}{h} = \frac{-GMm}{H}$ 01

$H = \frac{2hGM}{(2GM - hv_i^2)}$ 01

(iii) When $V_i = V_e'$ $H \to \infty$

$2GM - hv_e'^2 = o$

$v_e' = \sqrt{\frac{2GM}{h}}$ 01

(c) $\frac{mv_o^2}{h} = \frac{GMm}{h^2}$ 01

$v_o = \sqrt{\frac{GM}{h}}$ 01

$v_e' = \sqrt{2}\ v_o$

(d) Escape velocity for the earth

$v_e = \sqrt{\frac{2GM}{R}}$

$= \sqrt{\frac{2 \times 6 \times 10^{-11} \times 6 \times 10^{24}}{6400 \times 10^3}}$

$v_e = \frac{3}{4} \times \sqrt{2} \times 10^4$

$v_e = 0.75 \times 1.4 \times 10^4$

$v_e = 1.05 \times 10^4 ms^{-1}$ 01

$[(10500 - 10607)\ ms^{-1}]$

(e) $V_{rms} = \sqrt{\frac{3kT}{m}}$ $\left[\frac{1}{2}mV_{rms}^2 = \frac{3}{2}kT\right]$

Therefore $(V_{rms})H_2 = \sqrt{\frac{3 \times 1.4 \times 10^{-23} \times 280}{3 \times 10^{-27}}}$

$= 14 \times \sqrt{2} \times 100$

$= 1960\ ms^{-1}$ 01

$[(1960 - 2000)\ ms^{-1}]$

$(V_{rms})O_2 = \sqrt{\frac{3kT}{16m_H}}$

$(V_{rms})O_2 = \frac{(V_{rms})H_2}{4}$

$= \frac{1960}{4}$

$= 490\ ms^{-1}$ 01

$[(490 - 500)\ ms^{-1}]$

(f) For H_2 gas, $(6\ V_{rms}) = 6 \times 1960 = 11760\ ms^{-1}$
$[(11760 - 12000)\ ms^{-1}]$

O_2 gas $(6\ V_{rms}) = 6 \times 490 = 2940\ ms^{-1}$
$[(2940 - 3000)\ ms^{-1}]$ 01

Therefore the condition $6V_{rms} < Ve$ is satisfied only for O_2 gas OR the condition $6\ V_{rms} > Ve$ is not satisfied for H_2 gas 01

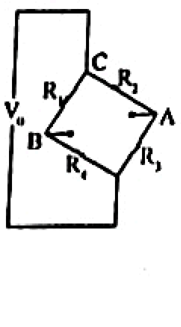
05. (A) (a) Let I_1 be the current through the branch R_1, R_4 and I_2 be the current through the branch R_2 R_3 when the brige is balanced

$I_1 R_1 = I_2 R_2$ —① 02

$I_1 R_4 = I_2 R_3$ —② 02

①/② $\frac{R_1}{R_4} = \frac{R_2}{R_3}$

(b) When all the resistances are equal except R_3 which is R + r



$V_A = \frac{R + r}{R + R + r} V_0(v)$ 01

OR $\left[V_c - V_A = \frac{R}{R + R + r} V_0(v)\right]$

$V_B = \frac{1}{2} V_0(v)$ 01

OR $\left[V_c - V_B = \frac{1}{2} V_0(v)\right]$ 01

$\therefore V_{AB} = \left[\frac{R + r}{2R + r} - \frac{1}{2}\right] V_0(v)$ OR $V_A - V_B = \left[\frac{1}{2} - \frac{R}{2R + r}\right] V_0(v)$

$V_{AB} = \frac{V_0(v)\, r}{4R + 2r}$

(c) $R_3 = R + r$ and $R_2 = R - r$

$V_A = \frac{(R + r)}{2R} V_0(V)$ OR $V_c - V_A = \frac{(R - r)}{2R} V_0(V)$

$V_B = \frac{1}{2} V_0(V)$ OR $V_c - V_B = \frac{1}{2} V_0(V)$

$\therefore V_{AB} = \left[\frac{R + r}{2R} - \frac{1}{2}\right] V_0(V)$ OR $V_A - V_B = \left[\frac{1}{2} - \frac{R + r}{2R}\right] V_0$

$V_{AB} = \frac{V_0(V) r}{2R}$

(d) For the metal strip $R = \rho\, \ell / A$ 01 $(V = \ell$

$R = \rho\, \ell^2 / V$ $(A = V/$

If the volume of the strip remains unchaged when ℓ increased, its area of cross - section should decrea
Therefore R should increase. (

(e) (i) length of the strip P will increase 0
length of the strip Q will decrease 0

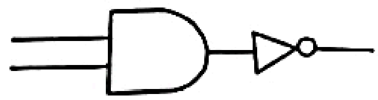
(ii) $r/R = 1/100$ 0

Voltage qenerated accoss AB $= 5/100 \times 2$ 0

$= 25\ mV$ OR $(2.5 \times 10^{-2} V)$ 0

(iii) Connect a voltmeter and measure voltages across AB For several known accelerations. Calibrate th voltmetar scale with acceleration values. 01

05. (B) (a)



01

(b) When x is grounded (V_x = 0V), the diode is forward baised and V_0 becomes 0.7V whether the voltage at y is O or 5V.

When Y is grounded (Vy = oV), the diode is forward baised and V_0 becomes 0.7V whether the voltage at X is O or 5V.

When X and Y bare both at 5V, both diodes are not foward biased and V_0 becomes 5V. 01

x	y	V_0
0	0	0
0	1	0
1	0	0
1	1	1

01

(c) (i) When B is connected to 5V, the base current I_B is given by the equ.

$V_{AB} = I_B R_B + V_{BE}$

$5 = 4.3 \times 10^3 I_B + 0.7$ 01

$I_B = 1\ mA\ (10^{-3}A)$ 01

If it is oprating in the saturation mode 01

$\beta I_B > I_C$

$\beta I_B = 100 \times 10^{-3}$

$= 0.1A$ 01

The maximum current that can flow through the collector circuit.

$I_c = 5/10^3$

$= 5 \times 10^{-3}$ A (5mA) 01

$\beta I_B > I_c$ and the transistor operates in the Saturation mode.

(ii) When the voltage at the input B is 5V (logic 1)
the output voltage at C is 0.1v (OR 0V) (logic 0)

and

when the input voltage is 0 the transistor does not conduct and voltage at C becomes 5V. 01

the circuit operates as a NOT gate.

B	C
1	0
0	1

(d) (i) When the logic level of p is 0, the x and y in puts should have the logiclevels of x = 0, y = 0, or x = 1 y = o or x = o, y = 1 when p = o on the hand C = 1
when the logic levelof P is 1, the x and y inputs Should have the logic levels of x = 1, y = 1 and in that case C should be O 01

Thuth table for the NAND gate 01

x	y	c
0	0	1
0	1	1
1	0	1
1	1	0

x	y	p	c
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

(ii) When x = y = 5V current through the Base Emitter Junction (I_B) is given by the equation.

$5 = (700 + 4.3 \times 10^{+3})\, I_B + 0.7$

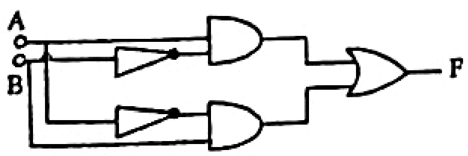
$I_B = 8.6 \times 10^{-4}$ A 01

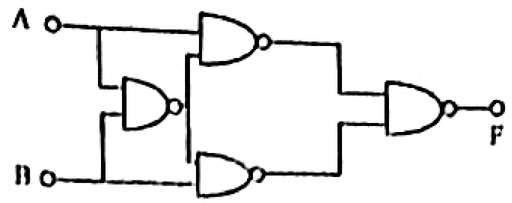
(e) (i)

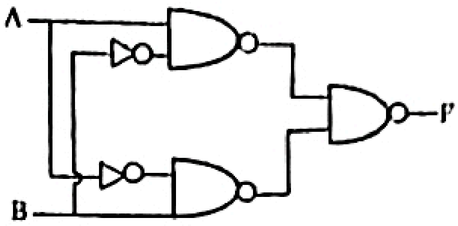
A	B	F
0	0	0
0	1	1
1	0	1
1	1	0

$F = A\bar{B} + \bar{A}B$ 01

(ii)







06. (A) (a) (i) Appying $PV = \frac{m}{M} RT$ OR $PV = nRT$ 01

$10^5 \times 830 = \frac{m_1}{30 \times 10^{-3}} \times 8.3 \times 300$ 01

$m_1 = 10^3$kg [(996 - 1000) kg] 01

Density of air at 300k = $\left(\frac{m_1}{V}\right)$

$= \frac{10^3}{830}$

$= 1.2$ kgm^{-3} 01

(1.2 - 1.202kgm^{-3})

(ii) PV = nR T

$10^5 \times 830 = \frac{m_2}{30 \times 10^{-3}} \times 8.3 \times T$

$m_2 = \frac{3 \times 10^5}{T}$ 01

(b) Upthrust on the balloon (u) $= \rho V g$

$= 1.2 \times 830 \times 10$ 01

u = 9960 N 01

(9960 - 10000N)

(c) (i) For the balloon of Just lift off the ground.

$m_2 g + mg = u$

$\frac{3 \times 10^5}{T} + 2460 = 996 \times 10$

$\frac{T}{3 \times 10^5} = 7500$

$T = \frac{3 \times 10^5}{7500}$

T = 400 k (127°C) 01

(397k - 400k)

$m_2 = \frac{3 \times 10^5}{400}$

$m_2 = 750$kg 01

(750kg - 755kg)

(ii) Heat absorbed by the air remaining inside the balloon

$= mC_p\theta$

$= 750 \times 10^3 \times 100$ 01

$= 75 \times 10^6 J$

Heat absorbed by the removed form the balloon

$= 250 \times 10^3 \times 50$ 01

$= 125 \times 10^5$

heat supplied $= (750 + 125) 10^5 J$ 01

$= 875 \times 10^5 J$

$= 8.75 \times 10^7 J$ 01

$= (8.4 - 8.9)$

(iii) Mass of Propane used $= \frac{8.75 \times 10^7}{8.75 \times 10^6}$

$= 1 kg$ 01

$[(0.9 - 1.1)kg$

06. (B) (a) Number of protons $= 24$ 01

Number of neutrons $= 51 - 24$

$= 27$ 01

(b) $t_{\frac{1}{2}} = \frac{0.7}{\lambda}$

$\lambda = \frac{0.7}{t_{\frac{1}{2}}}$

$= \frac{0.7}{28} d^{-1}$

$= 0.025 d^{-1}$ 01

(c) Maximum allowed activity inside the patient

$= (6.0 \times 10^4) \times 70$ 01

$= 4.2 \times 10^6 Bq$

Maximum possible mass of ^{51}Cr that can be added to 10m*l* blood sample.

$= \frac{4.2 \times 10^6}{3.5 \times 10^{15}}$

$= 1.2 \times 10^{-9} g$ 01

$(1.2 \times 10^{-12} kg)$

(d) Number of ^{51}Cr nuclei atoms added to the sample

$= N_o = \frac{6.0 \times 10^{23} \times 1.53 \times 10^{-10}}{51}$

$= 1.8 \times 10^{12}$

01

Activity of the sample $= \lambda N_o$

$= \left[\frac{0.025}{9 \times 10^4}\right] \times (1.8 \times 10^{12})$ 01

$= 5.0 \times 10^5 Bq$

01

$(5.3 - 5.4)$

(e) Initial activity / Final activity = Blood Volume / 10m*l*

OR

Blood volume $= \frac{5.0 \times 10^5}{1000} \times 10ml$ 01

$= 5000 ml$

$(5000 - 5400) ml$ 01

(f) The calculated value of blood volume in (e) will be Silightly greater than the actual value. 01
In Calculating the blood volume it has been assumed that the total number of ^{51}Cr atoms has not changed. But to get the correct answer a higher value for the activity than the measured value has to be substituted in (e) above.

OR

The measured activity substituted in (e) above is smaller than the actual value. that has to be used in the calculation. 01

(g) Time required $= 6 \times$ half life OR $6 \times t_{\frac{1}{2}}$

$= 6 \times 28$ days 01

$= 168$ days 01

(h) Most of the atoms would decay before mixing up with the blood volume in the body OR half $(t\frac{1}{2})$ life is too short. 01