1 Hooke's law states that the force, *F* needed to extend or compress a spring by a distance, *x* is given by the formula, where *k* is a constant.

F = kxWhich is the S.I. unit for constant *k*? **A** kg m⁻¹ s⁻¹ **B** kg m⁻¹ s⁻² **C** kg s⁻¹ **D** kg s⁻²

2 The graph below shows the velocity – time graph of a cyclist.



What is the average speed of the cyclist?

| A 5.5115 D 0.7115 C 0.9115 D 0.0115 | Α | 5.3 m s ⁻¹ | В | 6.7 m s ⁻¹ | С | 6.9 m s ⁻¹ | D | 8.0 m s ⁻¹ |
|---|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|
|---|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|

- 3 An object falls from rest through air until it reaches terminal velocity. What can be said about the acceleration of the object during the fall?
 - A constant at 10 m s⁻²
 - B increases from zero to 10 m s⁻²
 - C decreases from 10 m s⁻² to zero
 - **D** zero acceleration

4 A car drives at a constant speed around the racing track **JKLM** as shown below.



Along which sections of the racing track will the car experience a resultant force?

- A JK and LM
- B JK and KL
- C KL and MJ
- D LM and MJ
- A woman stands in a lift that is accelerating upwards at 0.75 m s⁻². She has a mass of 52 kg.
 What is the normal reaction force exerted on her by the floor during the motion?
 - **A** 390 N **B** 481 N **C** 520 N **D** 559 N
- 6 The diagram below shows two objects on a beam balance.



The beam balance is in equilibrium.

Which of the following quantities may be different in magnitude?

- A the masses of the two objects
- **B** the moments about the pivot of the two objects
- **C** the volume of the two objects
- **D** the weights of the two objects

- 7 A wooden block of dimension 1.0 m by 1.0 m by 1.0 m has a mass of 800 kg. If a boy saws half the block away, what is the density of the remaining wooden block?
 - A 400 kg m⁻³ B 800 kg m⁻³ C 1200 kg m⁻³ D 1600 kg m⁻³
- 8 The diagram shows a balancing toy pivoted on a stand.



If the toy is tilted slightly, it does not topple but returns to its original position. This is because the centre of gravity of the toy is

- A inside the weight.
- **B** below the pivot.
- **C** exactly at the pivot.
- **D** between the weight and pivot.
- 9 The diagram below shows a bar pivoted to a point closer to one end.

Assuming that the forces applied on the bar are of equal magnitude, which force would produce the moment with the greatest magnitude?



10 The diagram below shows a cube suspended from a string being submerged in a liquid. The cube experiences a pressure caused by the liquid.



What would increase the pressure acting on bottom surface of the cube?

- A lowering the cube deeper into the liquid
- B increasing the mass of the cube
- **C** decreasing the bottom surface area of the cube
- **D** using a liquid with a lower density
- **11** The system shown in the diagram contains an incompressible liquid.



A downward force of 3.0 N is exerted on piston L.

What is the upward force on piston K?

| Α | 0.15 N | В | 27 N | С | 60 N | D | 240 N |
|---|--------|---|------|---|------|---|-------|
|---|--------|---|------|---|------|---|-------|

12 The diagram below shows a curved track that has a steel ball rolling on it. The ball is released from rest at point **A**.

At which point does the ball have the minimum gravitational potential energy?



13 A rocket of total mass **M** is travelling at a speed **v**. The engine of the rocket is fired and fuel is used up. The mass of the rocket decreases to M/2 and its speed increases to 2v.

What happens to the kinetic energy of the rocket?

- A The kinetic energy doubles.
- **B** The kinetic energy halves.
- **C** The kinetic energy increases by a factor of four.
- **D** The kinetic energy remains the same.
- 14 A fixed mass of gas is trapped in a metal cylinder by a movable piston. The piston is moved inwards slowly such that the temperature of the gas remains constant.



What happens to the speed of the gas molecules and pressure of the gas?

| | speed of gas molecules | pressure of gas |
|---|------------------------|-----------------|
| Α | unchanged | increases |
| в | increases | decreases |
| С | unchanged | unchanged |
| D | decreases | increases |

15 The diagram below shows a plate-warmer in which candles are used as heaters.



The flames of the candles do not touch the underside of the top tray.

How does heat pass to the top tray?

- A mainly conduction and some convection
- **B** mainly conduction and some radiation
- **C** mainly convection and some radiation
- **D** mainly radiation and some conduction
- 16 The resistance **R** of a wire increases uniformly with temperature. The values of **R** at the fixed points are shown in the table.

| | 0 °C | 100 °C |
|--------------|------|--------|
| R / Ω | 100 | 250 |

What is the temperature when $\mathbf{R} = 160 \Omega$?

| Α | 24 °C | В | 40 °C | С | 60 °C | D | 64 °C |
|---|-------|---|-------|---|-------|---|-------|
|---|-------|---|-------|---|-------|---|-------|

17 In an experiment, 2040 J of thermal energy is supplied to 10 g of ice at 0 °C. Assume that water from the melted ice stays at 0 °C and the specific latent heat of fusion of ice is 340 J g⁻¹.

What is the mass of the remaining ice?

A 0.0 g **B** 4.0 g **C** 6.0 g **D** 9.7 g

18 Two solid metals, **P** and **Q** with the same mass are heated and their temperature-time graphs are shown in the diagram below. Both metals were heated with the same power source at constant rate.



Which statement about solid **P** and **Q** is incorrect?

- A Solid **Q** has a higher melting point than solid **P**.
- **B** Solid **Q** has a lower specific latent heat of vaporisation than solid **P**.
- C Solid Q has a lower specific heat capacity than solid P.
- **D** Solid **Q** has a higher specific latent heat of fusion than solid **P**.
- **19** The diagram below shows the wavefronts of water spreading from a vibrating source at **X** in a large pool.



Which statement about the wavefront patterns is correct?

- A The frequency of the wave on the left side of **X** is higher than that on the right side.
- **B** The frequency of the wave on the left side of **X** is lower than that on the right side.
- **C** The speed of wave is constant in all directions.
- **D** The speed of wave is higher on the right side of **X** than on the left side.

20 The diagram below shows a transverse wave travelling to the right.



At the instant shown, how are the speeds of particles X, Y and Z compared?

- $A \quad X > Y > Z$
- **B X** > **Z** > **Y**
- $C \quad Z > Y > X$
- $\mathsf{D} \quad \mathsf{Z} > \mathsf{X} > \mathsf{Y}$
- 21 The diagram below shows the path of a light ray from air into a medium.



What is the refractive index of the medium?

| Α | 1.06 | В | 1.31 | С | 1.46 | D | 1.56 |
|---|------|---|------|---|------|---|------|
| | | | | | | | |

22 The rays of light from a ray box pass through three lenses placed at positions 1, 2 and 3.



What type of lens is used at positons 1, 2 and 3 respectively?

- A converging, converging, converging
- **B** converging, converging, diverging
- C diverging, converging, diverging
- D diverging, diverging, diverging
- 23 Which of the following electromagnetic radiation is emitted by a normal human body?
 - A infrared radiation
 - **B** ultraviolet radiation
 - C visible light
 - **D** X-rays

24 Which graph represents the variation of wavelength, λ , with frequency, *f*, of electromagnetic waves in vacuum?



25 A sound pulse P_1 is transmitted via an echo sounder towards the sea floor. The time taken for the pulse to hit the sea floor and to reflect back to the ship as pulse P_2 is 0.30 s. The speed of sound in water is 1500 m s⁻¹.

Which of the following shows the distance between the ship and the sea floor as well as the amplitude of P_2 compared to P_1 ?

| | distance / m | amplitude of P2 |
|---|--------------|---------------------------|
| Α | 225 | lower than \mathbf{P}_1 |
| в | 225 | same as P 1 |
| С | 450 | lower than \mathbf{P}_1 |
| D | 450 | same as P 1 |

26 Which row correctly compares the speeds of sound in gas, liquid and solid?

| | highest — | | → lowest |
|---|-----------|--------|----------|
| Α | air | liquid | solid |
| в | air | solid | liquid |
| С | liquid | air | solid |
| D | solid | liquid | air |

27 M, N, O and P are light conductive balls which behave as follows:

M repels N, M attracts O, O repels P

- If **P** is positively charged,
- **A N** must be positively charged.
- **B** N must be negatively charged.
- **C N** must be positively charged or neutral.
- **D N** must be negatively charged or neutral.
- **28** A stationary negative charge in an electric field experiences an electric force in the direction shown.



What is the direction of the electric field?

- A to the left
- **B** to the right
- **C** down the page
- **D** up the page

- 29 Which quantity is equal to the potential difference (p.d.) across a component in a circuit?
 - A The power used to drive one electron through the component.
 - **B** The power used to drive unit charge through the component.
 - **C** The work done in driving one electron through the component.
 - **D** The work done in driving unit charge through the component.
- **30** A current of 40 mA passes through a slice of conducting material of dimensions shown below.



The slice dissipates 400 mJ of thermal energy per second.

What is the resistivity of the conducting material?

| Α | 0.25 Ω m | В | 0.36 Ω m | С | 56 Ω m | D | 380 Ω m |
|---|----------|---|----------|---|--------|---|---------|
|---|----------|---|----------|---|--------|---|---------|

31 In which circuit does the voltmeter reading decrease when light shines on the light dependent resistor?



Α





В

D





32 A diode is connected in the following circuit.



What is the reading on the ammeter?

| Α | 1.0 A | В | 1.5 A | С | 3.0 A | D | 4.5 A |
|---|-------|---|-------|---|-------|---|-------|
|---|-------|---|-------|---|-------|---|-------|

33 The diagram below shows an old standing fan with a plastic base and a metal casing. The plug of the fan is wrongly wired as shown.





What is the effect of using the plug wired this way?

- A The fan does not work.
- **B** The fuse in the plug blows.
- **C** The metal case becomes live.
- **D** The fan catches fire.
- A 1.9 kW vacuum cleaner and a 200 W television is connected in parallel to a 240 V mains.Which will be a suitable fuse rating for the mains?
 - **A** 7 A **B** 8 A **C** 9 A **D** 20 A

35 An object **X** is brought near (but not touching) a bar magnet which is placed on an electronic balance as shown below.



The reading on the electronic balance decreases. What can X be?

- **A** A bar magnet or a copper bar.
- **B** A bar magnet or an iron bar.
- **C** An aluminium bar or a steel bar.
- **D** Only a bar magnet.
- **36** A steel bar can be magnetised by stroking it with a magnet.



When the magnet strokes the steel bar in the direction as shown above, which poles are produced at X and Y?

| | X | Y |
|---|---|---|
| Α | S | S |
| в | S | Ν |
| С | Ν | S |
| D | Ν | Ν |

37 The diagram below shows a simple d.c. motor. Which part of the motor allows it to turn continuously by reversing the direction of the current in the coil?



38 The diagram below shows, in cross section, a wire lying on the ground. There is a direct current in the cable. The Earth's magnetic field is as shown.

Which arrow gives a possible direction for the magnetic force on the cable?



39 The diagram below shows a wire coiled around a soft iron rod and a copper ring **R**.



What will happen to the copper ring at the instance when the switch S is closed?

- **A** The ring will be heated up.
- **B** The ring will be repelled from the coil.
- **C** A steady current will be set up in the ring.
- **D** The ring will be attracted to the coil.
- 40 An ideal transformer has a primary coil of 1000 turns and a secondary coil of 400 turns. The primary voltage is 600 V and the secondary coil is attached to a resistor of resistance 120Ω .



End of paper