Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) (i) heat water to 100 °C, energy (= 190 × 4200 × 79) = 63 (MJ) **(1)**
vapourise water, energy
(=190 × 2.3 × l0^6) = 440(MJ) **(1)**
(437MJ)

energy transferred (per sec) = (437 + 63) MJ **(1)**
(= 500 MJ)

(ii) mass of rocks (= 4.0 × 10^6 × 3200)

= 1.3 × 10^{10}(kg) **(1)**
(1.28 × 10^{10})

temperature fall of Δ*T* in one day, energy removed
(= 1.28 ×10^{10} × 850 × Δ*T*) = 1.1 × 10^{13} Δ*T* **(1)**
(1.09 x 10^{13} AT)
(allow C.E. for value of mass of rocks)

energy transfer in one day (= 500 × 10^6 × 3600 × 24)
= 4.3 × 10^{13} (J) **(1)**

in one day $\Delta T\left(=\frac{4.3\times10^{13}}{1.1\times10^{13}}\right)=3.9(1)$ K **(1)**

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(b) number of nuclei in 1 kg of ^{238}U = $\left(\frac{6.02\times10^{23}}{0.238}\right)=2.5(3)\times10^{24}$ **(1)**

activity of lkg of ^{238}U = $\frac{1n2}{T_{1/2}}\times2.53\times10^{24}$ **(1)**

$\left(=\frac{1n2}{4.5\times10^{9}\times3.1\times10^{7}}\times2.53\times10^{24}\right)=1.2(6)\times10^{7}(s^{-1})$ **(1)**

energy released per sec per kg of ^{238} U

= 1.2(6) × 10^7 × 4.2 × 1.6 × 10^{-13}(J) **(1)**
(8.47 × 10^{-6}(J))

mass of ^{238}Uneeded = $\frac{500 \times 10^6}{\quad}$ = 5.9(0) × 10^{13}kg **(1)**

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[12]

Q2.

(a) (use of $\Delta Q = mcT$ gives)
ΔQ_1 = 1.5 × 4200 × 18 **(1)**
= 1.134 × 10^5(J) **(1)**
ΔQ_2 = 1.5 × 3.4 × 10^5 = 5.1 × 10^5(J) **(1)**
total energy released (= 1.134 × 10^5+ 5.1 × 10^5)
= 6.2 × 10^5J **(1)**
(6.23 × 10^5J)

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(b) (ice) requires energy to melt [or mention of latent heat] **(1)**
stays at 0 °C (for longer) (or cools for longer) **(1)**
(or extracts more energy from the drink)

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[6]