9 (a) (i) State what is meant by a field of force.

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.....

..... [1]

(ii) State **two** similarities of and **two** differences between electric and gravitational fields.

similarities

1 .....

.....

2 .....

.....

differences

1 .....

.....

2 .....

.....

[4]

(b) A planet has one moon, as shown in Fig. 9.1.

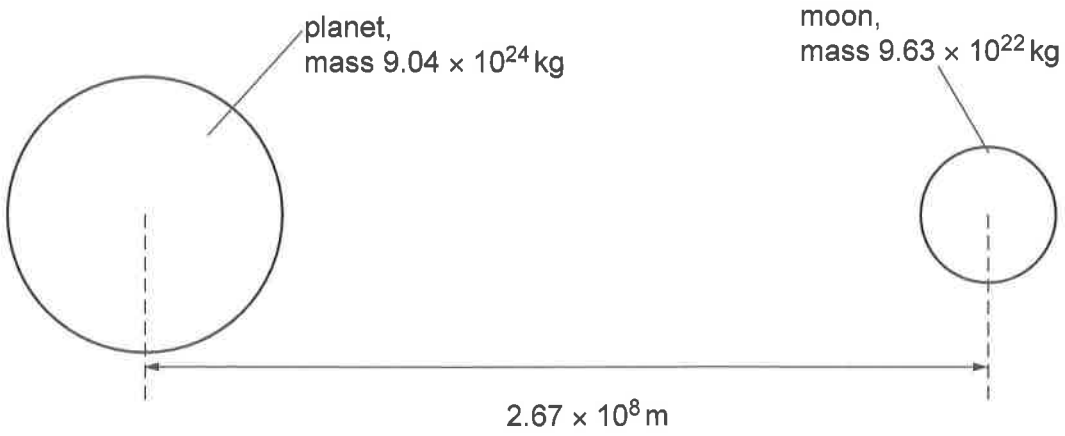

Fig. 9.1 (not to scale)

The planet and the moon are both spheres of uniform density.

The planet has a mass of 9.04×10^{24} kg.

The moon has a mass of 9.63×10^{22} kg.

The distance between the centre of the planet and the centre of the moon is 2.67×10^{8} m.

Assume that, outside the planet, the gravitational field due to the planet is identical to that of a point mass at its centre. This assumption also applies to the moon.

The planet–moon system is isolated in space.

(i) The gravitational field strength due to the moon at its surface is $2.71\,\text{N kg}^{-1}$.

Show that the radius of the moon is 1.54×10^{6} m.

[1]

(ii) Explain why the gravitational field strength is **not** 2.71 $N kg^{-1}$ everywhere on the surface of the moon, and why it varies with position around the surface of the moon.

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..... [3]

(iii) There is a point between the planet and the moon where the gravitational field strength is zero. This is called the null point.

(A) Calculate the shortest distance of this null point from the surface of the moon.

distance = ... m [4]

(B) Explain why the gravitational potential at the null point is **not** zero.

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.....

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..... [2]

(C) Calculate the gravitational potential at the null point.

gravitational potential = ... $J kg^{-1}$ [3]

(c) Two point charges are placed close to each other in space. On the line between these charges there is a point where the electric potential is zero.

Explain why, for these charges, there **cannot** be a point on this line where the electric field strength is zero.

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..... [2]