1 What is a reasonable estimate of the average kinetic energy of an athlete during a 100 m race that takes 10 s?

A 40 J **B** 400 J **C** 4000 J **D** 40 000 J

2 When a force F moves its point of application through a displacement S in the direction of the force within a time t, the power P generated by the force is given by

$$P = \frac{FS}{t}$$

How many vector quantities and scalar quantities does this equation contain?

A One scalar quantity and three vector quantities

B Two vector quantities and two scalar quantities

C Four scalar quantities

D Four vector quantities

3 What is a possible unit for the product VI, where V is the potential difference across a resistor and I is the current through the same resistor?

A newton per second $(N\ s^{-1})$

B newton second $(N\ s)$

C newton metre $(N\ m)$

D newton metre per second $(N\ m\ s^{-1})$

4 A small steel ball falls from rest through a distance of m. When calculating the time of fall, air resistance can be ignored because

A Air is less dense than steel.

B Air resistance increases with the speed of the ball.

C The air is not moving.

D Air resistance is much less than the weight of the ball.

5   Two identical metal spheres are held above the ground as shown.
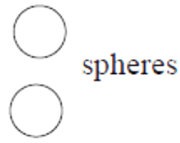
spheres

(not to scale)

ground

The separation between them is small compared to their distance above the ground.
When the spheres are released, the separation of the spheres will

A Remain constant.

B Decrease continuously.

C Increase continuously.

D Increase initially and then remain constant.

6   What is the condition for an object to be in translational equilibrium?

A The forces acting upwards are equal to the forces acting downwards.

B The object must be at rest.

C The object must be moving at constant speed.

D There is no resultant force on the object in any direction.

**7** A student uses a metre rule and a set-square to measure a series of vertical heights, as shown.
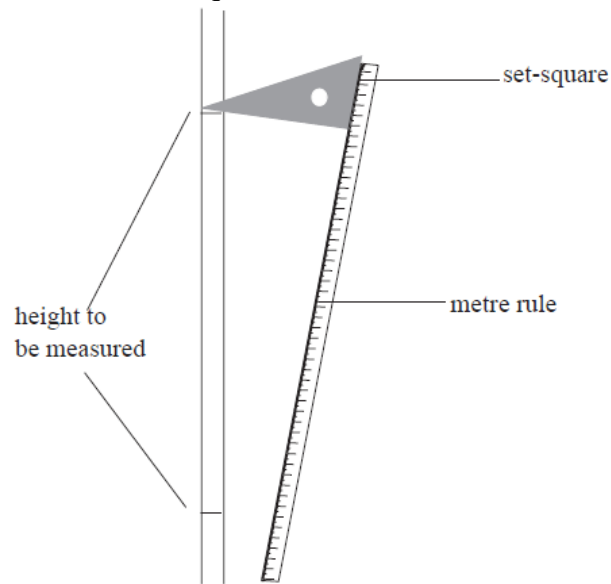
What type of error is reduced by using a set-square and what type of error is caused because the metre rule is not vertical respectively?

**A** Random, random

B Random ,systematic

C Systematic, random

D Systematic ,systematic

8 A box of weight W is moved at constant velocity v along a horizontal floor. There is a constant frictional force F between the box and the floor.
What is the power required to move the box through a distance s?

A Fs　　　　　　　**B** Fv　　　　　　　**C** Ws　　　　　　　**D** Wv

9 The diagram below shows two vectors X and Y.
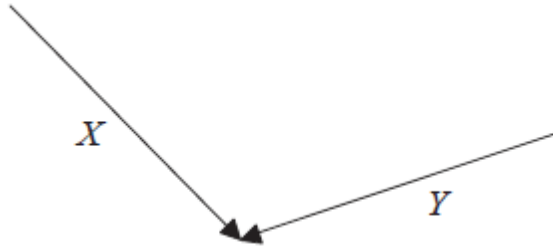
X Y Which of the following best represents the vector Z = X − Y ?

A.

B.

C.

D.
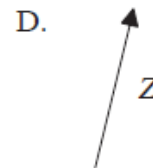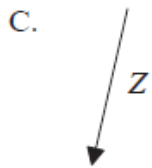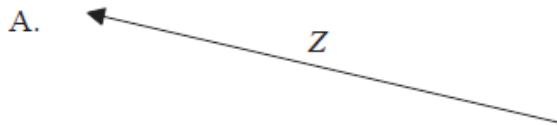
10 The period T of oscillation of a mass m on a spring, having spring constant k is $T = 2\pi\sqrt{\dfrac{m}{k}}$.

The uncertainty in k is 11 % and the uncertainty in m is 5 %.
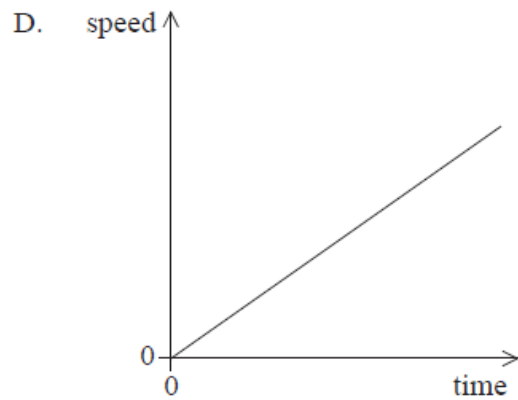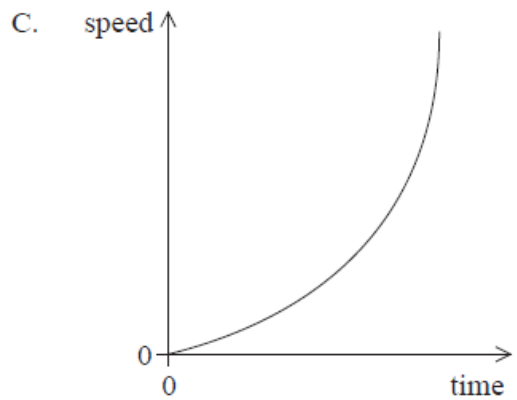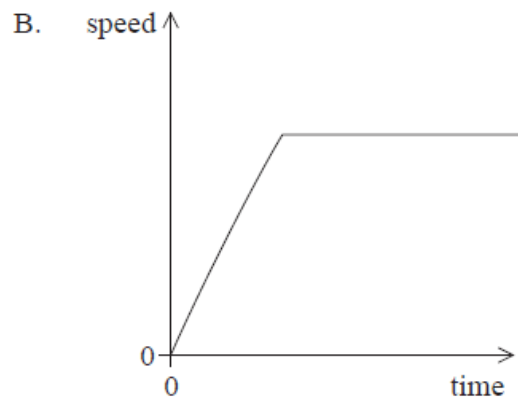The approximate uncertainty in T is

A 4 %.   **B** 6 %   **C** 8 %   **D** 16 %.

11 Steel sphere is dropped from rest in oil. Which of the following graphs best represents the variation with time of the speed of the sphere?

A.

B.

C.

D.
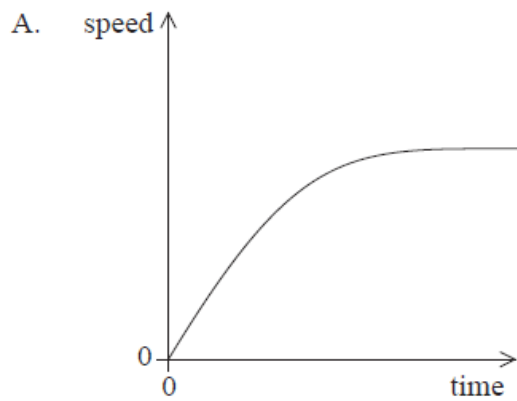
12 The graph below shows the variation with time t of the acceleration a of an object from $t = 0$ to $t = T$.
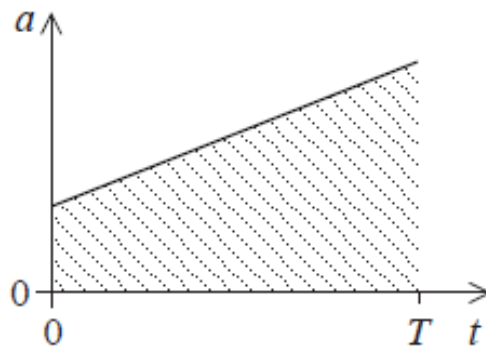
The shaded area under the graph represents change in

A displacement.   B velocity.   C momentum.   D kinetic energy.

13 Diagram below shows the trajectory of a ball thrown into the air. There is no air resistance.

trajectory of ball
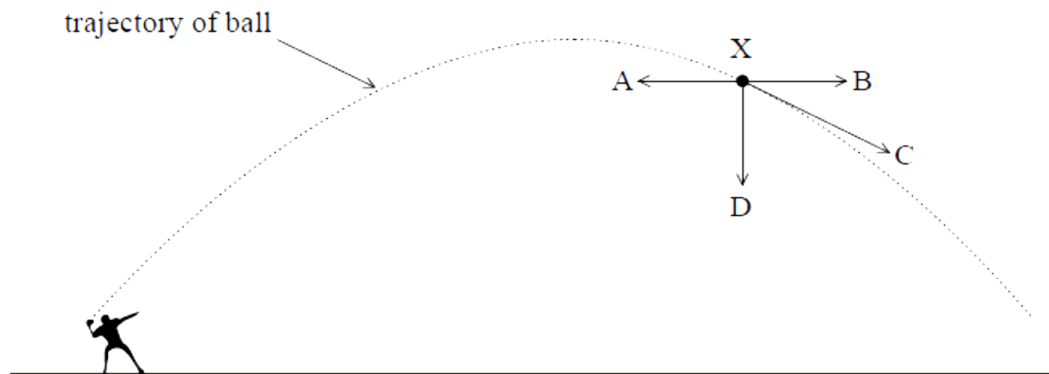
Which arrow gives the direction of the resultant force on the ball at the point X?

A A **B** B **C** C **D** D

14 Trolley of mass 1.5 kg is pulled along a horizontal table by a force of 5.0 N.

mass 1.5 kg

force 5.0 N ←
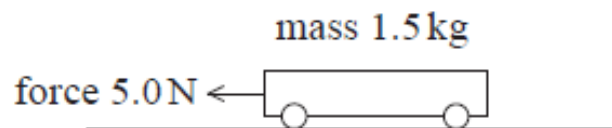
The frictional force acting on the trolley is 0.50 N. The acceleration of the trolley is

A 0.30 m s^{-2}.

B 0.33 m s^{-2}.

C 3.0 m s^{-2}.

D 3.3 m s^{-2}.

15 A load is to be moved using a wheelbarrow. The total mass of the load and   wheelbarrow   is 60 kg.

What is the size of force F needed just to lift the loaded wheelbarrow?

A 343 N **B** 424 N **C** 588 N **D** 839 N

16 The velocity v of a small steel ball falling in a viscous liquid inside a long vertical tube varies with time t, as follows:
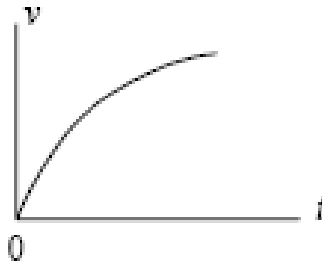
Which of the following graphs best represents the variation of the viscous force F acting   on the body?

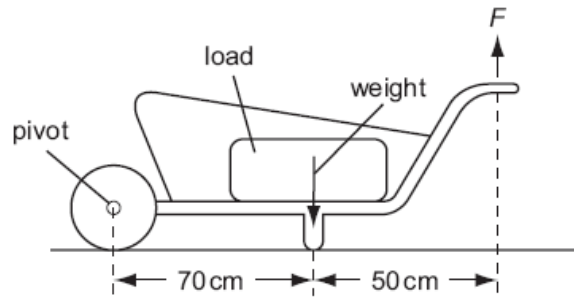**A**   **B**   **C**   **D**
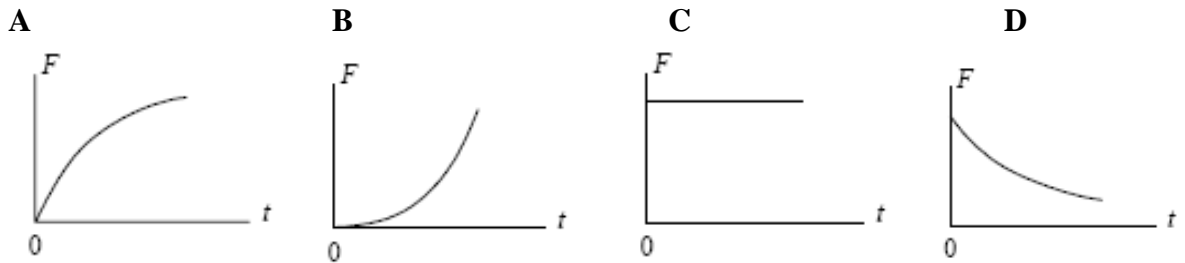
17 Two bodies are allowed to fall freely from the same location, one of which is   released a short time before the other. If the air resistance can be neglected, while   they are falling,
  (1) the two bodies have the same acceleration.
  (2) their speeds always differ by the same amount.
  (3) their distance of separation is always the same.

A (1), (2) and (3) **B** (1) and (2) only **C** (2) and (3) only **D** (1) only

18 Electric motor has an input power of 160 W. In raising a load, 120 W of power is dissipated. The best estimate for the efficiency of the motor is

A 25 %.   **B** 33 %.   **C** 57 %.   **D** 75 %.

19 A concrete cube of side 0.60 m and uniform density 2.0×10^3 kg m^{-3} is lifted 5.0 m vertically by a crane. What is the change in potential energy of the cube?

A 2.2 kJ   **B** 21 kJ   **C** 59 kJ   **D** 450 kJ

20 What is the internal energy of an object?

A It is the energy associated with the object's movement through space.

B It is the energy associated with the random movement of the molecules in the object.

C It is the energy due to the attractions between the molecules in the object.

D It is the sum of all the microscopic potential and kinetic energies of the molecules in the object

21 Pollen grains are suspended in a liquid and are illuminated strongly. When observed under a microscope they are seen to be in continuous random motion.
What is the reason for this?

A convection currents in the liquid

B evaporation of the liquid

C molecules of the liquid colliding with the pollen grains

D pollen grains colliding with each other

22 Which line in the table gives approximate ratios of density and molecular spacing for a substance in its solid, liquid and gas phases?

	density	molecular spacing
	solid : liquid : gas	solid : liquid : gas
A	1000 : 1000 : 1	1 : 1 : 10
B	1000 : 100 : 1	1 : 10 : 1000
C	1000 : 1000 : 1	1 : 1 : 1000
D	1000 : 100 : 1	1 : 10 : 100

[Turn Over

23 Which two substances are normally both crystalline?

A copper and diamond

B copper and glass

C diamond and glass

D diamond and rubber

24 What is represented by the gradient of a graph of force (vertical axis) against extension (horizontal axis)?

A elastic limit

B spring constant

C stress

D the Young modulus

25 What is the unit of the Young modulus?

A $N\,m^{-1}$ B $N\,m$ C $N\,m^{-2}$ D $N\,m^{2}$

26 A steel wire of diameter d is found to have a strain of 1.0×10^{-4} when supporting a certain load. This wire is replaced by a second wire of the same material and of the same length but of diameter $0.5\,d$.
What is the strain when the second wire supports the same load, assuming that neither wire exceeds its elastic limit?

A 8.0×10^{-4} B 4.0×10^{-4} C 2.0×10^{-4} D 5.0×10^{-5}

27 Two solid substances P and Q have atoms of mass M_p and M_Q respectively. They have N_p and N_Q atoms per unit volume.
The density of P is smaller than the density of Q.
Which of the following **must** be correct?

A $M_p < M_Q$

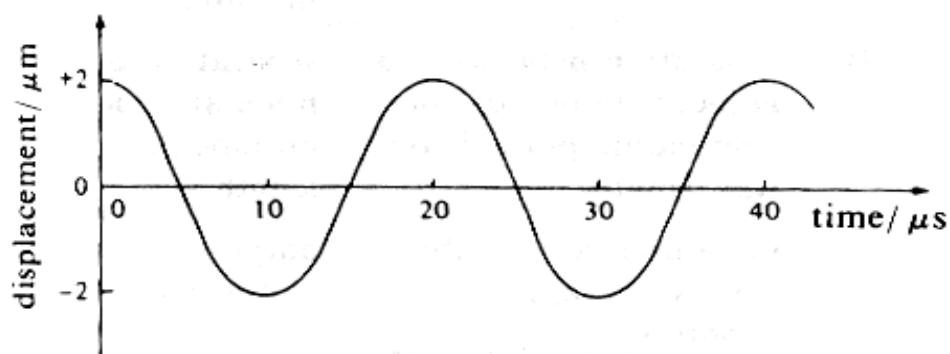B $N_p < N_Q$

C $M_p N_p < M_Q N_Q$

D $M_p / N_p < M_Q / N_Q$

28 The phenomenon of diffraction is associated with

   A sound waves only.

   B light waves only.

   C water waves only.

   D all waves.

29 A wave of amplitude 20 mm has intensity I_X. Another wave of the same frequency but of amplitude 5 mm has intensity I_Y. What is I_X/I_Y?

   A 2   **B** 4   **C** 16   **D** 256

30 .

The figure above represents the propagation of a particle in a progressive wave traveling at a speed of 5.0 km s^{-1}.
What is the wavelength?

   A 10 mm   **B** 15 mm   **C** 50 mm   **D** 100 mm

31 A progressive simple harmonic wave has a frequency of 150Hz and a velocity of 30ms^{-1}. The phase difference between two vibrating points which are 10cm apart is

   A 0 rad   **B** $\pi/2$ rad   **C** π rad   **D**. 2π rad

32 Which statement is true for standing (stationary) waves?

   A All points in the wave vibrate in phase.

   B There is no energy in a standing wave.

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

   D Neighbouring points in the wave have different amplitudes of vibration.

33 The diagram below represents the fundamental (first harmonic) standing wave of sound inside a pipe.

pipe
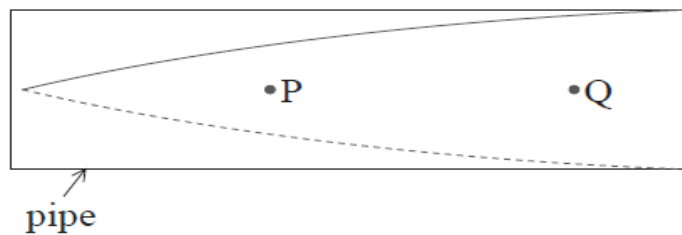
Which of the following correctly represents the displacement of the air at P and Q?

34 Which two conditions are necessary for observable interference between two light beams?

A meet at a point constant phase difference

B constant phase difference similar amplitude

C same frequency similar amplitude

D similar amplitude meet at a point

35 When monochromatic light of wavelength 5.0×10^{-7} m is incident normally on a plane diffraction grating, the second order diffraction line are formed at angles of 30° to the normal to the grating.
What is the number of lines per millimeter of the grating?

   A 250   **B** 500   **C** 1000   **D** 2000

36 Under which conditions will the bright fringes of a double-slit light interference pattern be farthest apart?

|	distance between slits	distance from slits to screen	wavelength of source
A	small	large	short
B	small	large	long
C	large	small	short
D	large	small	long

37 The principle of superposition states that

   A the total displacement due to several waves is the sum of the displacements due to those waves acting individually.

   B two stationary waves superimpose to give two progressive waves.

   C a diffraction pattern consists of many interference patterns superimposed on one another.

   D two progressive waves superimpose to give a stationary wave.

**38** In the direction indicated by an electric field line,

   A the electric field strength must increase.

   B the electric field strength must decrease.

   C the potential must increase.

   D the potential must decrease.

39 Two parallel metal plates separated by a distance d have a potential difference V across them. What is the magnitude of the electrostatic force acting on a charge Q placed midway between the plates?
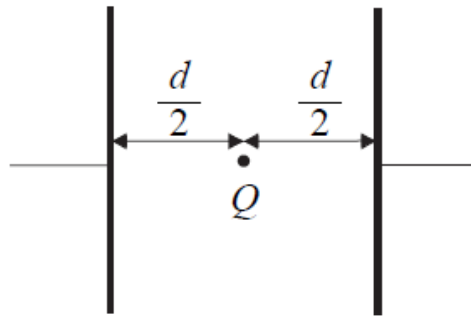
A $\dfrac{2VQ}{d}$

B $\dfrac{VQ}{2d}$

C $\dfrac{VQ}{d}$

D $\dfrac{Qd}{V}$

40 An electron enters a region a space where there is a uniform electric field E as shown below.
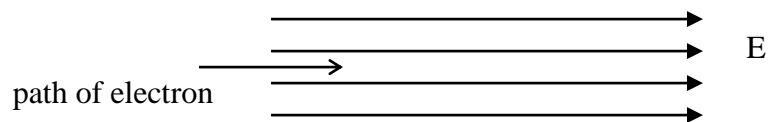
Initially, the electron is moving parallel to and in the direction of the electric field. What is the subsequent path and change of speed of the electron?

	path of electron	change of speed of electron
A	linear	decreases
B	linear	increases
C	parabolic	decreases
D	parabolic	increases