Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Fields And Their Consequences(Gravitational Field)

Name of the Student:____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) mass depends only on the amount of matter present owtte

B1

weight is force between body and Earth/depends on *g/mg*/ gravitational field strength or answers in terms of Newton's gravitational law

B1

g (etc) varies at different points on and above the Earth or is different on different planets etc

B1

3

(b) (i) reference is 'infinity' where potential is 0

B1

energy has to be put in/work has to be done to move mass to infinity or a bodies energy/PE decreases as a body moves from infinity towards the Earth

B1

2

(ii) need to show *Vr* to be constant, clear from algebra or final statement

B1

two sets of data used correctly

B1

all three sets of data used correctly (4.02, 4.025, 4.028)

B1

3

(iii) energy change per kg = $(5.36 - 3.22) \times 10^7$ (J)

B1

total change = 963 (960) × 10^7 J

B1 **2**

(c) (i) $GMm/r^2 = mv^2/r$ or $v = (GM/r)$

C1

$v^2 = 3.2 \times 10^7 m^2 s^{-2}$ or $v = 5670\ ms^{-1}$

C1

use of KE = ½ mv^2 using their v

C1

7.2 GJ

A1 **4**

(ii) KE changes by 4.8 GJ (allow ecf, 12 – their ci)

B1 **1**

(iii) total energy (supplied) = (4.8) GJ (cnao)

(allow 5.2 GJ using 10 GJ for change in E_p)
(allow variations due to rounding off if physics is correct in previous parts)

B1 **1**

[16]

Q2.

(a) (i) relationship between them is $E_p = mV$ (allow $\Delta E_p = m\Delta V$) [or V is energy per unit mass (or per kg)] **(1)**

1

(ii) value of E_p is doubled **(1)**

value of V is unchanged **(1)**

2

(b) (i) use of $V = -\frac{GM}{r}$ gives $r_A = \frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{12.0 \times 10^6}$ **(1)**

= 3.3(2) × 10^7 (m) **(1)**

2

(ii) since $V \propto (-)\frac{1}{r}\left(\text{or } \frac{r_A}{r_B} = \frac{v_B}{v_A} = \frac{36.0}{12.0} = 3\right) r_B = \frac{3.32 \times 10^7 \text{ m}}{3}$ **(1)**

(which is ≈ 1.1 × 10^4 km)

1

(iii) centripetal acceleration $g_B = \frac{GM}{r^2} = \frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{(1.11 \times 10^7)^2}$ **(1)**

[allow use of 1.1×10^7 m from (b)(ii)]

= 3.2 (m s^{-2}) **(1)**

[**alternatively**, since $g_B = (-)\frac{V_B}{r_B}$, $g_B = \frac{36.0 \times 10^6}{1.11 \times 10^7}$ **(1)**

= 3.2 (m s^{-2}) **(1)**]

2

(iv) use of $\Delta E_p = m\Delta V$ gives $\Delta E_p = 330 \times (-12.0 - (-36.0)) \times 10^6$ **(1)**

(which is 7.9×10^9 J or ≈ 8 GJ)

1

(c) *g* is not constant over the distance involved

(**or** *g* decreases as height increases
or work done per metre decreases as height increases
or field is radial and/or not uniform) **(1)**

1

[10]