10.2 Fields at Work

Question Paper

Course	DP IB Physics
Section	10. Fields (HL only)
Topic	10.2 Fields at Work
Difficulty	Easy

Time allowed: 20

Score: /10

Percentage: /100

Question 1

When a mass is moved against the force of gravity, work is done such that the change in work done, ΔW is equal to the change in gravitational potential ΔV.

Which line correctly identifies the equation and named variables for work done when moving a mass in a gravitational field?

	symbol equation	word equation
A.	Fs	force × distance
B.	$F\Delta V$	force × change in gravitational potential
C.	ms	mass × distance
D.	$m\Delta V$	mass × change in gravitational potential

[1 mark]

Question 2

When a mass moves through a gravitational field the magnitude of the potential energy E_P changes. Which equation could be used to correctly calculate this?

A. $\Delta E_p = GMm\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$

B. $\Delta E_p = GMm\left(-\frac{1}{r_1} - \frac{1}{r_2}\right)$

C. $\Delta E_p = GMm\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

D. $\Delta E_p = GMm\left(\frac{1}{r_1} \times \frac{1}{r_2}\right)$

[1 mark]

Question 3

Two point charges q_1 and $2q_2$ are separated by distance $2r$.

What is the value of the gravitational potential energy E_p?

A. $E_p = \frac{2q_1q_2}{4\pi\varepsilon_0 r}$

B. $E_p = \frac{q_1q_2}{8\pi\varepsilon_0 r}$

C. $E_p = \frac{q_1q_2}{4\pi\varepsilon_0 r}$

D. $E_p = \frac{2q_1q_2}{8\pi\varepsilon_0 r}$

[1 mark]

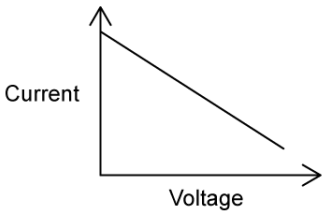
Question 4

An electric field can be defined in terms of the variation of electric potential at different points in the field.

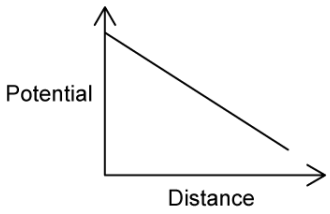
Which graph correctly represents this relationship?

[1 mark]

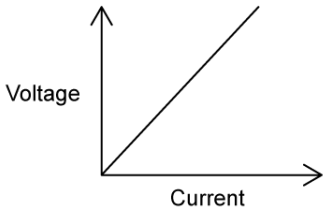
A



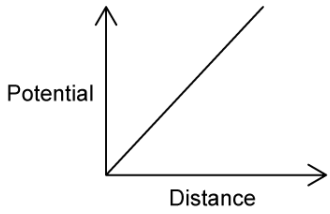
B



C



D



Question 5

Which quantity does the following statement define?

The work done by moving a positive test charge from one point to another in an electric field.

A. Potential gradient

B. Electric field strength

C. Gravitational potential

D. Potential difference

[1 mark]

Question 6

Two parallel metal plates are separated by distance, d and have a potential difference of V_e.

Which equation correctly gives the magnitude of the electric force acting on a stationary charged particle between the plates if the particle has a charge of Q?

A. $F = \frac{E}{Q}$

B. $F = k\frac{q_1 q_2}{d^2}$

C. $F = ma$

D. $F = \frac{QV_e}{d}$

[1 mark]

Question 7

Read the following statements about the escape velocity on Earth. Which ones are correct?

Escape velocity;

I. Increases as the mass of the object increases

II. Depends on the mass of the Earth and is not affected by the mass of the object

III. Is defined as the minimum speed that allows an object to escape a gravitational field with no further energy input

A. I. only

B. I. and II.

C. II. and III.

D. III. only

[1 mark]

Question 8

The equation for linear orbital speed is

$$v = \sqrt{\frac{GM}{r}}$$

Which statement is a consequence of this equation?

A. Orbital speed is the same for all objects, regardless of their mass, when their orbital radius is the same.

B. Orbital speed is the same for all objects, regardless of their mass, when they orbit the same planet.

C. The gravitational constant, *G*, can be derived if orbital speed and radius are both known.

D. Time period, *T* can be derived from orbital speed and radius.

[1 mark]

Question 9

Gravitational and electrostatic forces are similar in many ways. Which statements are correct about both?

I. Both electrostatic forces and gravitational forces are always attractive

II. Both electrostatic forces and gravitational forces may be attractive or repulsive

III. Both electrostatic forces and gravitational forces follow an inverse square law

IV. The equations used to calculate these forces rely on knowing certain universal constants

A. I and III only

B. III and IV only

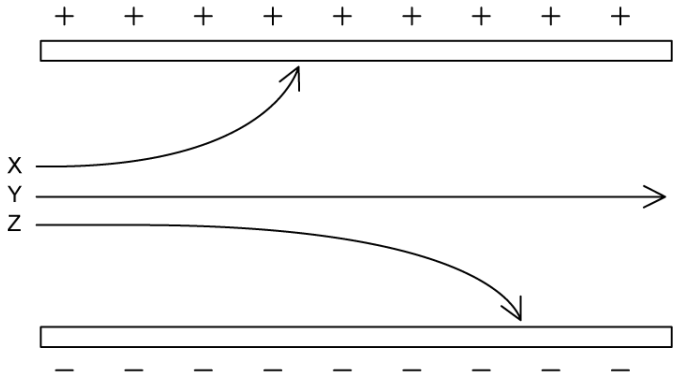
C. I, II, and III only

D. II, III, and IV only

[1 mark]

Question 10

A charged particle in an electric field will experience a force on it that will cause it to move. The three particles X, Y and Z are experiencing a force which deflects their motion as shown. What three particles could X, Y and Z be?



	X	Y	Z
A.	beta-minus particle	photon	nucleus
B.	alpha particle	neutron	photon
C.	neutron	electron	alpha-particle
D.	electron	beta-plus particle	neutron

[1 mark]