Candidates' Performance

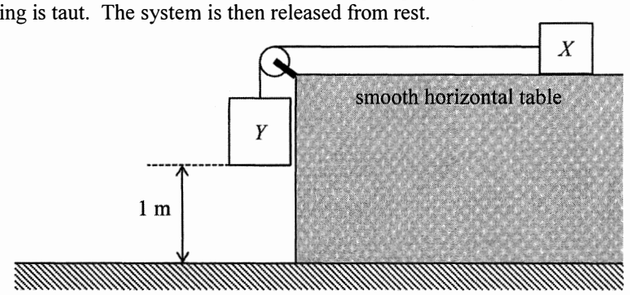
Paper 1

Paper 1 consists of two sections, multiple-choice questions in Section A and conventional questions in Section B. All questions in both sections are compulsory.

Section A (multiple-choice questions)

Section A consisted of 33 multiple-choice questions and the mean score was 21. Items where candidates' performance was typically weaker will be discussed below.

10. Blocks X and Y are connected by a light inextensible string passing over a fixed frictionless light pulley as shown. The mass of X and Y are 0.5 kg and 1 kg respectively. Initially, Y is 1 m above the ground and the string is taut. The system is then released from rest.



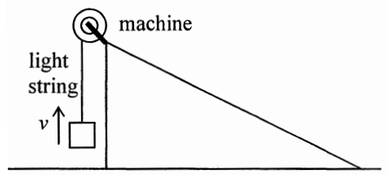
What is the speed of Y just before it reaches the ground ? (Take $g = 9.81$ m s^{-2})

* A.	3.62 m s^{-1}	(40%)
B.	4.43 m s^{-1}	(40%)
C.	6.26 m s^{-1}	(12%)
D.	9.81 m s^{-1}	(8%)

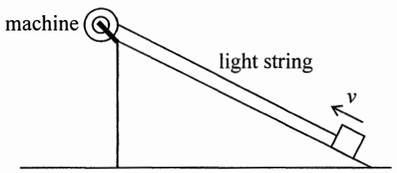
40% of the candidates choosing option B suggests they did not take into account the gain in kinetic energy of block X.

11. A machine is fixed at the top of a smooth inclined plane. Two methods, (I) and (II), are used to lift a block from the ground to the top of the inclined plane by the machine.

(I) Pull the block vertically upward at a uniform speed v.
(II) Pull the block up along the inclined plane at the same uniform speed v.



(I)



(II)

Which of the following statements correctly compare(s) the two methods ?

(1) The tension in the string is the same.
(2) The average output power of the machine is the same.
(3) The work done by the machine on the block is the same.

A.	(1) only	(9%)
* B.	(3) only	(57%)
C.	(1) and (2) only	(9%)
D.	(2) and (3) only	(25%)

About one-third of the candidates chose options which support the statement that the average output power of the machine was the same in both situations.

13. A small object is released from rest at a point very far away from a planet X. The object then starts moving towards X. X does not have an atmosphere. Neglect the effect of other celestial bodies.

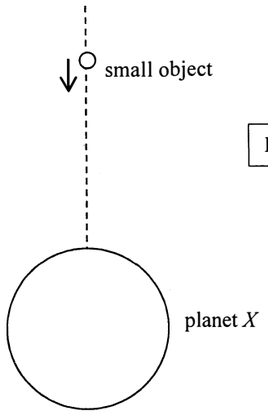
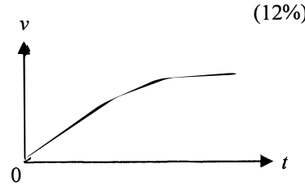


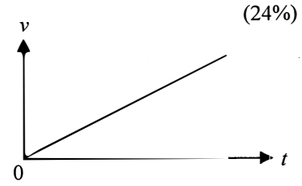
Diagram **NOT** drawn to scale

Which of the following graphs best shows the variation of the velocity v of the object with time t before it hits X?

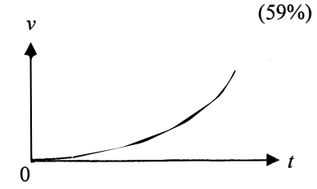
A. (12%)



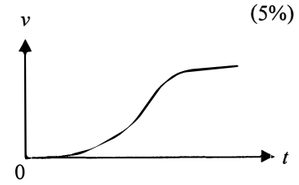
B. (24%)



*C. (59%)

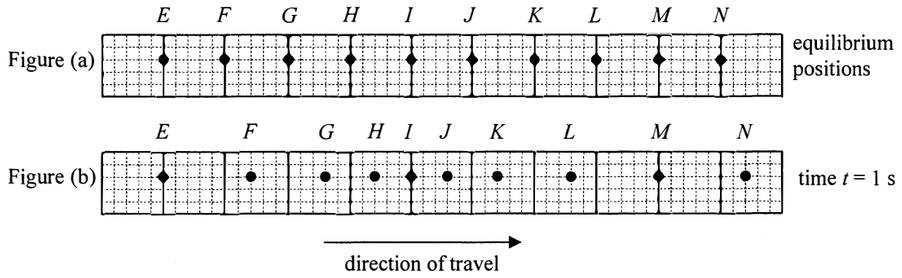


D. (5%)



Nearly a quarter of the candidates chose option B, possibly assuming that the acceleration of the object was constant throughout its fall.

14. Figure (a) shows the equilibrium positions of particles E to N in a medium. At time t = 0, a longitudinal wave starts travelling from left to right. At time t = 1 s, the positions of the particles are shown in Figure (b).

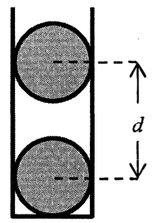


Which of the following statements **MUST BE** correct ?

* A. The distance between particles F and N is equal to the wavelength of the wave. (54%)
B. The period of the wave is 1 s. (6%)
C. Particle E is always at rest. (10%)
D. Particle I is momentarily at rest at t = 1 s. (30%)

30% of the candidates wrongly thought that particle I was momentarily at rest at t = 1 s when it was at the equilibrium position.

22. In the figure, two charged conducting spheres of the same mass m are put in a vertical plastic cylinder. The inner wall of the cylinder is smooth. The spheres are separated by a distance d and remain in equilibrium.



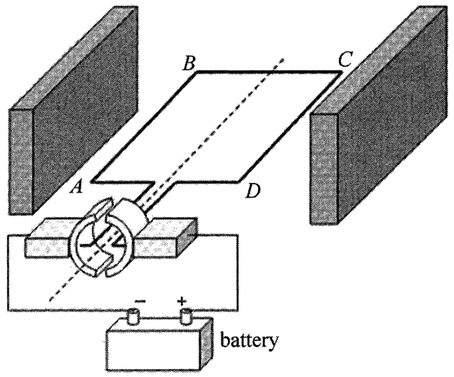
Which of the following statements **MUST BE** correct ?

(1) Both spheres carry positive charges.
(2) The amount of charges on the two spheres is the same.
(3) The separation d depends on m.

A. (1) only (11%)
* B. (3) only (63%)
C. (1) and (2) only (9%)
D. (2) and (3) only (17%)

Over a quarter of the candidates chose options which support the statement that the amount of charges on the spheres was the same.

26. The figure shows a simple d.c. motor, the coil *ABCD* is mounted between the poles of two slab-shaped magnets.

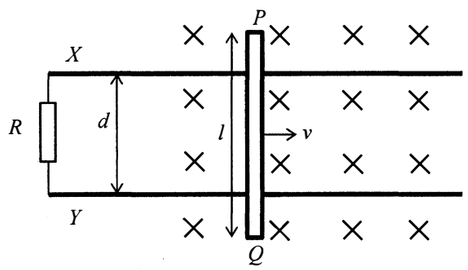


Which of the following statements is correct ?

* A.	The turning effect is zero when the coil is vertical.	(46%)
B.	The magnetic force acting on *BC* is the greatest when the coil is horizontal.	(16%)
C.	The direction of the magnetic force acting on *AB* remains constant.	(14%)
D.	The direction of the current in the coil remains unchanged.	(24%)

Surprisingly, nearly a quarter of the candidates did not realise that the direction of the current in the coil would change in each cycle.

28. A metal rod *PQ* of length *l* is moving along smooth horizontal metal rails *X* and *Y* with constant speed *v* in a uniform magnetic field of magnetic field strength *B* pointing into the paper. The metal rails *X* and *Y* are separated by a distance of *d* and are connected to a resistor of resistance *R* as shown.



Which of the following descriptions about the induced current is correct ?

	magnitude	**direction**	
A.	$\frac{Blv}{R}$	from *X* to *Y* through *R*	(28%)
B.	$\frac{Blv}{R}$	from *Y* to *X* through *R*	(13%)
* C.	$\frac{Bdv}{R}$	from *X* to *Y* through *R*	(46%)
D.	$\frac{Bdv}{R}$	from *Y* to *X* through *R*	(13%)

Nearly 30% of the candidates mistook the whole length of the metal rod for finding the induced current.

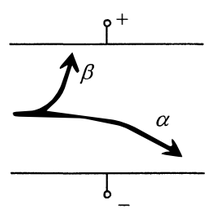
30. The input terminal of a transformer is connected to the 220 V mains supply. Ten identical light bulbs are connected in parallel to the output terminal of the transformer. All the light bulbs are working at their rated values of '3 V, 1.5 W'. If the efficiency of the transformer is 70%, what is the current drawn from the mains supply ?

A.	0.007 A	(8%)
B.	0.048 A	(19%)
C.	0.068 A	(19%)
* D.	0.097 A	(54%)

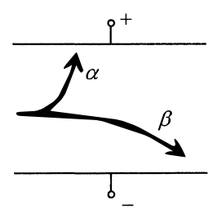
Just more than half of the candidates managed to obtain the correct answer corresponding to transformers which were less than ideal.

31. Which of the following diagrams best shows the deflection of α and β particles in a uniform electric field in vacuum ?

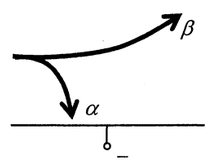
* A. (57%)



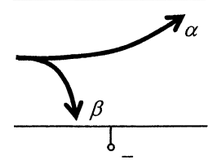
B. (7%)



C. (31%)



D. (5%)



Over 30% of the candidates made mistakes in identifying the curvature of the paths described by α and β particles.

Section B (conventional questions)

Question Number	Performance in General
1	This question was based on a passage describing the use of soil thermometers. The situation was unfamiliar to most candidates and the general performance was unsatisfactory. In (a), few were able to state that a larger bulb of such a thermometer would improve its sensitivity. Most candidates did well in parts (b)(i)(ii). However, very few gave a concise explanation of the function of paraffin wax in (b)(iii).
2	This question required candidates to describe how to measure the speed of a bullet using the apparatus provided. The general performance was poor. Many candidates failed to mention that the speed of the trolley immediately after the collision should have been taken. A small number of candidates did not know that the motion sensor registered the trolley's speed instead of its distance travelled. Not many were able to state the precautions for getting a more accurate result such as the bullet should be fired along the trolley's direction of travel.
3	This question was on the microscopic properties of gases. Candidates' performance was fair. In (a), most candidates knew that the root-mean-square speed of gas molecules was related to the gas temperature, but some forgot to take the square root of the ratio of temperatures. Quite a number of them had a misconception in part (b) that the collisions among gas molecules themselves would contribute to the gas pressure.
4	This question tested candidates' knowledge and understanding on projectiles. In general, candidates' performance was fair. Most answered part (a)(i) correctly. However, some failed to distinguish the horizontal uniform motion and the vertical uniformly accelerated motion of a projectile in (a)(ii). Weaker ones even employed $v^2 = u^2 + 2as$ to compute the resultant speed of the projected bearing. Part (b) revealed that quite a number of the candidates had misconceptions about Newton's third law of motion — taking weight and air resistance as an action-and-reaction pair in this case.
5	This question tested candidates' knowledge and understanding on circular motion. In (a), most candidates managed to indicate the forces acting on the teapot although a few of them labelled the frictional force as 'centripetal force'. In (b), quite a lot of the candidates' failed to work out the correct angular velocity from the rate of revolution given. Weaker ones misunderstood part (c) and they wrongly applied the equation for circular motion to tackle the problem.
6	This question tested candidates' basic knowledge of wave motion. Candidates' performance was satisfactory. Part (a) was well answered. In (b)(i), some candidates only stated 'crest meets trough at Q' to explain why a minimum occurred there. Quite a number of them did not know that in (b)(iii) the amplitude of the water waves would decrease gradually with the distance from the source.
7	This question was well answered. Most were able to obtain the correct answers in parts (a)(i)(ii). Some candidates failed to recognise that in (a)(iii) the light ray would eventually emerge from the plastic block as the incident angle within the block becomes smaller than the critical angle. Weaker ones drew a light ray bending towards the normal when the light ray emerged from the block to the air. Part (b) was in general well answered.
8	This question tested candidates' understanding of the relationship among voltage, current and resistance in a circuit. Candidates' performance was poor. Part (a) was well answered. In (b), few were able to state explicitly that the temperature increase led to the increase in resistance. Not many pointed out that by definition $R = \frac{V}{I}$ in part (c). Although most were able to obtain the correct resistances in (d), not many realised that the one corresponding to room temperature should be employed to find the length of the tungsten filament in part (e).

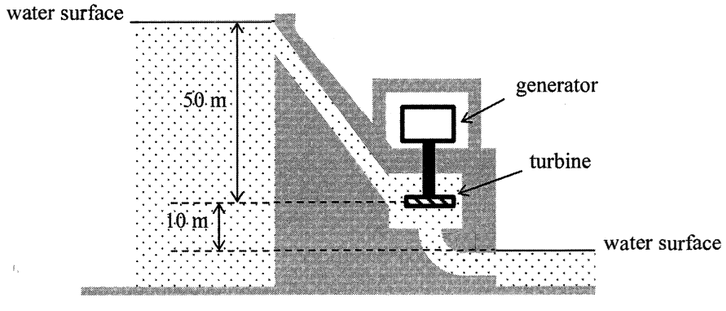
9	This question tested candidates' knowledge and understanding on electromagnetism. Their performance was fair. Part (a) was in general well answered except (a)(iv) in which not many were able to explain why the two magnetic forces, a pair of action and reaction forces, were equal in magnitude. In (b)(i), only the more able candidates referred to the direction of currents in neighbouring wire segments when explaining the origin of magnetic forces. Some misunderstood the situation in (b)(ii) and tried to answer the question by considering the induced current in the spring.
10	This question on radioactivity was in general well answered. Candidates did well in parts (a) and (c). In (b), quite a number of candidates wrongly thought that the α particles neutralised the charged dust directly. Most candidates knew how to calculate the activity in part (d), only some of them made mistakes in the unit.

The mean percentage correct achieved by the candidates was slightly higher than 50%. Most markers agreed that there was an appropriate balance between questions testing basic knowledge and those testing higher-order skills.

Paper 2

Paper 2 consisted of four sections. Each section contained eight multiple-choice questions and one structured question which carried 10 marks. Section A contained questions on 'Astronomy and Space Science', Section B on the 'Atomic World', Section C on 'Energy and Use of Energy' and Section D on 'Medical Physics'. Candidates were required to attempt all questions in two of the four sections.

3.7 The hydroelectric power plant shown has an efficiency of 40% in electricity generation. If the flow rate of the water is 300 $m^3 s^{-1}$, what is the power output of the plant ?
Given: density of water is 1000 kg m^{-3}. Take $g = 9.81$ m s^{-2}.



A. 11.8 MW
B. 58.9 MW
C. 70.6 MW
D. 88.3 MW

A	B	C	D
○	○	○	○

This item has been deleted due to inadequate discrimination power. Candidates might have different understandings of the efficiency of the hydroelectric power plant as well as the power input.

Question	Popularity (%)	Performance in General
1	20	Candidates' performance in (a) was satisfactory. Some candidates employed incorrect formulae or made mistakes in manipulating equations using ratios. In (b)(i), quite a number of the candidates failed to relate blue shift with the decrease in wavelength of the spectral line observed. Some candidates arrived at answers with wrong orders of magnitude in the calculation in (b)(ii)(iii). Only a few candidates used the comparison of data of M33 and the solar system to solve the problem in (b)(iii). Part (b)(iv) was in general well answered.
2	67	In (a), not many candidates pointed out explicitly that energy levels in an atom were 'quantized' or 'discrete'. Weaker ones even failed to relate the transitions between energy levels with the photons emitted. Some candidates did not recognise that in part (b) line *X* corresponded to the electron transition from infinity to energy level $n = 2$. Although many candidates were able to apply $E = hf$ to find the energy of a photon in (b)(ii), a considerable number of them confused the energy of electrons at each level with the energy difference of a transition between energy levels. In (c), not many stated correctly the transition corresponding to line *Y*. Some candidates confused 'excitation' and 'ionization'. Weaker ones even misunderstood the constant *R* and took it as universal gas constant.
3	86	Part (a) was in general well answered although a few candidates wrongly described the change of state of the refrigerant and the heat exchange resulted. In (b), quite a number of them did not realise that the calculation involving thermal conductivity only dealt with heat transfer by conduction and thus failed to answer part (b)(ii) in which radiation had a part to play. Candidates' performance in (c) was satisfactory though some of their answers were far from concise.
4	27	Most candidates in (a) knew how X-rays are produced. However, candidates' answers to parts (b) and (c)(i) involving CT scans were usually not concise. For the estimation of the equivalent background radiation dose in (c)(ii), most were able to obtain the correct answer. In (d), some candidates did not fully understand what the question asked for and they just worked out the intensity ratios separately instead of the overall ratio required. A few candidates failed to distinguish 'radiation' and 'ionizing radiation' in part (e).

School-based Assessment

All school candidates sitting for HKDSE Physics have to participate in School-based Assessment (SBA). For the 2017 examination, 10615 students from 430 schools submitted their SBA marks this year. The schools were divided into 24 groups and the implementation of SBA by the teachers in each group was monitored by a District Coordinator (DC). The DCs were also responsible for reviewing the submitted samples of students' work.

A statistical moderation method was adopted to moderate the SBA scores submitted by schools. Outlier schools after statistical moderation were identified for further follow-up by the SBA Supervisor. 58.6% of schools fall into the 'within the expected range' category, with 24.8% of schools having marks slightly higher than expected, and 16.6% of schools having marks slightly lower than expected. This is encouraging as the data shows that the majority of the teachers do have a good understanding about the SBA implementation, and hence the marking standards are generally appropriate.

Some schools were visited by the DCs to gather first-hand information on the implementation of SBA in schools. From the feedback of teachers and the DC's reports, the assessment process was smooth and effective in general. SBA marks were submitted on time and all requirements of SBA were met. The major observations for this year's SBA are:

1. Most schools opted for the write-up of a detailed report instead of an Investigative Study for SBA. The goal of a detailed report is to help students develop the science process skills to handle tasks with or without detailed instruction. The design, format and tasks of experiments submitted for SBA were diverse and most of the assignments were appropriate. There were only a few cases found where students would have benefitted from being given opportunities for more demanding tasks through which they could demonstrate higher ability skills.

2. Based on the SBA submission, the majority of teachers submitted a total of 4 to 5 experiments for assessment, which was more than the minimum requirement. Teachers selected a diverse range of practical tasks which were of an appropriate level of difficulty and relevant to the curriculum. The most popular tasks include refractive index and critical angle of a glass block, focal length of a lens, wavelength of visible light and diffraction grating, measurement of resistance of a wire and magnetic flux of a current-carrying solenoid. Some experiments involved the verification of Boyle's Law, centripetal force and Ohm's Law. It was encouraging to see that some teachers provided experiments related to the elective topics with extended questions to stretch higher-tier students to experience a full range of science process skills.

3. Most reports submitted took the format of worksheets and they should be a clear record of the data taken, working steps, calculations and the analysis. Students are expected to work efficiently and complete the experiment as well as all the calculations during the laboratory session. Moreover, they should be encouraged to spend time studying before the laboratory session. There were cases in which the worksheets were deliberately designed to be open-ended in which procedures of the experiment were not given and with unknown results. It is encouraging to see that students were able to make comments on things that went wrong, make notes on something extra they attempted that was not in the manual, or comment on problems encountered, e.g. instrument handling, difficulties or outliers in the data.