

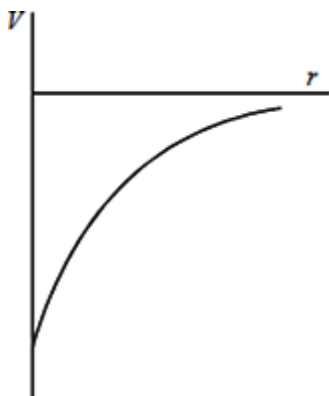
Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

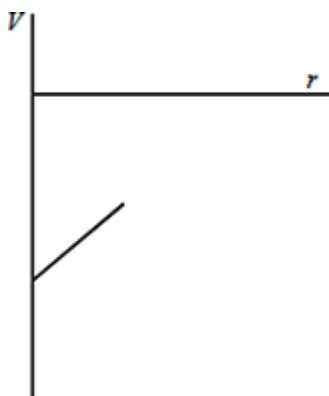
Q1.



gradient decreases as r increases (1)

V increases as r increases (1)

only negative values of V shown (1)



constant gradient (1)

V increases as r increases (1)

[max 4]

Q2.

(a) (i) $R_D = 1.3 \times 2^{1/3} = 1.64 \text{ fm}$ (1) $R_T = 1.3 \times 3^{1/3} = 1.64 \text{ fm}$ (1)

(ii) energy at 'contact' = $\frac{Q_1 Q_2}{4\pi\epsilon_0 r}$ (1)

$$= \frac{e^2}{4\pi\epsilon_0 r^2} \quad (1)$$

$$= 6.56 \times 10^{-14} \text{ J} \quad (1)$$

$$\frac{6.56 \times 10^{-14}}{1.6 \times 10^{-13}} = 4.10 \text{ MeV} \quad (1)$$

(max 5)

- (b) energy of nucleus = $3/2 kT$ (1)
 $6.56 \times 10^{-14} = 3/2 \times 1.38 \times 10^{-23} \times T$ (1)
gives $T = 3.2 \times 10^9 \text{ K}$ (1) (marks available for alternative sensible use of energy data)

reference to range of speeds (or energies) of nuclei (or atoms) (1)

(max 3)

[8]

Q3.

- (a) (i) force per unit mass/force per kg

B1

- (ii) N kg^{-1} **not** ms^{-2} alone

B1

2

- (b) (i) GM/R^2 seen

C1

$GM_Q/(3R)^2$ seen

C1

mass of Q = $9M$

A1

- (ii) passes through $(3R, g)$ and falls off in curve

M1

two further points checked e.g., $(6R, g/4)$ $(12R, g/16)$

M1

overall line quality – single smooth line (both Ms for this)

A1

6

[8]