1. Which list of SI units contains only base units?

A. newton, kelvin, second, volt, mole
B. kilogram, metre, second, ohm, mole
C. kilogram, newton, metre, ampere, ohm
D. Kelvin, metre, mole, ampere, kilogram

2. Convert 3400 N cm^{-2} to N m^{-2}

A. 3.4 x 10^{-1} Nm^{-2}
B. 3.4 x 10^{1} Nm^{-2}.
C. 3.4 x 10^{5} Nm^{-2}
D. 3.4 x 10^{7} Nm^{-2}

3. Four physical quantities P, Q, R & S are related by the equation P = Q – RS
Which of the statement must be correct for the equation to be homogeneous?

A. P, Q, R & S all have the same units
B. P, Q, R & S are all scalar quantities
C. The product RS has the same units as P & Q
D. The product RS is numerically equal to (Q-P)

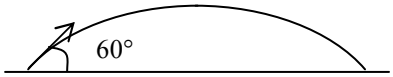
4. In an experiment to determine the acceleration of free fall, *g*, a lump of plasticine is released at height, *h* of 180.0 ± 0.1 cm. Time taken for the plasticine to fall through this height, *t*, is measured to be 0.6 ± 0.1 sec. Find the experimental acceleration with its absolute uncertainty.

A. (10.0 ± 0.3) ms^{-2}
B. (10 ± 3.3) ms^{-2}
C. (10 ± 3) ms^{-2}
D. (10.0 ± 3.0) ms^{-2}

5. An animal of mass 40 kg changes its velocity from 5.5 ms^{-1} due north to 10 ms^{-1} due west in order to escape from a predator. What is the magnitude of the change in the momentum of the animal?

A. 11.2 kg m s^{-1}
B. 180 kg m s^{-1}
C. 457 kg m s^{-1}
D. 620 kg m s^{-1}

6. A projectile leaves the ground at an angle of 60˚ to the horizontal. Its initial kinetic energy is K. Neglecting air resistance, find in terms of K its kinetic energy at the highest point of the motion.

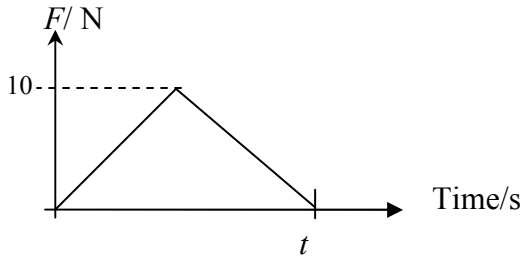


A. zero **B**. ½ K **C.** ¼ K **D**. K

7. A stone is dropped from the top of a tower of height 40 m. The stone falls from rest and air resistance is negligible.
What is the time taken for the stone to fall the last 20 m to the ground?

A. 0.84 s **B**. 2.0 s **C**. 2.5 s **D**. 2.9 s

8. When a force *F*, which varies with time is applied to a mass of 2kg, the gain in momentum after a time *t* is 40 $kgms^{-1}$. What is the time *t*?



A. 4.0 s B. 8.0 s C. 16.0 s D 32.0 s

9. Two asteroids in space collide inelastically. What happens to the kinetic energy and momentum?

	Kinetic energy	*momentum*
A.	conserved	conserved
B.	conserved	reduced
C.	reduced	conserved
D.	reduced	reduced

10. A spacecraft, of mass 4500kg, which is landing on the moon, uses its engines to keep its speed of descent constant at 5.0 ms^{-1} from the time when the craft is 14m above the Moon's surface until it is 4.0m above the surface. Calculate, for the spacecraft, the power of the engines while the speed is constant(gravity of the moon=1.67ms^{-2})

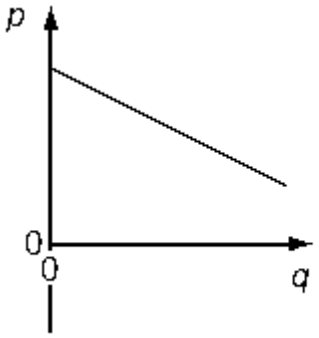
.

A 21kW
B 37.6kW
C 2207 kW
D 3090 kW

11 The probable maximum magnitude and the minimum magnitude for the resultant force are respectively 10N and 4N .The magnitude of the two forces are

A 3 N and 7 N
B 4 N and 6 N
C 4 N and 10 N
D 6 N and 14 N

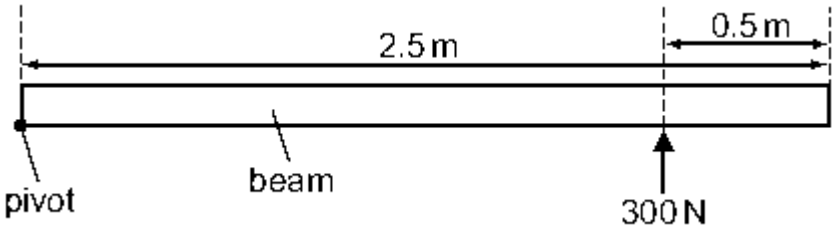
12 The graph shows how a certain quantity p varies with another quantity q for a parachutist falling at terminal speed.



What are the quantities p and q, and what is represented by the magnitude of the gradient of the graph?

	quantity p	**Quantity q**	**magnitude of gradient**
A	height	time	terminal speed
B	momentum	time	Weight of parachutist
C	height	potential difference	mass of parachutist
D	velocity	time	acceleration of free fall

13 A long uniform beam is pivoted at one end. A force of 300 N is applied to hold the beam horizontally.



What is the weight of the beam?

A 300 N **B** 480 N **C** 500 N **D** 960 N

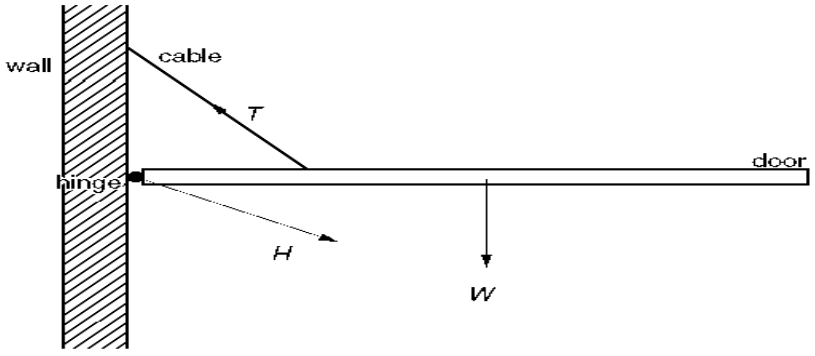
14 Which of the following experimental evidence does not support the wave nature of the electromagnetic radiation?

A Polarization
B Diffraction
C Interference fringe
D Photoelectric effect

15 A force *F* is applied to a freely moving object. At one instant of time, the object has velocity *v* and acceleration *a*.
Which quantities **must** be in the same direction?

A *a* and *v* only
B *a* and *F* only
C *v* and *F* only
D *v*, *F* and *a*

16 A hinged door is held closed in the horizontal position by a cable.
Three forces act on the door: the weight *W* of the door, the tension *T* in the cable, and the force *H* at the hinge.



Which list gives the three forces in **increasing** order of magnitude?

A *H*,*T*,*W* **B** *T*,*H*,*W* **C** *W*,*H*,*T* **D** *W*,*T*,*H*

17 A mass is raised vertically. In time t, the increase in its gravitational potential energy is Ep and the increase in its kinetic energy is Ek.
What is the average power input to the mass?

A (Ep – Ek)t
B (Ep + Ek)t
C (Ep + Ek)/ t
D (Ep – Ek)/ t

18 An area of land is an average of 2.0m below sea level. To prevent flooding, pumps are used to lift rainwater up to sea level.
What is the minimum pump output power required to deal with 1.3×10^9 kg of rain per day?

A 15 kW **B** 30 kW **C** 150 kW **D** 300 kW

19 A twig from a tree drops from a 200m high cliff on to a beach below. During its fall, 40% of the twig's energy is converted into thermal energy.
What is the speed with which the twig hits the beach?

A 35 ms^{-1} **B** 40 ms^{-1} **C** 49 ms^{-1} **D** 63 ms^{-1}

20 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

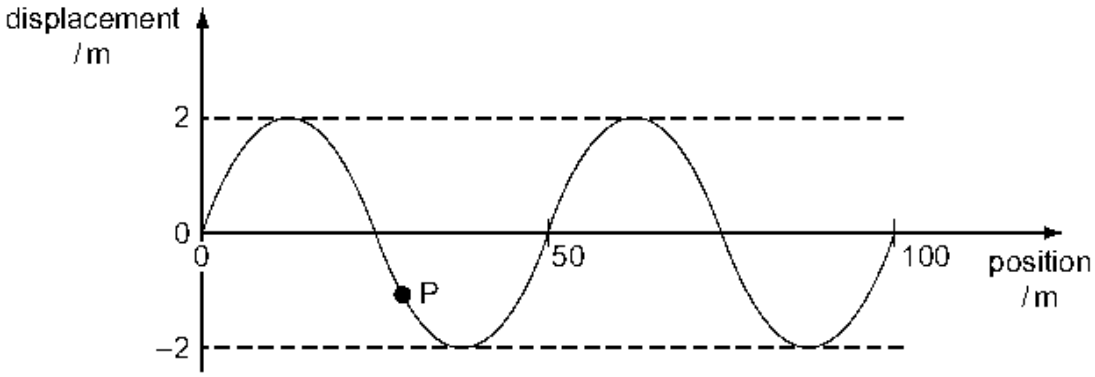
21 Ultrasound waves differ from ultraviolet rays in that

A they cannot be diffracted
B they cannot interfere
C they cannot be polarized
D they cannot produce stationary waves

22 An electromagnetic wave has a frequency of 108Hz.
In which region of the electromagnetic spectrum does the wave occur?

A infra-red
B radio
C ultraviolet
D visible

23 The graph represents a sinusoidal wave in the sea, travelling at a speed of 8.0 m s^{-1}, at one instant of time. The maximum speed of the oscillating particles in the wave is $2\pi af$, where a is the amplitude and f is the frequency.



An object P of mass 2.0×10^{-3} kg floats on the surface.
What is the maximum kinetic energy of P due to the wave? Assume that its motion is vertical.

A 0.026 mJ **B** 4.0 mJ **C** 39 mJ **D** 64 mJ

24 Monochromatic light illuminates two narrow parallel slits. The interference pattern which results is observed on a screen some distance beyond the slits.
Which change increases the separation between the dark lines of the interference pattern?

A decreasing the distance between the screen and the slits
B increasing the distance between the slits
C using monochromatic light of higher frequency
D using monochromatic light of longer wavelength

25 A narrow beam of monochromatic light is incident normally on a diffraction grating. Third-order diffracted beams are formed at angles of 45^{o} to the original direction.
What is the highest order of diffracted beam produced by this grating?

A 3rd **B** 4th **C** 5th **D** 6th

26 Which of the following may be used to produce stationary waves?

A blowing air over the top of an empty bottle
B making a loud sound near a mountain
C passing monochromatic light through a double slit
D passing water waves through a narrow slit

27 In an interference experiment, two slits are illuminated with white light.

What is seen on the screen?

A The central fringe is black with black and white fringes on each side.
B The central fringe is black with coloured fringes on each side.
C The central fringe is white with black and white fringes on each side.
D The central fringe is white with coloured fringes on each side.

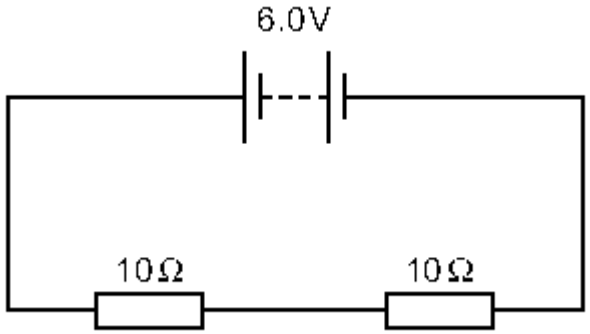
28 Microwaves of wavelength 3.00 cm are incident normally on a row of parallel metal rods. The separation of the rods is 8.00 cm. The first order diffraction maximum is observed at an angle of 22.0° to the direction of the incident waves.
What is the angle between the first and second order diffraction maxima?

A 22.0° **B** 26.6° **C** 44.0° **D** 48.6°

29 Which electrical quantity would be the result of a calculation in which energy is divided by charge?

A current
B potential difference
C power
D resistance

30 A battery of negligible internal resistance is connected to two 10 Ω resistors in series.



What charge flows through each of the 10 Ω resistors in 1 minute?

A 0.30C **B** 0.60 C **C** 3.0 C **D** 18 C

31 Two wires P and Q have resistances R_P and R_Q respectively. Wire P is twice as long as wire Q and has twice the diameter of wire Q. The wires are made of the same material.What is the ratio of $R_{P\ to}\ R_Q$?

A 0.5 **B** 1 **C** 2 **D** 4

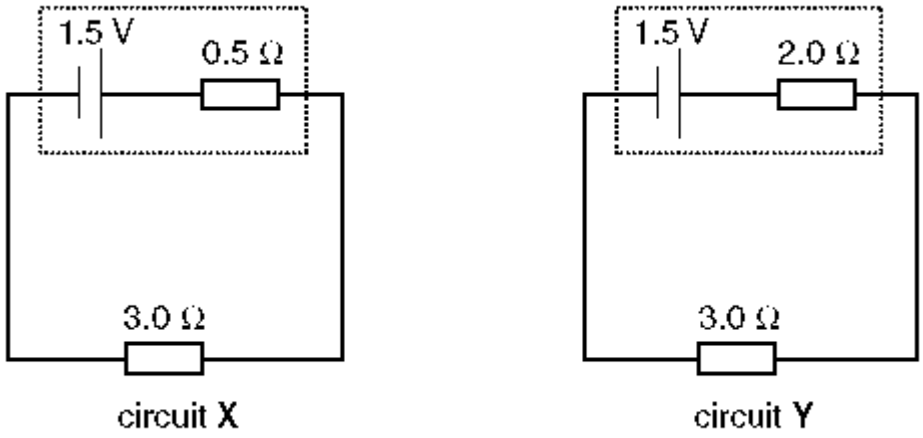
32 What is an equivalent unit to 1 volt?

A 1 J A^{-1} **B** 1 J C^{-1} **C** 1 W C^{-1} **D** 1 W s^{-1}

33 The terminal voltage of a battery is observed to fall when the battery supplies a current to an external resistor.
What quantities are needed to calculate the fall in voltage?

A the battery's e.m.f. and its internal resistance
B the battery's e.m.f. and the current
C the current and the battery's internal resistance
D the current and the external resistance

34 The diagram shows two circuits. In these circuits, only the internal resistances differ.



Which line in the table is correct?

	Potential difference between 3.0 Ω resistor	**Power dissipated in 3.0 Ω resistor**
A	Greater in X than in Y	less in X than in Y
B	Greater in X than in Y	greater in X than in Y
C	less in X than in Y	less in X than in Y
D	less in X than in Y	greater in X than in Y

35 When four identical resistors are connected as shown in diagram 1, the ammeter reads 1.0 A and the voltmeter reads zero.

diagram 1

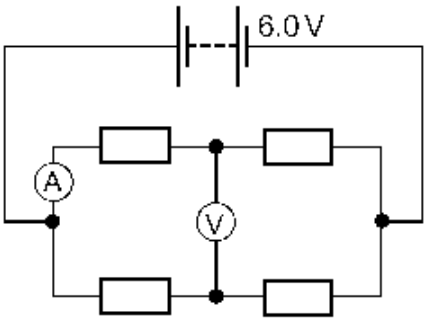
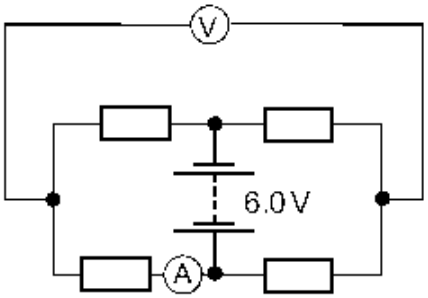


diagram 2



The resistors and meters are reconnected to the supply as shown in diagram 2.
What are the meter readings in diagram 2?

	Voltmeter reading/V	Ammeter reading/A
A	0	1
B	3	0.5
C	3	1
D	6	0

36 How is it possible to distinguish between the isotopes of uranium?

A Their nuclei have different charge and different mass, and they emit different particles when they decay.
B Their nuclei have different charge but the same mass.
C Their nuclei have the same charge but different mass.
D Their nuclei have the same charge and mass, but they emit different particles when they decay.

37 A detector is exposed to a radioactive source. Fluctuations in the count-rate are observed.
What do these fluctuations indicate about radioactive decay?

A It is random.
B It is spontaneous.
C It is exponential.
D It is non-linear.

38 A student conducts an experiment using an α-particle source.
When considering safety precautions, what can be assumed to be the maximum range of α-particles in air?

A between 0 and 5 mm
B between 5 mm and 200 mm
C between 200 mm and 500 mm
D between 500 mm and 1000 mm

39 The following represents a sequence of radioactive decays involving two α-particles and one β-particle.

$$^{217}_{85}At \xrightarrow{\alpha} V \xrightarrow{\alpha} W \xrightarrow{\beta} X$$

What is the nuclide X?

A $^{213}_{85}At$ **B** $^{215}_{77}Ir$ **C** $^{209}_{82}Pb$ **D** $^{217}_{81}Ti$

40 A nuclear reaction is represented by the equation

$$^{16}_{82}O + ^{4}_{2}He \rightarrow ^{19}_{9}F + X$$

What is particle X?

A an α-particle
B a β-particle
C a neutron
D a proton