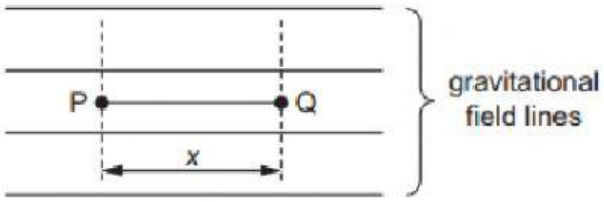
Multiple Choice Gravitational Fields Practice:

Name:_____

Grade:_____

1.

A mass *m* is situated in a uniform gravitational field.



When the mass moves through a displacement x, from P to Q, it loses an amount of potential energy *E*.

Which row correctly specifies the magnitude and the direction of the acceleration due to gravity in this field?

	magnitude	direction
A	$\frac{E}{mx}$	→
B	$\frac{E}{mx}$	←
C	$\frac{E}{x}$	→
D	$\frac{E}{x}$	←

2.

Five energies are listed.

5 kJ

5 mJ

5 MJ

5 nJ

Starting with the smallest first, what is the order of increasing magnitude of these energies?

A 5 kJ → 5 mJ → 5 MJ → 5 nJ

B 5 nJ → 5 kJ → 5 MJ → 5 mJ

C 5 nJ → 5 mJ → 5 kJ → 5 MJ

D 5 mJ → 5 nJ → 5 kJ → 5 MJ

3.

Two identical spheres exert a gravitational force F on each other. What is the gravitational force between two spheres, each twice the mass of one of the original spheres, when the separation of their centres is twice the original separation?

A F
B $2F$
C $4F$
D $8F$

4.

Four students each made a series of measurements of the acceleration of free fall g. The table shows the results obtained.

Which set of results could be described as precise but **not** accurate?

	g/m s^{-2}			
A	9.81	9.79	9.84	9.83
B	9.81	10.12	9.89	8.94
C	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

5.

A planet of mass M and radius R rotates so rapidly that loose material at the equator only just remains on the surface. What is the period of rotation of the planet?

G is the universal gravitational constant.

A $2\pi\sqrt{\frac{R}{GM}}$

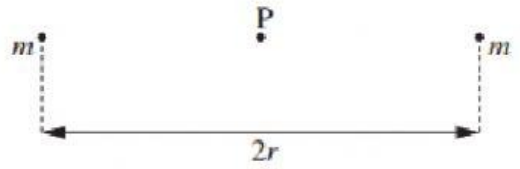
B $2\pi\sqrt{\frac{R^2}{GM}}$

C $2\pi\sqrt{\frac{GM}{R^3}}$

D $2\pi\sqrt{\frac{R^3}{GM}}$

6.

The diagram shows two point masses each of mass m separated by a distance $2r$.



What is the value of the gravitational field strength at the mid-point, P, between the two masses?

A $\frac{4Gm}{r^2}$

B $\frac{2Gm}{r^2}$

C $\frac{Gm}{2r^2}$

D zero

7.

What would the period of rotation of the Earth need to be if objects at the equator were to appear weightless?

radius of Earth = 6.4×10^6 m

A 4.5×10^{-2} hours

B 1.4 hours

C 24 hours

D 160 hours

8.

As a comet orbits the Sun the distance between the comet and the Sun continually changes. As the comet moves towards the Sun this distance reaches a minimum value. Which one of the following statements is **incorrect** as the comet approaches this minimum distance?

A The potential energy of the comet increases.

B The gravitational force acting on the comet increases.

C The direction of the gravitational force acting on the comet changes.

D The kinetic energy of the comet increases.

9.

Which one of the following statements about Newton's law of gravitation is correct?

Newton's law of gravitation explains

A the origin of gravitational forces.
B why a falling satellite burns up when it enters the Earth's atmosphere.
C why projectiles maintain a uniform horizontal speed.
D how various factors affect the gravitational force between two particles.

10.

If an electron and proton are separated by a distance of 5×10^{-11}m, what is the approximate gravitational force of attraction between them?

A 2×10^{-57}N

B 3×10^{-47}N

C 4×10^{-47}N

D 5×10^{-37}N

11.

The gravitational potential at the surface of the Earth, of radius R, is V. What is the gravitational potential at a point at a height R above the Earth's surface?

A $\frac{V}{4}$

B $\frac{V}{2}$

C V

D $2V$

12.

A satellite is in orbit at a height h above the surface of a planet of mass M and radius R. What is the velocity of the satellite?

A $\sqrt{\frac{GM}{(R+h)}}$

B $\frac{\sqrt{GM(R+h)}}{R}$

C $\sqrt{\frac{GM(R+h)}{R}}$

D $\frac{\sqrt{GM}}{(R+h)}$

13.

A small mass is situated at a point on a line joining two large masses m_1 and m_2 such that it experiences no resultant gravitational force. Its distance from the centre of mass of m_1 is r_1 and its distance from the centre of mass of m_2 is r_2.

What is the value of the ratio $\frac{r_1}{r_2}$?

A $\frac{m_1^2}{m_2^2}$

B $\frac{m_2^2}{m_1^2}$

C $\sqrt{\frac{m_1}{m_2}}$

D $\sqrt{\frac{m_2}{m_1}}$

14.

Which one of the following gives a correct unit for $\left(\frac{g^2}{G}\right)$?

A $\mathrm{N\,m^{-2}}$

B $\mathrm{N\,kg^{-1}}$

C $\mathrm{N\,m}$

D N

15.

The gravitational field strength at the surface of the Earth is 6 times its value at the surface of the Moon. The mean density of the Moon is 0.6 times the mean density of the Earth.

What is the value of the ratio $\left(\frac{\text{radius of Earth}}{\text{radius of Moon}}\right)$?

A 1.8

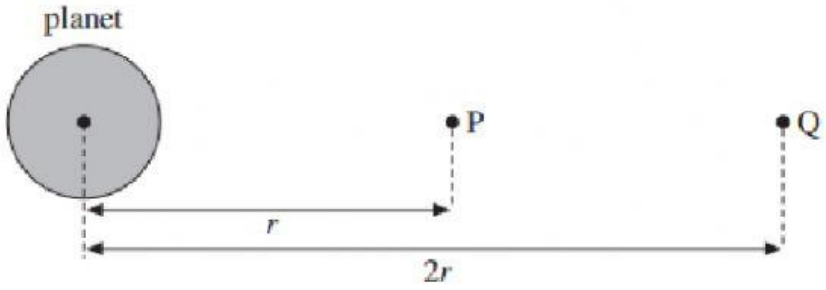
B 3.6

C 6.0

D 10

16.

The diagram shows two points, P and Q, at distances r and $2r$ from the centre of a planet.



The gravitational potential at P is $-16\,\text{kJ kg}^{-1}$. What is the work done on a 10 kg mass when it is taken from P to Q?

A $-120\,\text{kJ}$
B $-80\,\text{kJ}$
C $+80\,\text{kJ}$
D $+120\,\text{kJ}$