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

PHYSICS
STANDARD LEVEL
PAPER 1

Thursday 8 November 2007 (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.

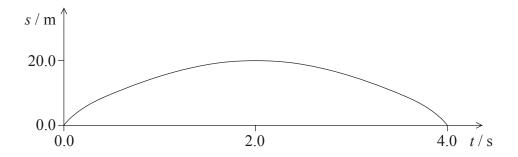**1.** Which of the following contains only **fundamental** SI units?

A.	ampere	newton	second
B.	volt	second	kelvin
C.	mole	ampere	kilogram
D.	kilogram	metre	tesla

2. The mass of a body is measured to be $0.600\,kg$ and its acceleration to be $3\,ms^{-2}$. The net force on the body, expressed to the correct number of significant figures is

A. $1.8\,N$.

B. $1.80\,N$.

C. $2\,N$.

D. $2.0\,N$.

3. The molar mass of water is $18\,g$. The approximate number of water molecules in a glass of water is

A. 10^{22}.

B. 10^{25}.

C. 10^{28}.

D. 10^{31}.

4. Both random and systematic errors are present in the measurement of a particular quantity. What changes, if any, would repeated measurements of this quantity have on the random and systematic errors?

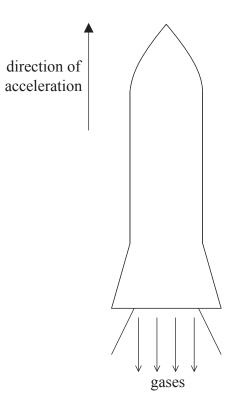|	**Random**	**Systematic**
A.	reduced	reduced
B.	reduced	unchanged
C.	unchanged	reduced
D.	unchanged	unchanged

5. The graph below shows the variation with time t of the displacement s of an object moving along a straight-line.

The best estimate of the instantaneous speed of the object at $t=2.0\,\text{s}$ is

A. $0.0\,\text{m s}^{-1}$.

B. $0.2\,\text{m s}^{-1}$.

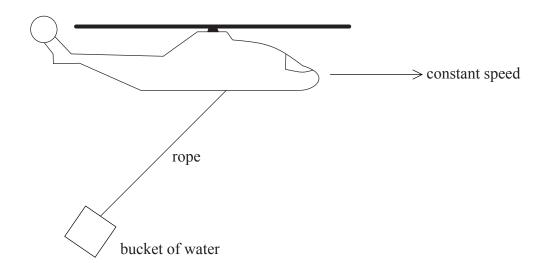C. $5.0\,\text{m s}^{-1}$.

D. $10.0\,\text{m s}^{-1}$.

6.   A rocket accelerates vertically upwards by ejecting high-speed gases vertically downwards as shown in the diagram below. At the instant shown the weight of the rocket is W and the magnitude of the force the rocket exerts on the gases is T.

direction of acceleration

gases

The magnitude of the net force on the rocket is
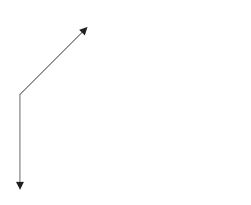
A. W.

B. T.

C. $T + W$.

D. $T - W$.

7. A fire-fighting helicopter is flying at constant speed along a horizontal straight-line carrying a bucket of water as shown in the diagram below. The rope to the bucket makes a fixed angle with the vertical.
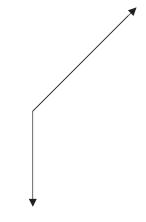

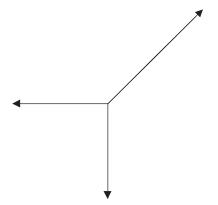Which of the following diagrams is the correct free body diagram of the forces acting on the bucket?
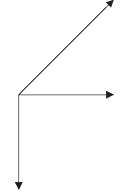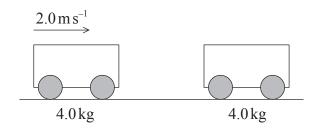
A.

B.

C.

D.

Turn over

8. The diagram below shows a trolley of mass 4.0 kg moving on a frictionless horizontal table with a speed of $2.0\,\text{m s}^{-1}$. It collides with a stationary trolley also of mass $4.0\,\text{kg}$.

$2.0\,\text{m s}^{-1}$

4.0 kg   4.0 kg

Which of the following diagrams shows a possible outcome?

A. $0.0\,\text{m s}^{-1}$ $2.0\,\text{m s}^{-1}$ B. $2.0\,\text{m s}^{-1}$

4.0 kg   4.0 kg   4.0 kg   4.0 kg

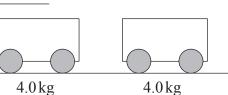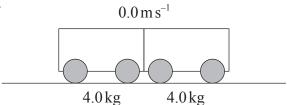C. $2.0\,\text{m s}^{-1}$ $0.0\,\text{m s}^{-1}$ D. $0.0\,\text{m s}^{-1}$

4.0 kg   4.0 kg   4.0 kg   4.0 kg

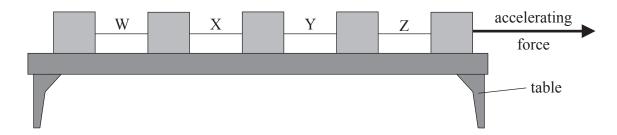**9.** Which of the following quantities **must** be zero for a particle in equilibrium?

A.   Kinetic energy

B.   Acceleration

C.   Velocity

D.   Momentum

10. The gravitational mass of a body as measured on Earth is M_g and its inertial mass is M_i. Which of the following correctly gives the changes, if any, in M_g and M_i as measured on the Moon?

	Inertial mass on the Moon	**Gravitational mass on the Moon**
A.	M_i	M_g
B.	M_i	less than M_g
C.	less than M_i	M_g
D.	less than M_i	less than M_g

11. An elevator (lift) of mass m is raised vertically with constant speed v for a time t. The work done on the elevator during this time is

    A. mgv.

    B. $mgvt$.

    C. $\dfrac{mgv}{t}$.

    D. $\dfrac{mgt}{v}$.

12. The diagram below shows five wooden blocks joined by inelastic strings. A constant force accelerates the blocks to the right on a frictionless horizontal table.

In which string is the tension the greatest?

A. W

B. X

C. Y

D. Z

13. A force of magnitude F_1 accelerates a body of mass m from rest to a speed v. A force of magnitude F_2 accelerates a body of mass $2m$ from rest to a speed $2v$.
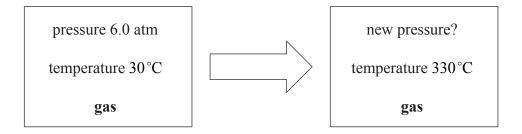
The ratio $\dfrac{\text{work done by } F_2}{\text{work done by } F_1}$ is

A. 2.

B. 4.

C. 8.

D. 16.

14. Two bodies are brought into thermal contact with each other. No thermal energy transfer takes place between the bodies. It may be deduced therefore, that the bodies must have the same

A. specific heat capacity.

B. heat capacity.

C. temperature.

D. internal energy.

15. An ideal gas is kept in a container of fixed volume at a temperature of $30\,°C$ and a pressure of $6.0\,atm$. The gas is heated at constant volume to a temperature of $330\,°C$.

pressure 6.0 atm temperature 30 °C **gas**	new pressure? temperature 330 °C **gas**

The new pressure of the gas is about

A.   0.60 atm.

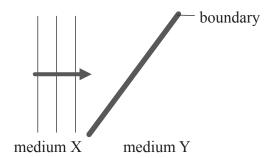B.   3.0 atm.

C.   12 atm.

D.   66 atm.

16. A liquid is heated in a well-insulated container. The power input to the liquid and its specific heat capacity are known.

Which of the following quantities must be known in order to calculate the rate at which the temperature increases?

A.   The time for which the liquid is heated

B.   The initial temperature of the liquid

C.   The final temperature of the liquid

D.   The mass of the liquid

17. Which of the following is **not** an assumption of the kinetic theory of gases?

A.   The volume of the molecules is negligible compared to the volume of the gas.

B.   The average kinetic energy of the molecules is proportional to the absolute temperature.

C.   The collisions of molecules with the walls and with each other are elastic.

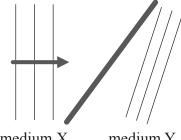D.   There are no forces between the molecules except during contact.

18. The phenomenon of diffraction is associated with

    A.   sound waves only.

    B.   light waves only.

    C.   water waves only.

    D.   all waves.

19. The diagram below shows plane wavefronts of a wave that is approaching the boundary between two media, X and Y. The speed of the wave is greater in medium X than in medium Y. The wave crosses the boundary.
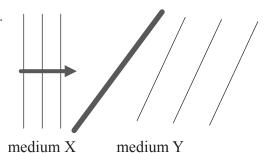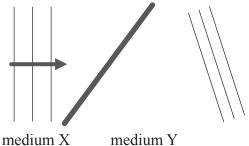

Which of the following diagrams is correct?

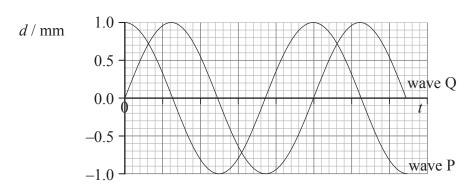**20.** The graph below shows the variation with time t of the separate displacements d of a medium, at a particular point in the medium due to two waves, P and Q.
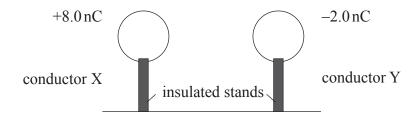

The amplitude of the wave resulting from the interference of P and Q is

A.   0.0 mm.

B.   1.0 mm.

C.   1.4 mm.

D.   2.0 mm.

21. One end of a long string is vibrated at a constant frequency f. A travelling wave of wavelength λ and speed v is set up on the string.

The frequency of vibration is doubled but the tension in the string is unchanged. Which of the following shows the wavelength and speed of the new travelling wave?

	Wavelength	**Speed**
A.	$\dfrac{\lambda}{2}$	v
B.	$\dfrac{\lambda}{2}$	$2v$
C.	2λ	v
D.	2λ	$2v$

Turn over

22. Two identical spherical conductors X and Y are mounted on insulated stands. X carries a charge of +8.0 nC and Y carries a charge of –2.0 nC.

+8.0 nC   –2.0 nC

conductor X   conductor Y
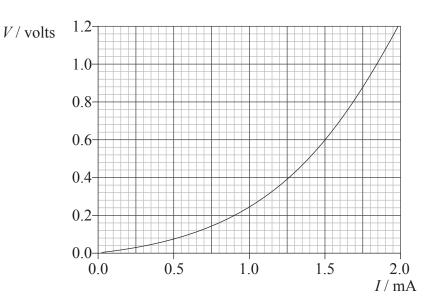
insulated stands

The two conductors are brought into contact and are then separated. Which of the following gives the charge on each conductor?

	Charge on X	Charge on Y
A.	0.0 nC	0.0 nC
B.	+8.0 nC	–2.0 nC
C.	+5.0 nC	+5.0 nC
D.	+3.0 nC	+3.0 nC

23. The work done on a positive point charge of magnitude 3.0 nC as it is moved at constant speed from one point to another is 12 nJ. The potential difference between the two points is

A.   0.0 V.

B.   0.25 V.

C.   4.0 V.

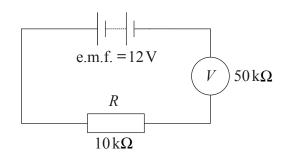D.   36 V.

24. The graph below shows the variation with current *I* of the potential difference *V* across a filament lamp.

The resistance of the lamp when $I = 1.5\,\text{mA}$ is

A. $950\,\Omega$.

B. $400\,\Omega$.

C. $0.95\,\Omega$.

D. $0.40\,\Omega$.

Turn over

25. A voltmeter of resistance $50\,\mathrm{k\Omega}$ is connected in a circuit as shown in the diagram below.

e.m.f. $= 12\,\mathrm{V}$

V $\quad 50\,\mathrm{k\Omega}$
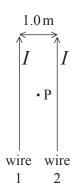
R

$10\,\mathrm{k\Omega}$

The e.m.f. of the battery is $12\,\mathrm{V}$ and the resistance of the resistor is $10\,\mathrm{k\Omega}$. The internal resistance of the battery is negligible.

The reading of the voltmeter is

A. $0.0\,\mathrm{V}$.

B. $2.0\,\mathrm{V}$.

C. $10\,\mathrm{V}$.

D. $12\,\mathrm{V}$.

26. The diagram below shows two long parallel wires, 1.0 m apart, on the plane of the page. Each wire carries a current I in the same direction.
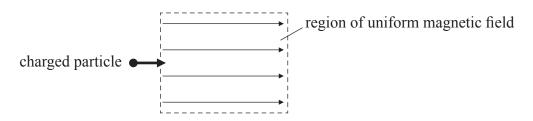
1.0 m

I I

• P

wire   wire
1   2

Point P is on the plane of the page midway between the two wires. The magnitude of the magnetic field strength at point P due to wire 1 alone is B_0.

The magnitude of the magnetic field strength at point P due to both wires is

A.   0.

B. $\frac{1}{2} B_0$.

C. B_0.

D. $2B_0$.

Turn over

27. A positively charged particle enters a region of uniform magnetic field. The direction of the particle's velocity is parallel to the direction of the magnetic field as shown in the diagram below.
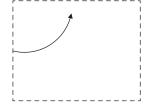
region of uniform magnetic field

charged particle

Which of the following diagrams correctly shows the path of the charged particle while in the region of magnetic field?

A.
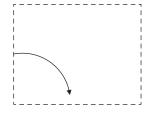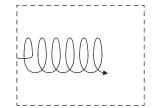
B.

C.

D.

28. The Geiger-Marsden alpha particle scattering experiment provides evidence for the existence of

A. atomic nuclei.

B. neutrons.

C. protons.

D. nuclear energy levels.

29. The initial activity (rate of decay) of a sample of mass $25\,\mu g$ of a radioactive isotope is A_0. The half-life of the isotope is $T_{\frac{1}{2}}$. Which of the following gives the initial activity and half-life of a sample of mass $50\,\mu g$ of this isotope?

	Activity	Half-life
A.	A_0	$T_{\frac{1}{2}}$
B.	$2A_0$	$T_{\frac{1}{2}}$
C.	A_0	$2T_{\frac{1}{2}}$
D.	$2A_0$	$2T_{\frac{1}{2}}$

30. A neutron is captured by a nucleus. Which of the following gives the changes in the atomic (proton) number and mass (nucleon) number of the nucleus?

	Atomic number	Mass number
A.	unchanged	unchanged
B.	unchanged	increases by 1
C.	increases by 1	unchanged
D.	increases by 1	increases by 1