IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

M05/4/PHYSI/SPM/ENG/TZ1/XX+

22056510

PHYSICS
STANDARD LEVEL
PAPER 1

Thursday 19 May 2005 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. The order of magnitude of the weight of an apple is

A. 10^{-4} N.

B. 10^{-2} N.

C. 1 N.

D. 10^{2} N.

2. Which **one** of the following contains three fundamental units?

A.	Metre	Kilogram	Coulomb
B.	Second	Ampere	Newton
C.	Kilogram	Ampere	Kelvin
D.	Kelvin	Coulomb	Second

3. The reading of a constant potential difference is made four times by a student. The readings are

1.176 V
1.178 V
1.177 V
1.176 V.

The student averages these readings but does not take into account the zero error on the voltmeter.

The average measurement of the potential difference is

A. precise and accurate.

B. precise but not accurate.

C. accurate but not precise.

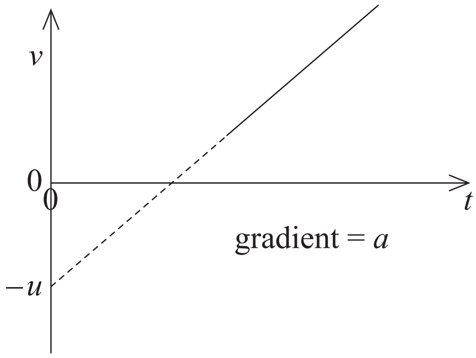
D. not accurate and not precise.

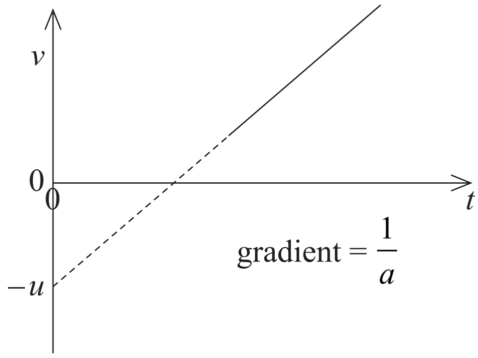
4. The variation with time t of the speed v of an object is given by the expression

$$v = u + at$$

where u and a are constants.

A graph of the variation with time t of speed v is plotted. Which **one** of the following correctly shows how the constants may be determined from this graph?

A.


B.


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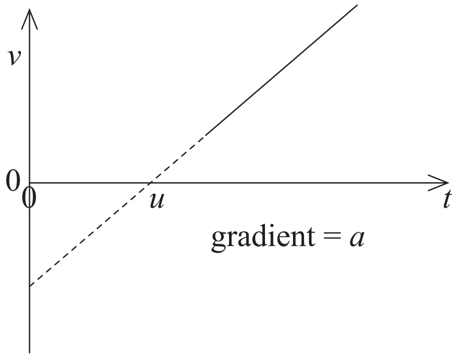

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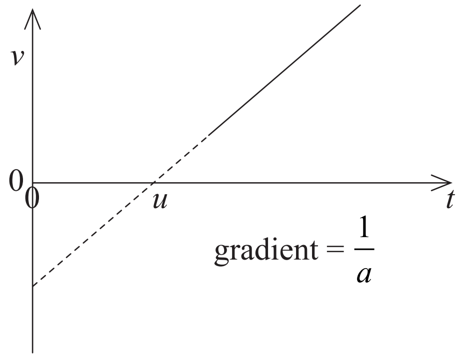


5. Which **one** of the following is a correct definition of *displacement*?

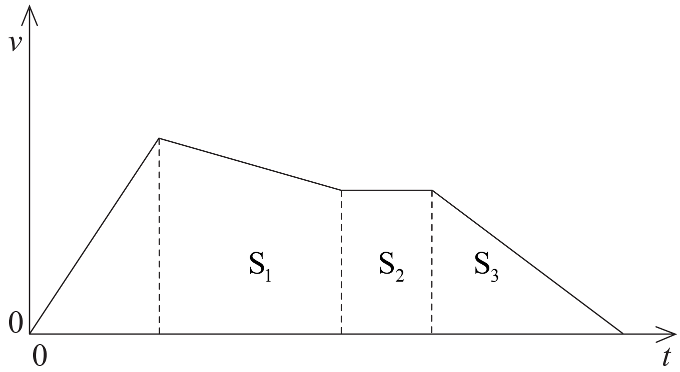
A. Distance from a fixed point

B. Distance moved from a fixed point

C. Distance from a fixed point in a given direction

D. Distance moved in a given direction

6. The variation with time t of the speed v of a car moving along a straight road is shown below.



Which area, S_1, S_2 or S_3, or combination of areas, represents the total distance moved by the car during the time that its speed is reducing?

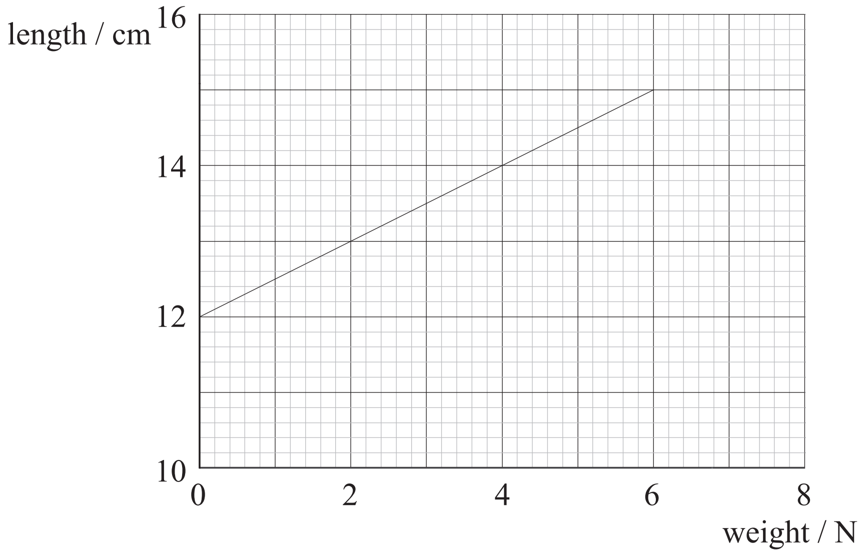
A. S_1

B. S_3

C. $S_1 + S_3$

D. $S_1 + S_2 + S_3$

7. A weight is suspended from a spring. The variation with weight of the length of the spring is shown below.



What is the value of the spring constant (force constant) of the spring?

A. 0.4 N cm^{-1}

B. 0.5 N cm^{-1}

C. 2.0 N cm^{-1}

D. 2.5 N cm^{-1}

8. Which **one** of the following objects is in equilibrium?

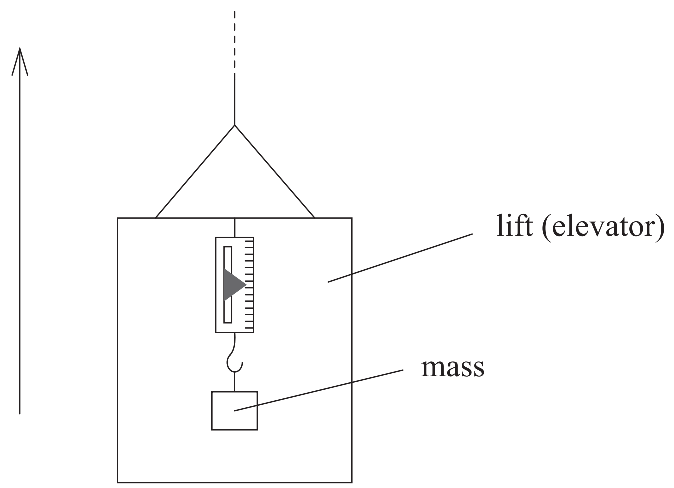
A. A stone trapped in the tread of a rotating tyre

B An air molecule as a sound wave passes through the air

C. A steel ball falling at constant speed through oil

D. An electron moving through a metal under the action of a potential difference

9. A mass is suspended from the roof of a lift (elevator) by means of a spring balance, as illustrated below.



The lift (elevator) is moving upwards and the readings of the spring balance are noted as follows.

Accelerating: R_a

Constant speed: R_c

Slowing down: R_s

Which **one** of the following is a correct relationship between the readings?

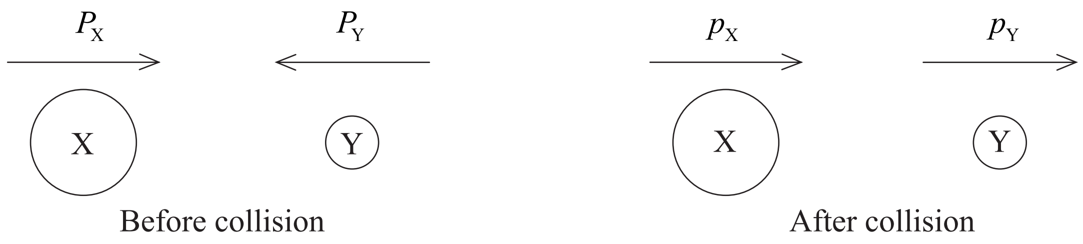
A. $R_a > R_c$

B. $R_a = R_s$

C. $R_c = R_s$

D. $R_c < R_s$

10. Two spheres X and Y are moving towards each other along the same straight line with momenta of magnitude P_X and P_Y respectively. The spheres collide and move off with momenta p_X and p_Y respectively, as illustrated below.



Which **one** of the following is a correct statement of the law of conservation of momentum for this collision?

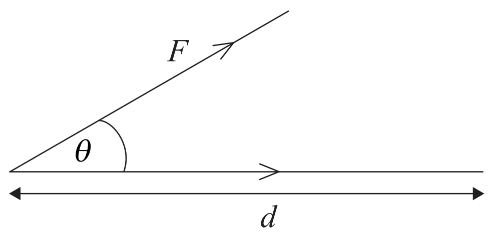
A. $P_X + P_Y = p_X + p_Y$

B. $P_X - P_Y = p_X + p_Y$

C. $P_X - P_Y = p_X - p_Y$

D. $P_X + P_Y = p_X - p_Y$

11. The point of action of a constant force F is displaced a distance d. The angle between the force and the direction of the displacement is θ, as shown below.



Which **one** of the following is the correct expression for the work done by the force?

A. Fd

B. $Fd\ \sin\theta$

C. $Fd\ \cos\theta$

D. $Fd\ \tan\theta$

12. Which **one** of the following is a true statement about energy?

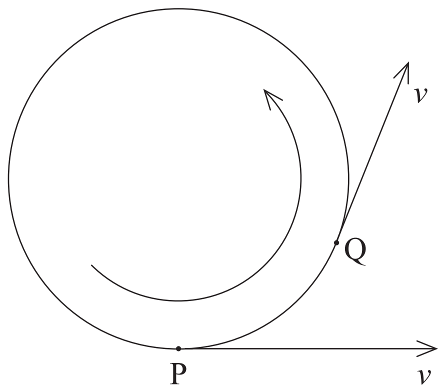
A. Energy is destroyed due to frictional forces.

B. Energy is a measure of the ability to do work.

C. More energy is available when there is a larger power.

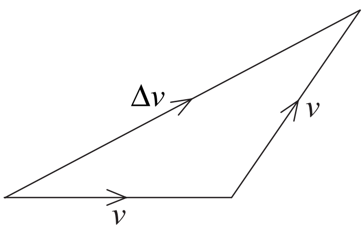
D. Energy and power both measure the same quantity.

13. A point mass is moving in a horizontal circle with a velocity of constant magnitude v. At one particular time, the mass is at P. A short time later, the mass is at Q, as shown below.

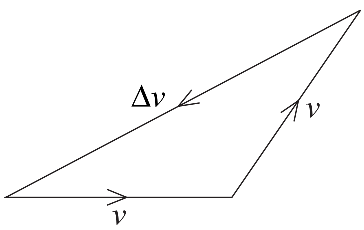


Which vector diagram correctly shows the change in velocity Δv of the mass during this time?

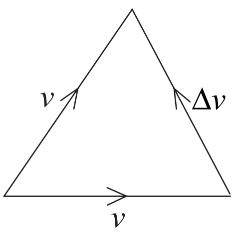
A.



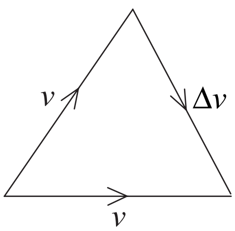
B.



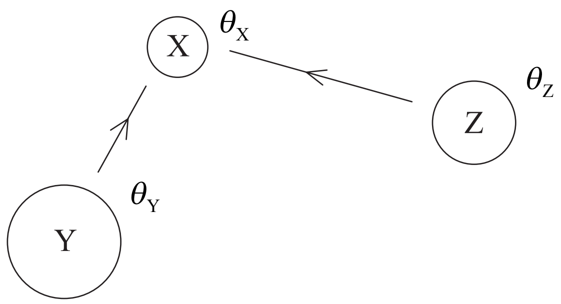
C.



D.



14. Three bodies X, Y and Z are at temperatures θ_X, θ_Y and θ_Z respectively. Thermal energy passes freely from Y to X and also from Z to X, as illustrated below.



The direction of flow of thermal energy, if any, between Y and Z is unknown.

What can de deduced about the temperatures θ_X, θ_Y and θ_Z ?

A. $\theta_X = (\theta_Y + \theta_Z)$

B. $\theta_Y = \theta_Z$

C. $\theta_Y > \theta_X$

D. $\theta_X > \theta_Z$

15. During an experiment, a solid is heated from 285 K to 298 K.

Which **one** of the following gives the rise in temperature, in deg C, and the final temperature, in ˚C, of the solid?

	Rise in temperature in deg C	Final temperature in ˚C
A.	13	571
B.	13	25
C.	286	571
D.	286	25

16. A liquid is contained in a dish open to the atmosphere.

Which **one** of the following contains three factors that affect rate of evaporation of the liquid?

A.	Temperature of the liquid	Surface area	Specific latent heat of vaporisation
B.	Temperature of the liquid	Mass of liquid	Specific latent heat of vaporisation
C.	Surface area	Mass of liquid	Temperature of the liquid
D.	Mass of liquid	Surface area	Specific latent heat of vaporisation

17. The equation of state of an ideal gas is

$$pV = nRT.$$

In this equation, the constant n is the number of

A. atoms in the gas.

B. molecules in the gas.

C. particles in the gas.

D. moles of the gas.

18. The wavelength of a progressive transverse wave is defined as

A. the distance between a crest and its neighbouring trough.

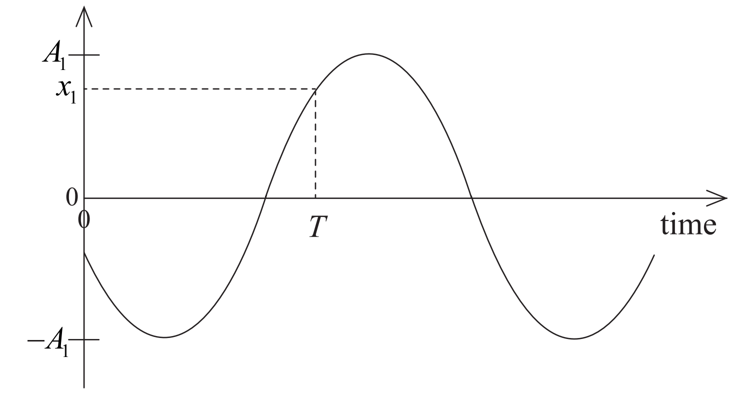
B. the distance between any two crests of the wave.

C. the distance moved by a wavefront during one oscillation of the source.

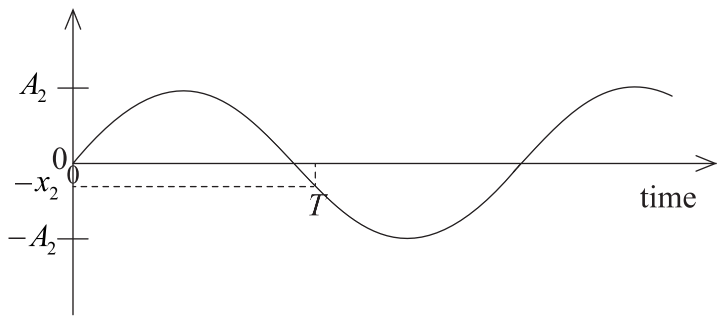
D. the distance moved by a particle in the wave during one oscillation of the source.

19. The two graphs show the variation with time of the individual displacements of two waves as they pass through the same point.

displacement



displacement



The displacement of the resultant wave at the point at time T is equal to

A. $x_1 + x_2$.

B. $x_1 - x_2$.

C. $A_1 + A_2$.

D. $A_1 - A_2$.

20. Which **one** of the following is **not** a true statement about a standing wave in one dimension?

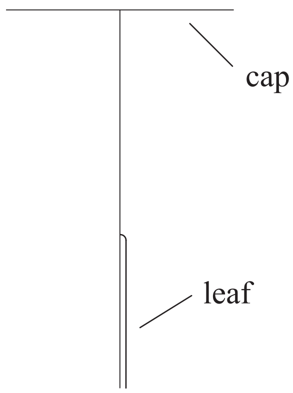
A. A standing wave is formed by the superposition of two progressive waves.

B. A standing wave stores energy but does not transfer it.

C. The wavelength of the standing wave is the distance between adjacent nodes.

D. The amplitude of vibration varies along the standing wave.

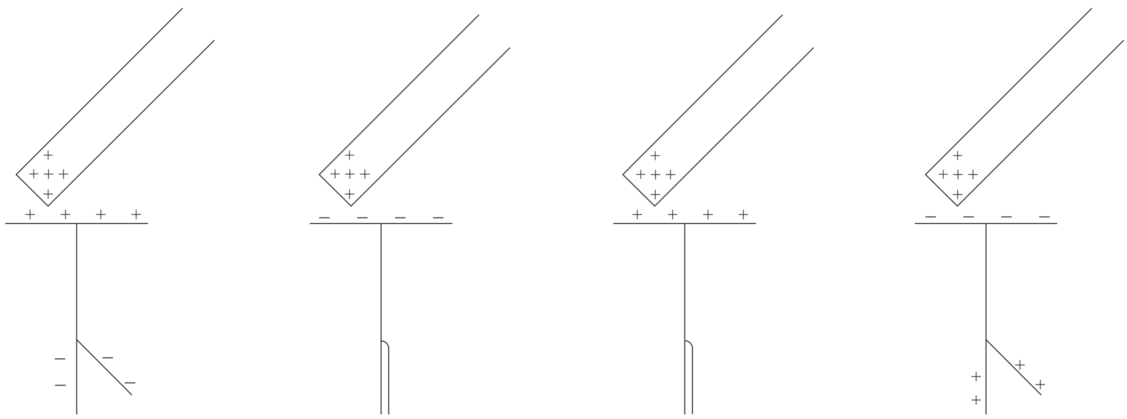
21. The leaf and cap of an uncharged gold-leaf electroscope are shown below.



A positively charged rod is brought near to the cap of the electroscope.

Which diagram best shows the distribution of charge on the electroscope?

A. B. C. D.



22. The electric field strength at a point may be defined as

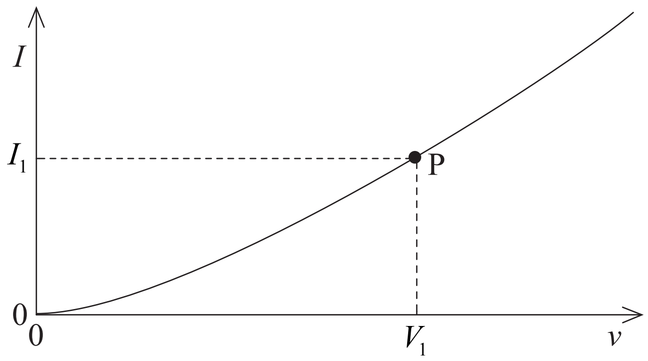
A. the force exerted on unit positive charge placed at that point.

B. the force per unit positive charge on a small test charge placed at that point.

C. the work done on unit positive charge to move the charge to that point from infinity.

D. the work done per unit positive charge to move a small test charge to that point from infinity.

23. The graph shows the variation with applied potential difference V of the current I in an electrical component.



Which **one** of the following gives the resistance of the component at point P?

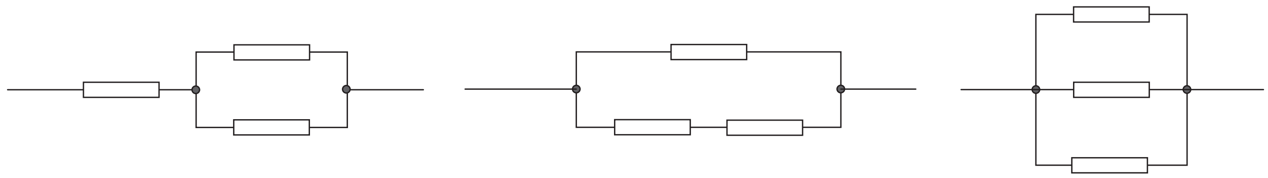
A. The gradient of the line at P

B. The reciprocal of the gradient of the line at P

C. The ratio $\frac{I_1}{V_1}$

D. The ratio $\frac{V_1}{I_1}$

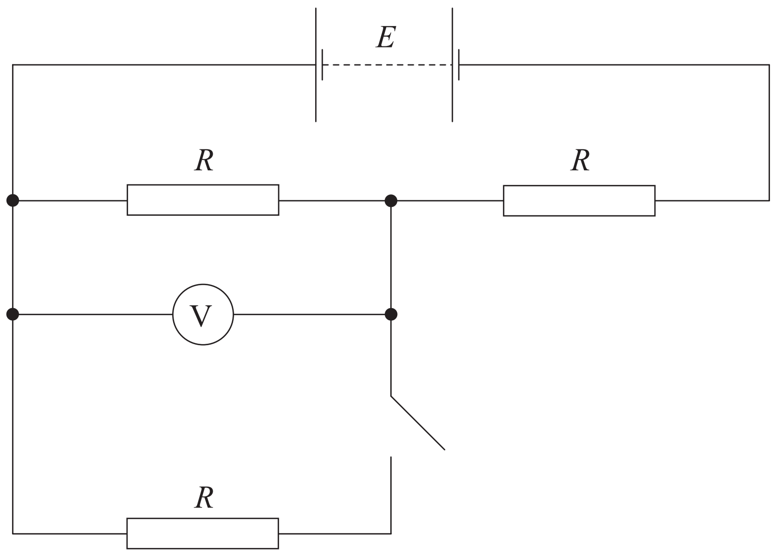
24. The diagrams below show combinations X, Y and Z of three resistors, each resistor having the same resistance.



Which **one** of the following shows the resistances of the combinations in increasing order of magnitude?

	lowest	→	**highest**
A.	Y	X	Z
B.	Z	X	Y
C.	X	Y	Z
D.	Z	Y	X

25. A battery of e.m.f. E and negligible internal resistance is connected to three resistors, each of resistance R, a voltmeter and a switch, as shown below.

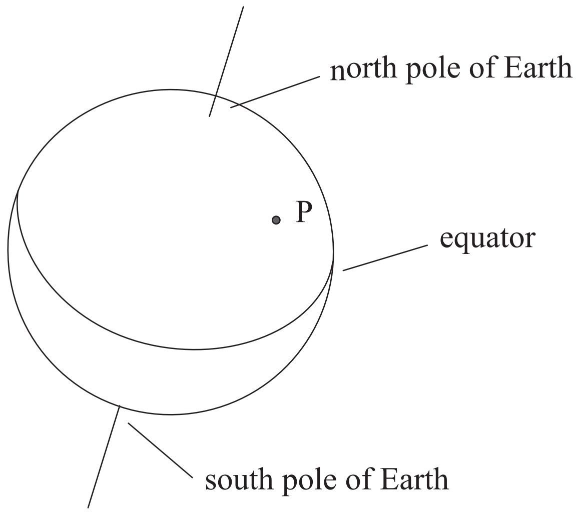


The voltmeter has infinite resistance.

What are the readings on the voltmeter when the switch is open and when it is closed?

	Switch open	**Switch closed**
A.	0	less than ½ E
B.	0	½ E
C.	½ E	less than ½ E
D.	½ E	½ E

26. The diagram below shows a point P on the Earth's surface at which a compass needle is suspended freely.



Which **one** of the following gives the correct direction in which the needle of the compass will point?

	Plane of compass needle	Direction of north pole of compass
A.	Horizontal	Towards north pole of Earth
B.	Horizontal	Towards south pole of Earth
C.	At an angle to the horizontal	Towards north pole of Earth
D.	At an angle to the horizontal	Towards south pole of Earth

27. The definition of the unit of current, the ampere, is based on

A. the force per unit length on a conductor in a uniform magnetic field.

B. the force per unit length on parallel current-carrying conductors.

C. the charge per unit time delivered by a cell of e.m.f. 1.0 V.

D. the charge passing a point per unit time in an electrical circuit.

28. Ag-102, Ag-103 and Ag-104 are three isotopes of the element silver.

Which **one** of the following is a true statement about the nuclei of these isotopes?

A. All have the same mass.

B. All have the same number of nucleons.

C. All have the same number of neutrons.

D. All have the same number of protons.

29. Radioactive decay is a *random* process. This means that

A. a radioactive sample will decay continuously.

B. some nuclei will decay faster than others.

C. it cannot be predicted how much energy will be released.

D. it cannot be predicted when a particular nucleus will decay.

30. A freshly-prepared sample of cobalt-64 $\left({}^{64}_{27}\text{Co}\right)$ decays by the emission of γ-ray photons. The decay may be represented by the nuclear equation

$${}^{64}_{27}\text{Co} \rightarrow {}^{64}_{27}\text{Co} + \text{energy}.$$

After this decay, the binding energy per nucleon has

A. increased in magnitude because energy has been emitted from the nucleus.

B. decreased in magnitude because energy has been emitted from the nucleus.

C. stayed constant because the number of nucleons in the nucleus is unchanged.

D. stayed constant because the proton number is unchanged.