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**PHYSICS**
STANDARD LEVEL
PAPER 1

Tuesday 13 November 2012 (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.
- A clean copy of the **Physics** Data Booklet is required for this paper.
- The maximum mark for this examination paper is [30 marks].

1. The graph shows the relationship between two quantities p and q. The gradient of the graph is r and the intercept on the p axis is s.
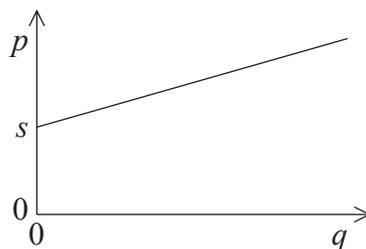
Which of the following is the correct relationship between p and q?

A. $p = sq + r$

B. $p = rq + s$

C. $p = rq - s$

D. $p = rs + q$

2. Aiming for the centre of a target, an archer fires arrows which produces a pattern of hits as shown below.
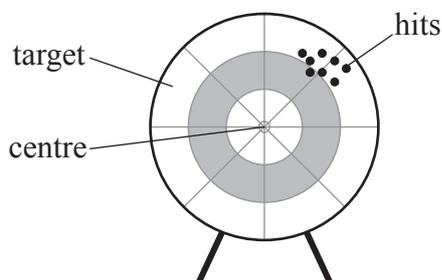
The pattern suggests the presence of

A.   random and systematic uncertainties.

B.   random uncertainties but no systematic uncertainties.

C.   systematic uncertainties but no random uncertainties.

D.   neither random nor systematic uncertainties.

3. The acceleration of free fall g is determined by the relationship $g = \dfrac{4\pi^2 l}{t^2}$. The uncertainty in the value of l is 2 % and the uncertainty in the value of t is 5 %. What is the uncertainty in g?

A.   3 %

B.   7 %

C.   8 %

D.   12 %

4. What is the correct SI unit for momentum?

A. $kg\,m^{-1}\,s^{-1}$

B. $kg\,m^2\,s^{-1}$

C. $kg\,m\,s^{-1}$

D. $kg\,m\,s^{-2}$

5. An object is thrown upwards leaving the thrower's hand at time $t=0$. Which graph shows how speed v varies with t as the object rises and falls?

A.

B.

C.

D.
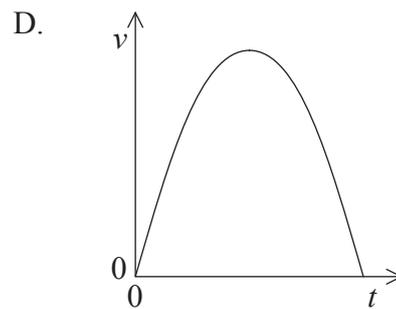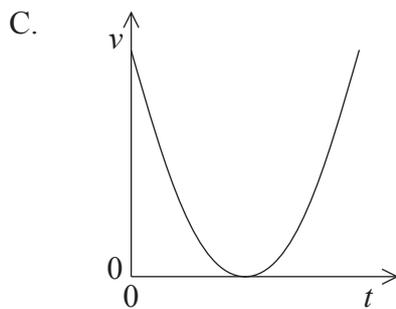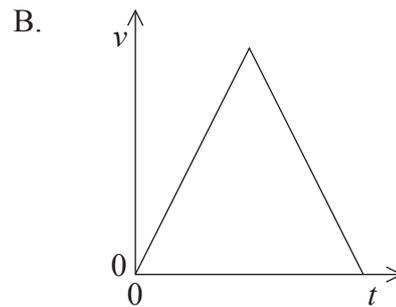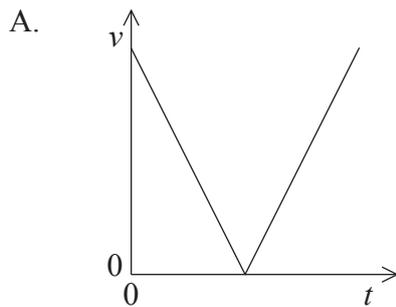
6. A ball of mass m travels horizontally with speed v before colliding with a vertical wall. The ball rebounds at speed v in a direction opposite to its initial direction. What is the magnitude of the change in momentum of the ball?

A.   0

B. $\dfrac{mv}{2}$

C. mv

D. $2mv$

7. A block rests on a plane inclined at an angle θ to the horizontal. Which of the following gives the relationships for the normal reaction N and the frictional force F with the weight W?
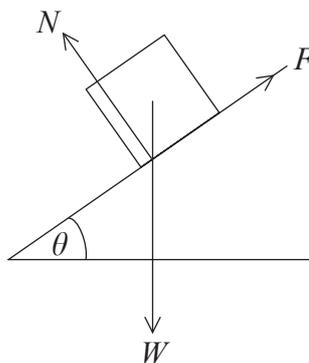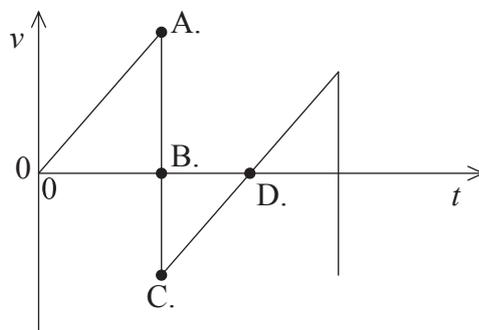

	N	F
A.	$W\sin\theta$	$W\sin\theta$
B.	$W\sin\theta$	$W\cos\theta$
C.	$W\cos\theta$	$W\sin\theta$
D.	$W\cos\theta$	$W\cos\theta$

8. Three coplanar forces of $5\,\text{N}$, $6\,\text{N}$ and $7\,\text{N}$ act on an object. Which force could **not** be the resultant of these three forces?

    A. $0\,\text{N}$

    B. $11\,\text{N}$

    C. $13\,\text{N}$

    D. $19\,\text{N}$

9. A ball is released at time $t=0$ above a horizontal surface. The graph shows the variation of velocity v with time. Which of the following shows the highest point of the ball after one bounce?

10. A driving force F acts on a car which moves with constant velocity v. The quantity Fv is equivalent to the

    A.   useful power developed by the engine of the car.

    B.   work done by the car against resistive forces.

    C.   energy of the car.

    D.   rate of change of momentum of the car.

11.   What is the acceleration of an object rotating with constant speed v in a circle of radius r?

  A.   Zero

  B. $\dfrac{v^2}{r}$ towards the centre of the circle

  C. $\dfrac{v^2}{r}$ away from the centre of the circle

  D. $\dfrac{v^2}{r}$ along a tangent to the circle

12.   A mass of $0.20\,kg$ of water at $20\,°C$ is mixed with $0.40\,kg$ of water at $80\,°C$. No thermal energy is transferred to the surroundings. What is the final temperature of the mixture?

  A. $30\,°C$

  B. $40\,°C$

  C. $50\,°C$

  D. $60\,°C$

13.   What is the temperature, in K, that is equivalent to $57\,°C$?

 A.   220

  B.   273

  C.   330

  D.   430

14. The internal energy of any substance is made up of the

    A.   total random kinetic and potential energy of its molecules.

    B.   total potential energy of its molecules.

    C.   total random kinetic energy of its molecules.

    D.   total vibrational energy of its molecules.

15. An object undergoes simple harmonic motion. Which graph shows the relationship between the acceleration a and the displacement x from the equilibrium position?

A.

B.

C.

D.
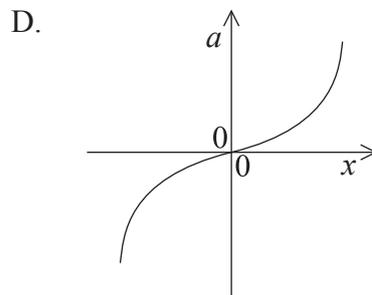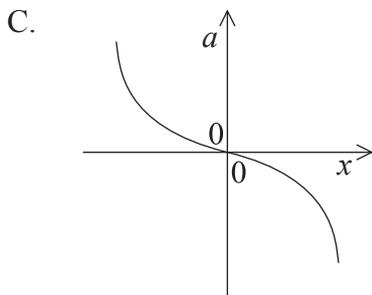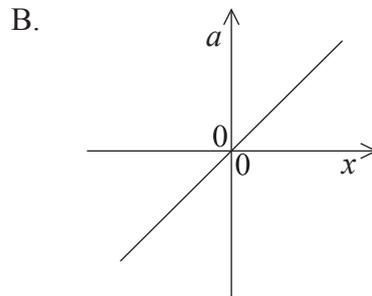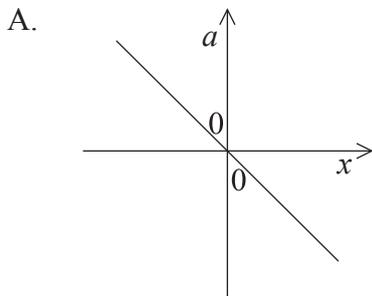
**16.** What property of a driving system must be approximately equal to that of the oscillating system for resonance to occur?

    A.   Amplitude

    B.   Displacement

    C.   Frequency

    D.   Kinetic energy

17. Waves emitted from sources X and Y have equal wavelengths and are initially in phase. The waves interfere destructively at point P, where the path difference is 0.60 m.

X •

      • P

Y •
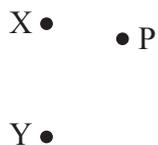
What is a possible value for the wavelength of the waves?

A. 0.20 m

B. 0.30 m

C. 0.40 m

D. 0.60 m

18. Three resistors each of resistance R are connected as shown.
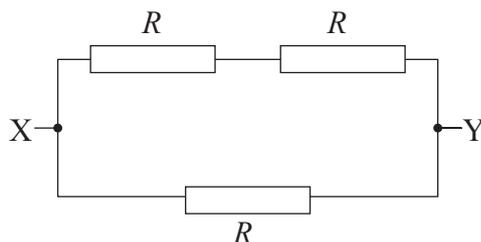

What is the total resistance between X and Y?

A. $\dfrac{R}{3}$

B. $\dfrac{2}{3}R$

C. $\dfrac{3}{2}R$

D. $3R$

19. An ideal ammeter is used to measure the current in a resistor. Which of the following gives the resistance of an ideal ammeter and the way it is connected to the resistor?

	Resistance	**Connection**
A.	infinite	in parallel
B.	infinite	in series
C.	zero	in parallel
D.	zero	in series

20. A cell with an emf of 2.0 V and negligible internal resistance is connected across a 1.00 m length of uniform resistance wire XY. The free end of the flying lead can be connected to any position on the wire.
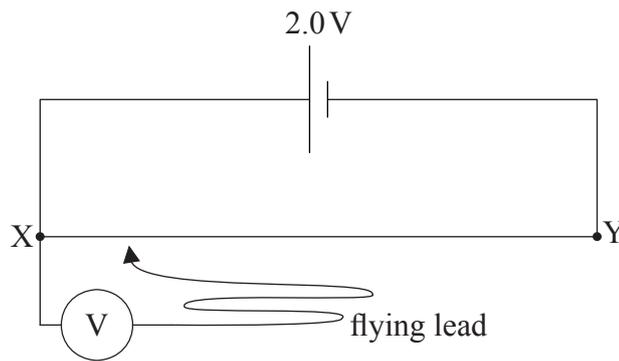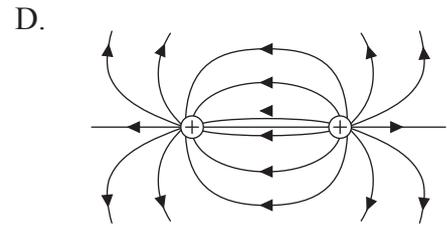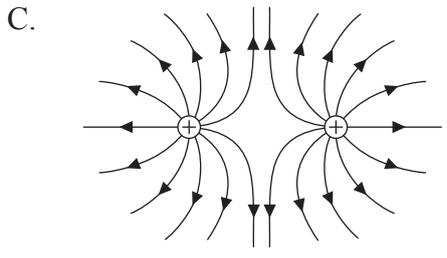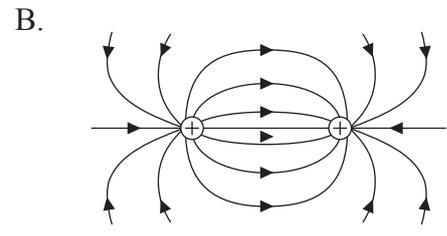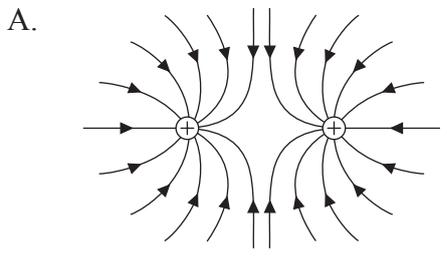

What is the voltmeter reading when the flying lead is connected 0.25 m from end X?

A.   0.00 V

B.   0.50 V

C.   1.50 V

D.   2.00 V

21. An electron has a kinetic energy of 4.8×10^{-10} J. What is the equivalent value of this kinetic energy?

   A. $3.0\,\text{eV}$

   B. $3.0\,\text{keV}$

   C. $3.0\,\text{MeV}$

   D. $3.0\,\text{GeV}$

22. Which diagram shows the electric field pattern surrounding two equal positive point charges?

   A.

   B.

   C.

   D.

23. The centres of two planets are separated by a distance R. The gravitational force between the two planets is F. What will be the force between the planets when their separation increases to $3R$?

   A. $\dfrac{F}{9}$

   B. $\dfrac{F}{3}$

   C. F

   D. $3F$

24. The magnetic field produced by a current in a straight wire is in

    A.   the same direction as the current.

    B.   the opposite direction to the current.

    C.   the same plane as the wire.

    D.   any plane perpendicular to the wire.

25. Which energy resource is renewable?

    A.   Natural gas

    B.   Uranium

    C.   Biogas

    D.   Coal

26. For a black-body at absolute temperature T the power emitted per unit area is P. What is the power emitted per unit area when the temperature is decreased to $\frac{1}{2}T$?

    A. $\dfrac{P}{32}$

    B. $\dfrac{P}{16}$

    C. $\dfrac{P}{8}$

    D. $\dfrac{P}{4}$

27. The intensity of radiation from a star at the surface of one of its planets is I. The distance between the star and the planet is d.

What is the intensity at the surface of another planet which is a distance $\dfrac{d}{4}$ from the star?

A. $4I$

B. $8I$

C. $16I$

D. $64I$

28. Which of the following would **not** reduce the effects of the enhanced greenhouse effect?

A. Replacing natural gas power stations with those using oil

B. Replacing conventional vehicles with hybrid vehicles

C. Replacing fossil fuel power stations with those using nuclear fuel

D. Increasing the use of carbon dioxide capture and storage

29. In the Geiger–Marsden experiment alpha particles were directed at a thin gold foil. Which of the following shows how the majority of the alpha particles behaved after reaching the foil?

A.

foil

alpha
particles

B.

foil

alpha
particles

C.

foil

alpha
particles

D.

foil

alpha
particles
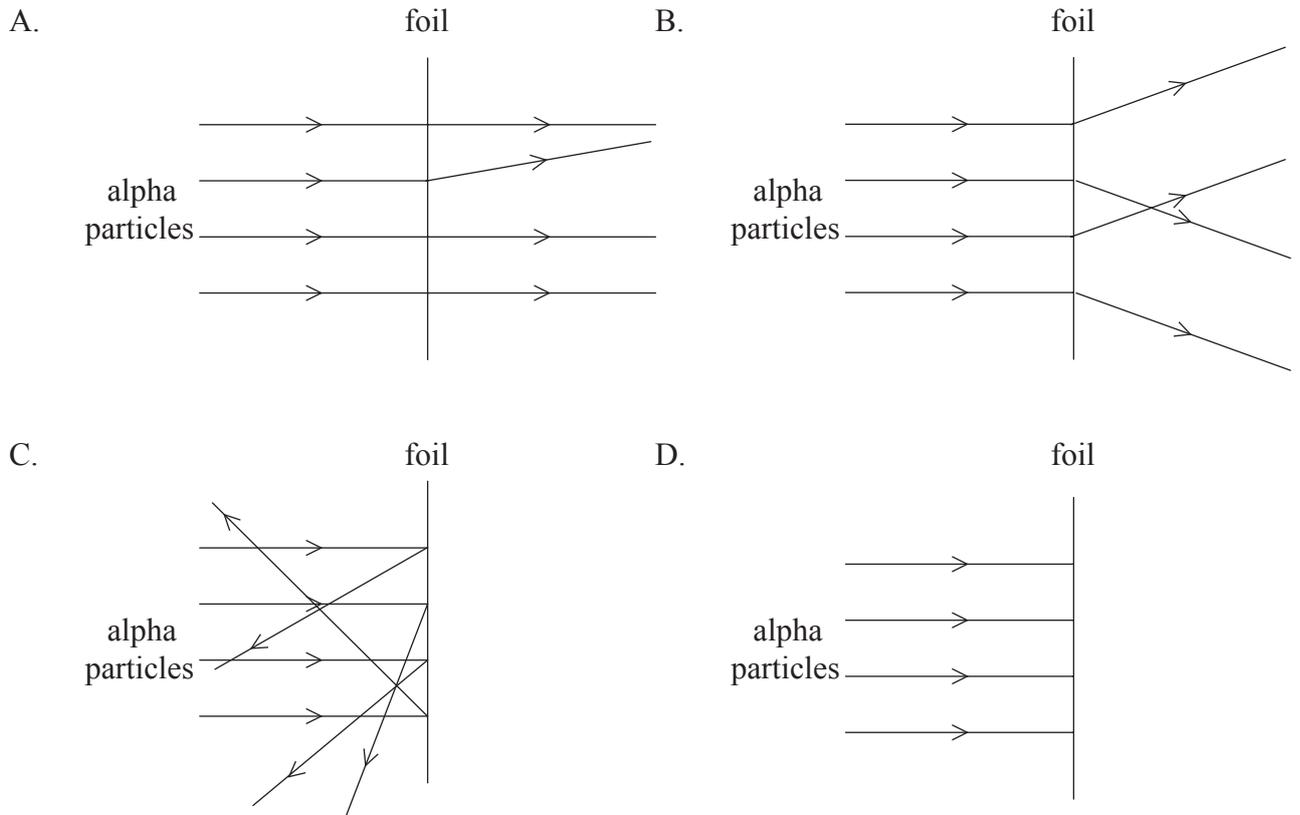
30. The graph shows the relationship between binding energy per nucleon and nucleon number. In which region are nuclei most stable?

binding energy per nucleon

C.

D.

B.

A.

0

0   50   100   150   200   250

nucleon number